CHAPTER II

Open Access: an Emerging Paradigm in Scholarly Communication

"If you have an apple and I have an apple and we exchange these apples then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas."

George Bernard Shaw (Delamothe and Smith, 2001)

2.1 Open Access: Definitions and Concept:

Earlier the terms 'open access' and 'closed access' used to express the type or level of access to the documents possessed by a library. In a closed access system, users did not have direct access to the documents but they were kept under lock and key and the access was through some mediator. With the increased understanding of users' needs, the libraries gradually adopted the open access system in which the users have the freedom to browse through the library collections placed in the open stack area. This concept of closed and open access covers the domain of printed documents. In the modern electronic environment, where we talk of electronic journals and e-books, the connotations of closed and open access means the "paid access" and "free access" respectively.

Since the birth of the scientific journal in 1665, the scientists have been publishing journal articles without payment in exchange for a host

of intangible benefits, such as the prestige, citations and impact that advance their careers. For more than 300 years, these author-donated works were distributed in print editions, whose costs were covered by the subscription fees. The rise of the Internet, however, meant that the tradition of free offering by authors could finally be matched with free distribution -or Open Access- to readers. At about the same time that the Internet was born, the price of journals began to grow sharply. The average price of a scientific journal has risen four times faster than the inflation for the past two decades. It resulted in a crisis in which no institutions can pay the subscription price for all the journals. As a result, librarians have canceled the journal subscriptions and scientists have thought of alternative ways of sharing their research work. They have discovered the open access as a tool to dilute this crisis by facilitating a more transparent and democratic nature of access to scholarship. In its traditional sense of open access, the readers are satisfied as they enjoy the freedom to browse the documents in libraries and select the book(s) of their choice. The implementation of open access in an online environment allows the users to browse online journals available over the world wide web and access the full-text of the article of their choice. Open access calls for the free availability of scholarly literature on the Internet. It has been defined by various organizations and individuals whose writings and efforts have a great impact on the open access movement. Some of the definitions of the term have been discussed below:

- Peter Suber[1] has defined open access as "immediate, free and unrestricted online access to digital scholarly material primarily peer-reviewed research articles in journals".

- The Budapest Open Access Initiative (BOAI)[2] defined open access

1. Suber, P. (2007, June 19). Open Access Overview: Focusing on open access to peer-reviewed research articles and their preprints. Retrieved July 26, 2010, from http://www.earlham.edu/~peters/fos/overview.htm
2. Budapest Open Access Initiative. (2002, February 14). Open Society Institute. Retrieved July 26,

as the "world-wide electronic distribution of the peer-reviewed journal literature, completely free and unrestricted access to it by all scientists, scholars, teachers, students, and other curious minds."

- According to JISC[3], the Open Access research literature is composed of free, online copies of peer-reviewed journal articles and conference papers as well as technical reports, theses and working papers. In most cases, there are no licensing restrictions on their use by readers. They can, therefore, be used freely for research, teaching and other purposes.

- Alma Swan defined open access as "the free (gratis) online availability of the research results that scholars give away themselves (peer reviewed journal articles and conference papers, mostly), provided by authors upon acceptance for publication and made permanently available without restrictions on use[4].

- Bethesda Statement on Open Access Publishing defines an open access publication as the one that meets the following two conditions[5]:

(1) "The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship, as well as the right to make small numbers of printed copies for their personal use.

2010, from http://www.soros.org/openaccess/read.shtml

3. Swan, Alma. 2005a. Open Access: Briefing Paper. JISC. Retrieved June 2006 from http://www.jisc.ac.uk/uploaded_documents/JISC-BP-OpenAccess-v1-final.pdf.
4. Alma Swan, 2006. Open Access: Why should we have it? Key Perspectives. Retrieved June 2006 from http://www.keyperspectives.co.uk/openaccessarchive/journalpublications.html.
5. Bethesda Statement on Open Access Publishing. Retrieved June 2006 from: http://www.earlham.edu/~peters/fos/bethesda.htm

(2) A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository that is supported by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving (for the biomedical sciences, PubMed Central is such a repository)."

2.2 Benefits of Open Access:

With the advent of the Internet and electronic publishing, information can now be exchanged globally, immediately and effectively. The open access movement has developed in response to these advancements and aims to promote access to information that is open to all and free of technological and economic restraints. One of the primary principles underlying open access is the widest possible dissemination of knowledge and free access to research and scholarly material. OA documents can be located easily and is immediately available to scholars, scientists, students and the interested public, thus facilitating wider dissemination of and access to research and scholarly material. It prevents duplicative research and advances intellectual development and collective learning. Jan Velterop opines that open access increases the efficiency of scientific discovery. According to him, "the likelihood of wasting resources and time on duplicative investigation decreases when researchers have comprehensive access to the results of earlier work. 'Cross-fertilization' between disciplines and specialities would also be enhanced[6]." OA not only allows others to access and use a researcher's work, but also allows a researcher to access and use his own work

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6. Velterop, Jan (2008): "Open access and publishing". *The E-Resources Management Handbook*, published by United Kingdom Serials Group (UKSG), 117-121. Retrieved January 2008, from http://uksg.metapress.com/link.asp?id=dplay0kyn6nkvk7u

enabling research to progress faster and more effectively benefiting the pubic as a whole.

Providing open access to information via a global tool such as the Internet is fundamentally important to researchers and academics in developing nations specially which cannot afford to pay costly subscriptions to a wide range of academic journals. OA leads to increased visibility and impact of research, thus enhancing their reputation and career advancement, including higher salaries. Availability on the World Wide Web (WWW) leads to increased use which, in turn, raises citation rates. Richard Poynder has reported that open access papers are accessed and read three times as much as papers that are not open access.[7] OA also promotes cooperation between scientists and accelerates the research process as they can receive immediate feedback from their colleagues who are often scattered around the globe. It enhances research efficiency through early discussion of findings as it provides the ideal framework for cooperation on complex research problems. Greater research impact leads to more funding opportunities. This in turn leads to the enhanced reputation and prestige of authors' institution. Additionally, open access can help institutions to reduce their expenses relating to journal subscription fees. It also promotes inter-disciplinary cooperation by drawing the attention of scientists to information from other fields which they might never have discovered if the article had been published only conventionally. OA content enables people from poorer countries to access and utilize scientific knowledge and information which they would not otherwise be able to afford. Compared to conventional publications, the time gap between manuscript submission and publication is less. In fact, since these journals are completely digital, no time is needed for printing and distribution.

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7. Poynder, Richard, "Open Access: Beyond selfish interests" Open and shut? Retrieved 20 November 2006 from http://poynder.blogspot.com/2006/11/open-access-beyond-selfish-interests.html

According to Peter Suber "knowledge is a public good, not a commodity. But today we are treating it as a commodity, not a public good."[8] The ethic demands open access to those who cannot afford to pay, and to distribute the public good of knowledge equitably among all who can make use of it. By treating knowledge, information and research as a commodity and by charging high subscription prices to access that commodity[9] , we are limiting the public benefit of research by limiting the number of people who can afford to access it. It is unfair that the public who pays for research to be conducted (most research being funded through taxpayers) is required to pay again to access that research. Since most of the members of the general public do not belong to an institution that subscribes to journals on their behalf and the subscription prices are far outside their reach ,they should have open access to the research that it has funded.

For publishers, open access makes their articles more visible and discoverable, drawing readership back to the journal and improving the journal's reputation for publishing quality research. Peter Suber writes, "If a journal is OA, then it can use this superior visibility to attract submissions and advertising, not to mention readers and citations."[10] Open access documents inherit all the benefits of digital documents like it can be accessed directly and are available round the clock, easily stored, copied, sent, printed and used as a basis for new texts, are not subject to limitations of space and can easily provide links to other materials such as audio and video files, data collections, programmes, etc. Such documents are protected by copyright in the same way as conventional publications and ensure long-term document availability through archiving, which is something that personal websites usually

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8. Poynder, Richard, "The Basement Interviews: Peter Suber" Open and shut? Retrieved 19 October 2007 from http://poynder.blogspot.com/2007/10/basement-interviews-peter-suber.html
9. Peter, S. (2007, June 19). Peter Suber, Open Access Overview (definition, introduction). Open Access Overview. Retrieved July 26, 2010, from http://www.earlham.edu/~peters/fos/overview.htm
10. Ibid.

cannot do. Permanent access to a deposited document is ensured by assigning persistent identifiers (PURL, DOI, etc.) which are independent of the actual location in which the document is deposited. The worldwide linking of scientific information, to which OA makes a significant contribution, promotes the internationalization of the disciplines while diluting the digital divide.

About 25,000 peer-reviewed journals are published worldwide in all disciplines and all languages[11]. They publish about 2.5 million articles per year. Most universities and research institutions can only afford to subscribe to a fraction of those journals, hence these articles are accessible to only a fraction of their potential users. If 100% of research articles were freely accessible through OA, then the usage, impact, productivity and progress of research would be maximized. Jan Velterop writes that there are no technical barriers to open access, just barriers of habit, such as restricted-access business models based on the legal construct of copyright.[12] The OA movement calls upon research academics to provide open access to their research by either publishing their findings in journals that provide open access to their content online or by depositing their work into repositories which make their content freely available over the Internet.

2.3 The Open Access Movement:

The Open Access movement is a social movement in the academic world and is dedicated to the cause of open access aiming information-sharing for the common good. The movement traces its history back to 1960s, but became much more prominent in 1990s. With the spread of the Internet and the ability to disseminate electronic data at no cost, open access has gained new significance. It has become a subject of discussion amongst the researchers, academics, librarians, university

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11. ulrichsweb.com -- The Global Source for Periodicals. (n.d.). Ulrichs Web redirection. Retrieved July 26, 2010, from http://www.ulrichsweb.com/ulrichsweb/
12. Velterop, Jan. op. Cit. p. 54

administrators, funding agencies, government officials, commercial publishers and learned-society publishers.[13] Open access was propagated mainly through electronic journals as they served a way of expanding access to scholarly findings. The first online-only, free-access journals (eventually called "open access journals") began appearing in the late 1980s which included Bryn Mawr Classical Review, Postmodern Culture and Psycoloquy.[14] These journals sprang from the potential unleashed by the electronic medium and by the World Wide Web. An important open access initiative is the creation of Scholarly Publishing and Academic Resources Coalition (SPARC) by the Association of Research Libraries in 1997.

The arXiv was originally developed by Paul Ginsparg in 1991 as a repository for electronic preprints in Physics and later expanded to include Astronomy, Mathematics, Computer science, quantitative Biology and most recently, Statistics. As of 3 October 2008, it crossed the half-million article milestone, with roughly five thousand new e-prints added every month. Another disciplinary archive CiteSeer, now CiteSeerX[15], was developed in 1997 at the NEC Research Institute, Princeton, New Jersey. It is a scientific literature digital library and search engine that focuses primarily on the literature in Computer and Information Science. It aims to improve the dissemination of scientific literature and to provide improvements in functionality, usability, availability, cost, comprehensiveness, efficiency, and timeliness in the access of scientific and scholarly knowledge. It focuses on providing resources such as algorithms, data, metadata, services, techniques, and software that can be used to promote other digital libraries. It claims to be the first digital library and search engine to provide automated citation indexing and

13. Open Access movement. (2009, September 19). In *Wikipedia*, The Free Encyclopedia. Retrieved July 27, 2010, from http://en.wikipedia.org/w/index.php?title=Open_Access_movement&oldid=314888352
14. Dru Mogge, (1999) "Seven years of tracking electronic publishing: the ARL", *Library Hi Tech*, Vol. 17 Iss: 1, pp.17 – 25. doi: http://dx.doi.org/10.1108/07378839910267154
15. CiteSeerX: Scientific Literature Digital Library and Search Engine. (n.d.). *CiteSeerX*. Retrieved July 26, 2010, from http://citeseerx.ist.psu.edu

citation linking. Another disciplinary archive, Cogprints, is an electronic archive for self-archive papers in Psychology, Neuroscience, and Linguistics and many areas of Computer Science as well as any other aspects of the physical, social and mathematical sciences that are pertinent to the study of cognition. These archives along with many other have strengthened open access in their respective disciplines and encouraged other disciplines to take similar initiatives.

In 1997, the U.S. National Library of Medicine (NLM) made Medline, the most comprehensive index to medical literature, freely available in the form of PubMed. In 1998, the American Scientist Open Access Forum was launched (and first called the "September98 Forum"). The Journal of Medical Internet Research (JMIR),one of the first Open Access journals in medicine, published its first issue in 1999. In the same year, Harold Varmus of the NIH proposed a journal called E-biomed, intended as an open access electronic publishing platform combining a preprint server with peer-reviewed articles. E-biomed later saw light in a revised form as PubMed Central, a postprint archive.

In 2000, a not-for-profit open access publisher, BioMed Central, was launched which publishes open access journals in biomedical sciences. In 2001, the Public Library of Science (PloS) was established which is now a well known open access publisher covering STM journals. In 2002, the Open Society Institute launched the Budapest Open Access Initiative. In 2003, the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities was drafted and the World Summit on the Information Society included open access in its Declaration of Principles and Plan of Action. Many associations, societies and organizations are now promoting open access through various publications including reports, white papers, papers, promotional materials and they are seriously engaged in pressing the policy makers in their countries and at international level to take steps for making the

scholarly literature freely available. Some of the significant initiatives include:

2.3.1 SPARC: (1997)

SPARC (the Scholarly Publishing and Academic Resources Coalition)[16] founded in 1997 under the aegis of the Association of Research Libraries, is an alliance of nearly 800 institutions in North America, Europe, Asia and Australia which are working to solve the issues in scholarly publishing system. It supports publishers "who are committed to fair pricing, the ethical use of scholarly resources, and intellectual property management policies that emphasize broad and easy distribution of material". SPARC is successfully helping develop and support lower-cost journals as alternatives to expensive commercial journals, particularly in STM fields. It also offers advisory services to smaller publishers and has currently has 25 publisher partners. The official newsletter of SPARC, 'SPARC Open Access Newsletter (SOAN)'[17], launched in July 2003, offers news and analysis of the open access movement. The Right to Research, a SPARC campaign introduced in early 2008, invites college students to consider the question of access to research along with the potential of unfettered access to scholarship.

2.3.2 The ACRL Scholarly Communications Initiative:

The purpose of the Association of College and Research Libraries' scholarly communications initiative[18] is to work in partnership with other library and higher education organizations to encourage reforms in the system of scholarly communication. It includes the broadest possible access to published research and other scholarly writings, increased

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16. Waller, A., & Jones, J. (n.d.). SPARC (Scholarly Publishing and Academic Resources Coalition). *Association of Research Libraries*. Retrieved July 26, 2010, from http://www.arl.org/sparc SPARC . www.arl.org/sparc
17. Suber, P. (n.d.). SPARC Open Access Newsletter & Forum (SPARC). *Association of Research Libraries*. Retrieved July 26, 2010, from http://www.arl.org/sparc/publications/soan
18. ACRL (Association of College and Research Libraries). (n.d.). *Scholarly Communication Toolkit*. Retrieved November 6, 2009, from acrl.ala.org/scholcomm/

control by scholars and the academy over the system of scholarly publishing, fair and reasonable prices for scholarly information, innovations in publishing that reduce distribution costs, speed delivery and extend access to scholarly research, quality assurance in publishing through peer review, fair use of copyrighted information for educational and research purposes, extension of public domain information, preservation of scholarly information for long-term future use and the right to privacy in the use of scholarly information.

2.3.3 IFLA:

IFLA/FAIFE[19] (Free Access to Information and Freedom of Expression) is an initiative of IFLA monitoring the state of intellectual freedom within the library community world-wide. It considers open access as a powerful medium that guarantees the integrity of the system of scholarly communication. IFLA endorses the definition of open access as given in Bethesda Statement on Open Access Publishing and considers an open access publication to be a property of individual works, not necessarily of journals or of publishers. IFLA has also come up with a statement on open access to scholarly literature and research documentation in accordance with the principles expressed in the Glasgow Declaration on Libraries, Information Services and Intellectual Freedom[20]. The statement mentions that comprehensive open access to scholarly literature and research documentation is vital to the understanding of our world and to the identification of solutions to global challenges and particularly the reduction of information inequality. It recognizes the important roles played by all involved in recording and dissemination of research, including authors, editors, publishers, libraries and institutions and advocates the adoption of open access

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19. Committee on Free Access to Information and Freedom of Expression (FAIFE) (n.d.). International Federation of Library Associations and Institutions (IFLA). Retrieved July 26, 2010, from http://www.ifla.org/en/faife
20. American Library Association (2003). The Glasgow Declaration on Libraries, Information Services and Intellectual Freedom. *Newsletter on Intellectual Freedom*, 52(5), 212-213. Retrieved from Library, Information Science & Technology Abstracts database.

principles in order to ensure the widest possible availability of scholarly literature and research documentation.

2.3.4 The Budapest Open Access Initiative:

In December 2001, the Open Society Institute (OSI) convened a meeting of prominent scholarly communication change agents in Budapest resulting in the "Budapest Open Access Initiative"[21] (BOAI) on February 14, 2002. BOAI considered open access literature to be freely accessible online without scholars making any payment. Such literature encompasses not only peer-reviewed journal articles, but also any un-reviewed preprint the researchers might wish to put online for comment or to alert colleagues to important research findings. BOAI opines that the control regarding the reproduction, distribution and copyright should be given to the authors along with the right to be properly acknowledged and cited. It has recommended two complementary strategies to achieve open access to scholarly journal literature. These include self-archiving in which the authors submit their articles in the repository without any mediated help and open access journals which offer free access to the full text articles . The BOAI statement is considered to be a landmark declaration for strengthening the foundation of open access. Till now, 5426 signatures have been added to the initiative as individuals or on behalf of an organization. For an individual, signing indicates a commitment to open access for one's own research by self-archiving what one publishes in journals. For an institution, signing means a commitment to open access by supporting institutional self-archiving and/or open-access-journals.

2.3.5 The Bethesda Statement on Open Access Publishing:

The Bethesda Statement on Open Access Publishing[22], drafted during a one-day meeting held on April 11, 2003 was released on June 20,

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21. Budapest Open Access Initiative. op.cit. p.52
22. Bethesda Statement on Open Access Publishing. op. cit., p. 53.

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2003. One of the highlights of the statement was the constitution of three working groups namely, Institutions and Funding Agencies Working Group, The Libraries & Publishers Working Group and The Scientists and Scientific Societies Working Group. The Institutions and Funding Agencies Working Group encouraged the faculty/grant recipients to publish their work according to the principles of the open access model and agreed to fund the necessary expenses of publication under the open access model of individual papers in peer-reviewed journals. This group asserted that the merit of the work, and not the title of the journal in which a candidate's work is published, will be considered in appointments, promotions, merit awards or grants. The working group committed that they will regard a record of open access publication as evidence of service to the community, in evaluation of applications for faculty appointments, promotions and grants.

The Libraries & Publishers Working Group recommended the libraries to give high priority to open access journals by highlighting them in their catalogs and other relevant databases. The journal publishers were asked to provide an open access option for any research article published, declare a specific timetable for transition of journals to open access models, and ensure that open access models requiring author fees lower barriers to researchers, particularly those from developing countries. The Scientists and Scientific Societies Working Group was of the view that the scientists as well as the professional societies have a great interest in ensuring that research results are disseminated as immediately, broadly and effectively as possible by selectively publishing in, reviewing for and editing for open access journals and journals that are effectively making the transition to open access. The group recommended that scientists and societies should educate their colleagues, members and the public about the importance of open access.

2.3.6 The Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities

Shortly after the release of the Bethesda Statement on Open Access Publishing, the Max Planck Society and European Cultural Heritage Online released the Berlin Declaration on Open Access to Knowledge in Sciences and Humanities[23] in October 2003. It encouraged the researchers to publish the results of their research according to the principles of open access and advocating the recognition of open access in promotion and tenure evaluation. A first version of a Roadmap to Open Access was put forth on occasion of the "Berlin 2 Open Access"[24] conference in 2004 at CERN, Geneva and a revised version was signed during a conference in 2005. The conference recommended that the institutions should implement a policy to require their researchers to deposit a copy of all of their published articles in an open access repository and encourage them to publish their work in open access journals.

Peter Suber refered to the collective BOAI, Bethesda Statement, and Berlin Declaration open access definitions as the "BBB definition of open access[25]" and noted that this definition "removes both price and permission barriers." On the basis of the BBB definition, the Open Society Institute (OSI) has stated that the three main essentials of open access are free accessibility, further distribution and proper archiving. OSI considers OA to be "real open access"[26] if:

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23. Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. 20 - 22 Oct 2003. Berlin. Retrieved February 08, 2007 from http://oa.mpg.de/openaccess-berlin/berlindeclaration.html
24. Berlin 2 Open Access: Steps Toward Implementation of the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. May 12 - 13, 2004, CERN, Geneva. Retrieved February 08, 2007 from http://www.zim.mpg.de/openaccess-cern/
25. Suber, P. (2004, September 2). Praising progress, preserving precision. Suber, *SPARC Open Access Newsletter*. Retrieved July 26, 2010, from http://www.earlham.edu/~peters/fos/newsletter/09-02-04.htm#progress
26. Velterop, J. (2005). *Open Access Publishing And Scholarly Societies: A Guide*. New York: Open Society Institute (OSI). Retrived March 2006 from http://www.soros.org/openaccess/pdf/open_access_publishing_and_scholarly_societies.pdf

1. "The article is universally and freely accessible, at no cost to the reader, via the Internet or otherwise, without embargo.
2. The author or copyright owner irrevocably grants to any third party, in advance and in perpetuity, the right to use, copy, or disseminate the article, provided that correct citation details are given.
3. The article is deposited immediately, in full and in a suitable electronic form, in at least one widely and internationally recognized open access repository committed to open access and long-term preservation for posterity".

2.3.7 National Institutes of Health (NIH)

The National Institutes of Health (NIH) is the primary agency of the United States government responsible for biomedical and health-related research.[27] On 11 January 2008, it announced a revision of its Public Access Policy that made its application mandatory rather than voluntary. The substance of the policy is contained in five points[28]:

1. The NIH Public Access Policy applies to all peer-reviewed articles that arise, in whole or in part, from direct costs funded by NIH or from NIH staff, that are accepted for publication on or after April 7, 2008.
2. Institutions and investigators are responsible for ensuring that any publishing or copyright agreements concerning submitted articles fully comply with this Policy.
3. PubMed Central (PMC) is the NIH digital archive of full-text, peer-reviewed journal articles. Its content is publicly accessible

27. National Institutes of Health. (2010, July 12). In *Wikipedia*, The Free Encyclopedia. Retrieved July 27, 2010, from http://en.wikipedia.org/w/index.php?title=National_Institutes_of_Health&oldid=373018866
28. National Institutes of Health (2008). Revised Policy on Enhancing Public Access to Archived Publications Resulting from NIH-Funded Research. *OER Home Page - Grants Web Site*. Retrieved July 26, 2010, from http://grants.nih.gov/grants/guide/notice-files/NOT-OD-08-033.html

and integrated with other databases.

4. The final, peer-reviewed manuscript includes all graphics and supplemental materials that are associated with the article.
5. Beginning May 27, 2008, anyone submitting an application, proposal or progress report to the NIH must include the PMC or NIH Manuscript Submission reference number when citing applicable articles that arise from their NIH funded research.

NIH has estimated that approximately 80,000 articles per year arise from their funded research[29] thereby making a substantial amount of the world's biomedical and health-related research literature publicly available.

2.3.8 The Wellcome Trust

The Wellcome Trust is the United Kingdom's largest non-governmental source of funds for biomedical research. The Wellcome Trust Position Statement in support of Open and Unrestricted Access to Published Research states that electronic copies of any research paper that has been accepted for publication in a peer-reviewed journal and is supported in whole or in part by Wellcome Trust funding to be made available through PubMed Central (PMC) and UK PubMed Central (UK PMC) as soon as possible or in any event within six months of the journal publication[30]. It provides grant holders with additional funding, through their institutions to cover open access charges. It has also decided to provide additional funding to researchers to meet open access charges, where appropriate.

2.3.9 European Commission (EC) Open Access Petition:

In January 2006, the European Commission(EC) published a study

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29. Baker, G. (2008, January 28). Public Science: NIH's New Open Access Policy Can Benefit Everyone. *Science Progress : Progressive science policy*. Retrieved July 27, 2010, from http://www.scienceprogress.org/2008/01/public-science/
30. Wellcome Trust. (Feb. 2008) Position statement in support of open access to published research . Retrieved July 27, 2010, from http://www.wellcome.ac.uk/doc_WTD002766.html

on the Economic and Technical Evolution of the Scientific Publication Markets of Europe. It noted that 'dissemination and access to research results is a pillar in the development of the European Research Area[31]. It made a number of balanced and reasonable recommendations to improve the visibility and usefulness of European research outputs. As on August 20, 2010, there were 19436 signatories including 205 signatories from India.

2.3.10 Brisbane Declaration on Open Access:

During the 'Open Access and Research Conference 2008' held at Brisbane, Queensland, Australia in September 2008, the participants recognized open access as a strategic enabling activity, on which research and inquiry will rely at international, national, university, group and individual levels[32]. The participants resolved that every citizen of Australia should have free access to publicly funded research and data, every Australian university should have access to a digital repository to store its research outputs, this repository should contain all materials reported in the Higher Education Research Data Collection (HERDC) and the deposit of materials should take place as soon as possible.

2.3.11 ERCIM Statement on Open Access

ERCIM (European Research Consortium for Informatics and Mathematics) aims to foster collaborative work within the European research community and to increase co-operation with European industry. Leading research institutes from twenty European countries are members of ERCIM. Some of the principles[33] supported by ERCIM include the research funded by the public via government agencies or

31. Petition for guaranteed public access to publicly-funded research results. (2007, January 17). Retrieved July 27, 2010, from http://www.ec-petition.eu/
32. Open Access and Research Conference 2008. (n.d.). *QUT OAR* 2008 . Retrieved July 27, 2010, from http://www.oar2008.qut.ed
33. ERCIM Statement on Open Access. (January 2006). *ERCIM - the European Research Consortium for Informatics and Mathematics*. Retrieved July 27, 2010, from http://www.ercim.org/publication/Ercim_News/enw64/ercim-oa.html

charities be available freely online, rigorous peer review of research publications, research datasets and software pertaining to research publications be openly available and the provision of open access should be made as cost-effective as possible.

2.4. Open Access Journals initiatives in Developed Countries:

Open Access Journals are electronic-based journals that make their published content available freely to all. There are many journals which have converted from paid journal to open access journal. Some of the major OA journal initiatives which originated in the developed countries are discussed below:

2.4.1 Directory of Open Access Journals (DOAJ)

It aims to provide a comprehensive list of all open access scientific and scholarly journals in all major subject areas that use a quality-control system including peer review or editorial quality control. It contains 5256 journals in which 2188 journals are searchable at article level. The journals which are covered by DOAJ[34] are those whose content users can read, download, copy, distribute, print, search, or link to the full texts of these articles. It provides access to quality controlled open access journals to increase the visibility and ease of use of open access scientific and scholarly journals thereby promoting their increased usage and impact. The directory is hosted, maintained and partly funded by Lund University Libraries Head Office. It has also launched a companion service to DOAJ called Journal Info that helps the academic authors to evaluate journals where they might submit their work.

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34. DOAJ . (n.d.). *Directory of open access journals*. Retrieved July 27, 2010, from http://www.doaj.org/

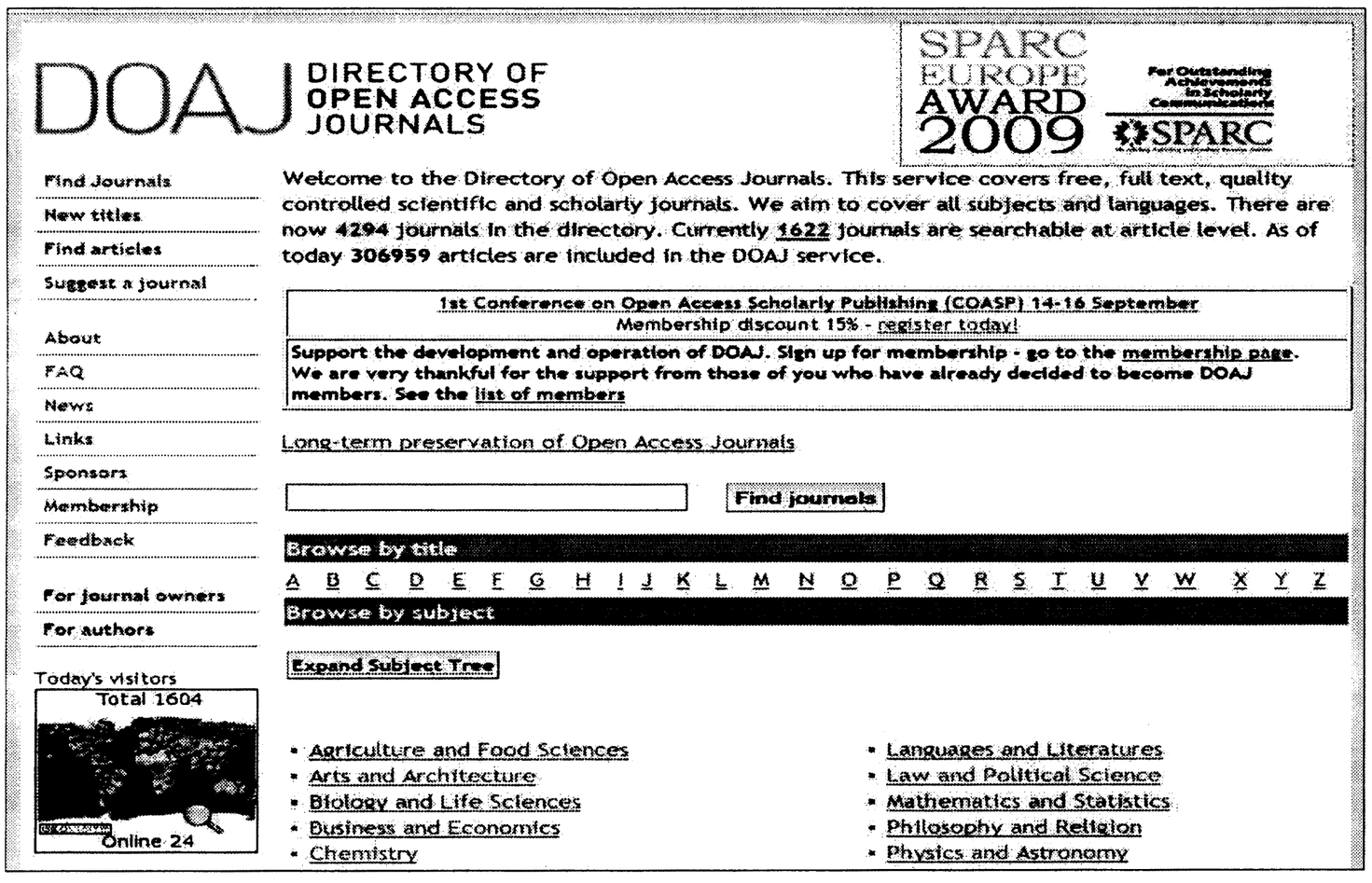

Figure 2. 1 DOAJ Homepage: http://www.doaj.org/

2.4.2 Information on the Elektronische Zeitschriftenbibliothek EZB (Electronic Journals Library)

It offers an effective use of both scientific and academic journals publishing full text articles on the Internet. This service has been developed at the Universitätsbibliothek Regensburg (University Library of Regensburg) in cooperation with the Universitätsbibliothek der Technischen Universität München (University Library of the Technical University of Munich). Meanwhile, 542 libraries and research institutions make use of this service in their daily work. They collect the titles cooperatively and update the bibliographic data jointly in a central database. This database offers fast, structured and standardized access to scientific and academic full text journals. As on August 05, 2010, it contains 50150 titles, among them 6616 are online-only journals covering all subjects. 25619 journals can be read free-of-charge. The discipline of Library and Information Science has 585 journal titles[35]. Additionally, the

35. Electronic Journals Library. (2008, April 23). *EZB-Server*. Retrieved July 27, 2010, from http://rzblx1.uni-regensburg.de/ezeit/fl.phtml?

participating libraries offer full text access to the respective journals they subscribe to. The journals are filed according to the subject. The subject lists for each member institution are generated from a database showing the current status. Full text accessibility is shown by means of dots in green colour. At the moment, it is possible to search for journal titles. By means of a web form, users can suggest titles to be added. The researcher has added the journal "DESIDOC Bulletin of Information Technology" (now entitled DESIDOC Journal of Library & Information Technology).

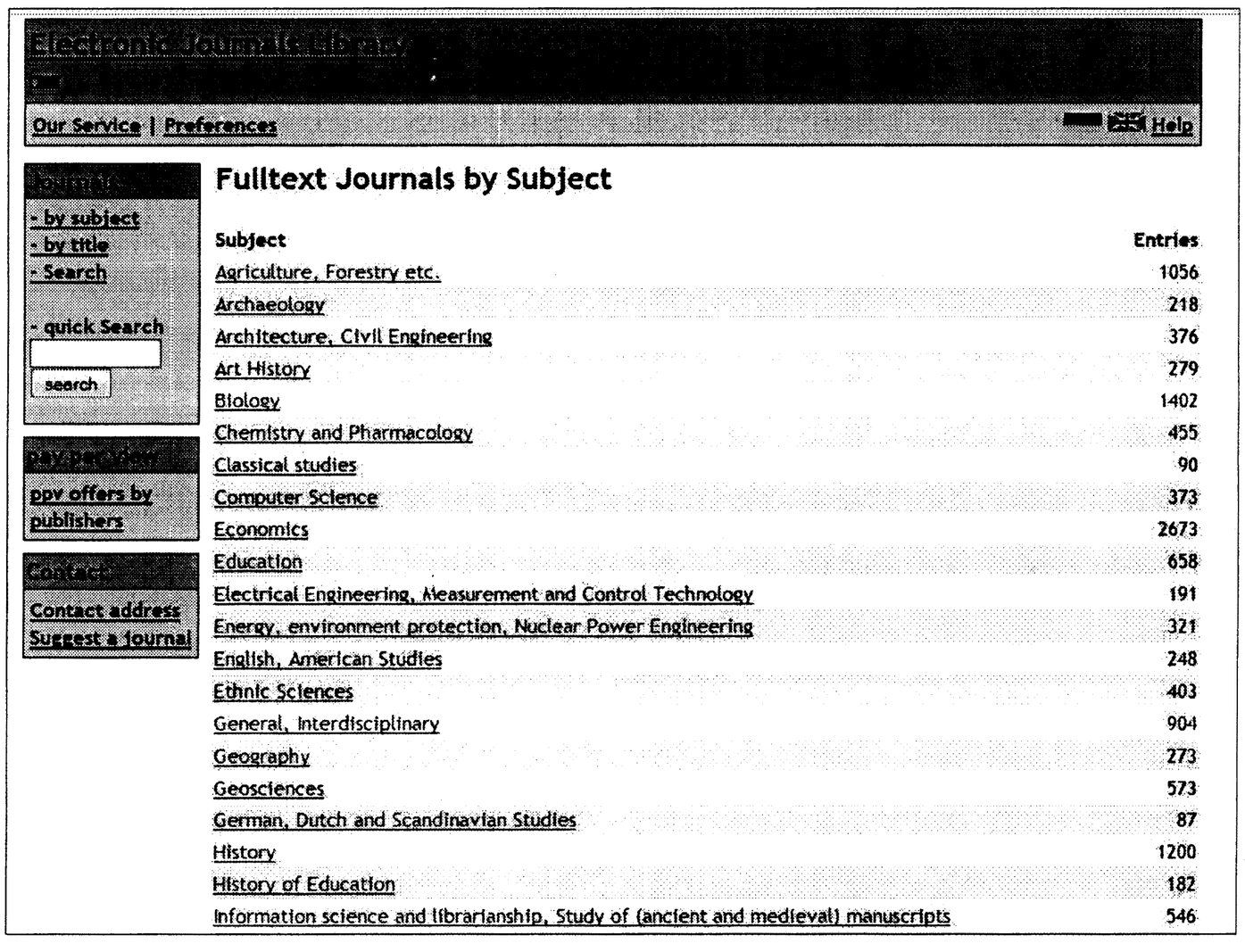

Figure 2.2 Electronic Journals Library

2.4.3 BioMed Central:

BioMed Central was established on May 2000 as an online Open Access publisher in response to the opportunities offered by new technologies. It is an STM (Science, Technology and Medicine) publisher which has pioneered the open access publishing model. All original research articles published by BioMed Central are made freely and

colors=7⟨=en&selected_colors[]=1&bibid=AAAAA

permanently accessible online immediately upon publication. At present, it publishes 198 peer-reviewed open access journals[36]. Its first entirely open access journals were the BMC series with 57 titles that covered all the major biomedical disciplines.

2.4.4 PubMed Central:

PubMed Central (PMC) is a free digital archive of biomedical and life sciences journal literature at the U.S. National Institutes of Health (NIH) in the National Library of Medicine (NLM). The NIH Public Access Policy[37] requires the scientists to submit their final peer-reviewed journal manuscripts that arise from NIH funds to its digital archive. Participation by publishers in PMC is voluntary, although participating journals must meet certain editorial standards. NLM has digitized the earlier print issues of many of the PMC journals in order to provide online access to all the issues of these journals. PMC has material dating back to mid- to late-1800s or early 1900s for some journals. By scanning back issues that were available only in print, NLM has helped create a complete digital archive of these journals in PMC.

2.4.5 Public Library of Science (PloS):

The Public Library of Science (PLoS) is a nonprofit organization of scientists and physicians committed to making the world's scientific and medical literature a public resource[38]. It was launched as an outcome of the campaign when 34,000 scholars around the world signed “An Open Letter to Scientific Publishers” calling for "the establishment of an online public library that would provide the full contents of the published record of research and scholarly discourse in medicine and the life sciences in a freely accessible, fully searchable, interlinked form". They also pledged

36. BioMed Central (n.d.). *BioMed Central - The Open Access Publisher*. Retrieved July 27, 2010, from http://www.biomedcentral.com/info/
37. op.cit., p. 15
38. Public Library of Science: Open Access (n.d.). Retrieved July 27, 2010, from http://www.plos.org/oa/index.php

not to publish in or peer-review for non-open access journals. All material published by the Public Library of Science is published under an open access license that allows unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited. The Impact Factor of the PLoS journals are remarkably high. The impact factor (IF) of PLoS Biology is 13.5 (14.7 in 2006). The IF of PLoS Medicine is 12.6, The IF of PLoS Computational Biology, PLoS Genetics and PLoS Pathogens is 6.2, 8.7 and 9.3 respectively.

2.4.6 Bentham Open:

Bentham Open[39] provides access to 250 peer-reviewed open access journals covering all major disciplines of science, technology and medicine (STM).

2.5 Open Access Journal Initiatives in Developing Countries:

Open Access is a matter of special concern in developing countries, which have less money to fund, publish research or to buy the research published elsewhere. Some open access initiatives are specifically designed for economically weaker countries and developing countries of the world. The resources made available to these countries consist of scholarly journals of some of the reputed publishers which are otherwise very expensive to be subscribed by the libraries. Some of the initiatives including HINARI, INASP and SciELO are discussed below:

2.5.1 HINARI:

The HINARI (Health InterNetwork Access to Research Initiative) programme was set up by WHO to facilitate access to one of the world's largest collections of biomedical and health literature to the developing countries. HINARI offers access to over 6400 journal titles in biomedical and related social sciences to not-for-profit institutions in 108 countries,

39. Bentham Science Publishers Ltd. Home Page. (n.d.). Retrieved July 27, 2010, from http://www.bentham.org/open/index.htm

areas and territories thereby benefiting many health workers and researchers. The project provides online access to either free or very low cost major journals. It was launched on January 2002 with 1500 journals from 6 major publishers: Blackwell, Elsevier Science, the Harcourt Worldwide STM Group, Wolters Kluwer International Health & Science, Springer Verlag and John Wiley. Today more than 150 publishers are collaborating with HINARI[40]. The core elements of the project are content, Internet connectivity and capacity building. It aims to improve public health by facilitating the flow of health information. It was created to bridge the 'digital divide' in health, ensuring that relevant information - and the technologies to deliver it - are widely available and effectively used by health personnel: professionals, researchers and scientists as well as policy makers.

2.5.2 INASP

INASP (The International Network for the Availability of Scientific Publications) was established by the International Council for Science (ICSU) in 1992 and aims to map, support and strengthen existing activities promoting access to and dissemination of scientific and scholarly information and knowledge. The organization also encourages and supports new initiatives that will increase local publication and general access to quality scientific and scholarly literature. It works with over 50 publishers and aggregators to make their resources available within their partner and network countries.

PERii (Programme for the Enhancement of Research Information phase 2)[41] is the second five-year phase of INASP's Programme for the Enhancement of Research Information. The Information Delivery component of PERii cooperates with publishers and library consortia to

40. WHO - HINARI (Access to Research in Health Programme). (n.d.). Retrieved July 27, 2010, from http://www.who.int/hinari/en/
41. PERii - INASP. (n.d.). *Programme for the Enhancement of Research Information (PERii)*. Retrieved July 27, 2010, from http://www.inasp.info/file/5f65fc901786033888288140 2dc594e4/perii.html

enable access to research materials for eligible institutions within developing countries. INASP also provides information about complementary developing country initiatives and a directory of open access resources.

2.5.3 SciELO

The Scientific Electronic Library Online[42] (SciELO) is an electronic library covering a selected collection of Brazilian scientific journals. It was conceived to meet the particular scientific communication needs of developing countries, particularly Latin America and the Caribbean. The objective was to create an electronic virtual library, providing Open Access to a collection of serial titles, a collection of issues from individual serial titles, as well as the fulltext articles. It provides free access to 221 scholarly journals[43] in the disciplines of Agricultural Sciences, Applied Social Sciences, Biological Sciences, Engineering, Earth Sciences, Health Sciences, Human Sciences and Linguistics.

2.6 Open Access Journals initiatives in India:

न चौरहार्यम् न च राज हार्यम् ।
न भ्रातृभाज्यम् न च भारकारी ।।
व्यये कृते वर्धत् एव नित्यं ।
विद्या धनम् सर्व धन प्रधानम् ।।

Neither can a thief steal it, nor can a powerful politician take it,
Neither can it be divided amongst brothers, nor is too heavy to carry.

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42. SciELO - Scientific Electronic Library Online. (n.d.). Retrieved July 27, 2010, from http://www.scielo.br/
43. http://www.scielo.br/scielo.php?script=sci_alphabetic&lng=en&nrm=iso

The more it is expended or shared, the more it increases.
Knowledge is prime amongst all wealths[44].

The message conveyed by this *shloka* (verse) resonates with the open access philosophy of sharing of knowledge without any barrier. The five laws of Library Science, as propounded by Dr. S. R. Ranganathan, are also in unison with open access. The second law of Library Science, i.e., "Every book its reader" and the third law, i.e., "Every reader his/her book" clearly recommends open access to knowledge. Some of the important Indian initiatives in this direction are discussed below:

2.6.1 Open J-Gate:

Open J-Gate[45] is an electronic gateway to global journal literature in open access domain. Launched in 2006, Open J-Gate is the contribution of Informatics (India) Ltd to promote OAI. It is a database of journal literature which is indexed from 5783 Open Access Journals (3330 Peer-Reviewed) with links to full text at publisher's site. It provide links to over one million open access articles with annual addition of more than 30,0000 new articles. The database is updated every day. Journals are classified in a three-level hierarchical system to provide for better relevancy in search results. Users can browse the TOC of latest issues and the back issues as well as the database allows various search options like title, author, author's address/institution, keywords with boolean search across fields. It also facilitates mailing of articles.

2.6.2 Indian Academy of Sciences (IAS):

The Indian Academy of Sciences, founded and registered as a society in 1934, aims to promote the progress as well as uphold the cause

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44. Offering Salutation to the Spirit of Knowledge and self-realization. (n.d.). Retrieved July 27, 2010, from http://blogs.oracle.com/gverma/2007/01/offering_salutation_to_the_spi.html
45. OpenJ-Gate. (n.d.). Retrieved July 27, 2010, from http://www.openj-gate.com/Search/QuickSearch.aspx

of science, both in pure and applied branches. A number of journals[46] currently being published by the Academy are 'open access' and their full text is available as PDF files.

2.6.3 Medknow Publications:

Medknow Publications provide free access to 80 high quality peer-reviewed scholarly STM journals. Medknow pioneers in '*fee-less-free*' model of open access publishing and provides immediate free access to the electronic editions of the journals without charging the author or author's institution for submission, processing or publication of the articles. Total number of journals providing open access is 87[47]. Each journal published by it has its independent website facilitating libraries to link users as directly as possible from citation to full text of the article resulting in more than half a million article downloads in a month. It also has an original electronic manuscript submission and peer review system that has processed over 25,000 manuscripts since 2001.

2.6.4 MedInd:

MedIND[48] is a database of 40 full-text Indian biomedical journals, accessible free of cost to the medical community in India as well those outside the country. It was developed by Indian MEDLARS Centre. The database which includes open access journals, was developed subsequent to the development of IndMED, a bibliographic database of 75 biomedical journals. Indian MEDLARS Centre provides an opportunity to journals to be covered in Index Medicus (MEDLINE) by participating in MedInd after signing an MoU with the Indian MEDLARS Centre[49].

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46. Indian Academy of Sciences - Index. (n.d.). Retrieved July 27, 2010, from http://www.ias.ac.in/
47. Medknow Publications: Publisher of peer reviewed scholarly journals. (n.d.). Retrieved July 27, 2010, from http://www.medknow.com/
48. medIND: Indian Fulltext Bio-Medical Journals Indexed in IndMED. (n.d.). Retrieved July 27, 2010, from http://medind.nic.in/
49. Indian Medlars Centre (Bibliographic Informatics Division, National Informatics Centre, New Delhi - 110003, India)". (n.d.). Retrieved July 27, 2010, from http://indmed.nic.in/

2.6.5 OK Society (Open Knowledge Society):

Open Knowledge Society[50] aims to facilitate all forms of Open Access to Knowledge. It aims to support creation of Institutional Repositories, publication of Open Access Journals, conversion of print journals into online versions, making online journals OAI-PMH complaint, automation of libraries, Digital Libraries, Open Courseware and Open Data.

2.6.6 CSIR (Council of Scientific & Industrial Research):

In February 2009, CSIR approved the implementation of the recommendations of the "Group for Open Access to Science Publications (GOASP) of CSIR"[51]. It recommended that all research papers published from the CSIR laboratories be made open access either by depositing the full-text and the metadata of each paper in an institutional repository or by publishing the papers in the open access journals and each laboratory should set up its own interoperable institutional open access repository, CSIR / lab to set up one or more centres to harvest the full-text and metadata of these papers, each laboratory to set up Electronic Thesis and Dissertations Repository, to hold a conference for creating awareness on Open Access, to hold in-house training programmes on open access and sensitize the CSIR researchers.

2.6.7 National Knowledge Commission (NKC):

NKC constituted a working Group on Open Access and Open Educational Resources (OER)[52] which considered open access and open

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50. Open Knowledge Society. (n.d.). Retrieved July 27, 2010, from http://www.oksociety.in/
51. Memorandum issued by Dr. Naresh Kumar, Head of CSIR's R&D Planning Division to the directors of all CSIR labs on February 6, 2009. http://epublishingtrust.blogspot.com/2009/02/big-step-for-oa-in-india.html
52. National Knowledge Commission Working Group on Open and Distance Education. 2007. *Report of the working group on Open Access and Open Educational Resources*. New Delhi: National Knowledge Commission, Government of India, p.3. Retrieved from http://knowledgecommission. gov.in/downloads/documents/wg_open_course.pdf.

educational resources of national importance as carrier of growth and development of India. The working group opined that the Indian government will have to review and upgrade its education system, specially the higher education network. Hence, the government must take significant steps to improve, adapt and grow the overall knowledge capital. NKC has recommended that all research articles published by Indian authors which have received 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. Moreover, a national academic OA portal should be developed and research articles should be made available through this portal. Moreover, the government should allocate specific funding to increase the current digitization efforts of books and periodicals which are outside the copyright protection and a training program be developed to take the materials available under Open Access to remote towns and villages.

The NKC working group has suggested that the parent institution should pay on behalf of the author in case the publishers charge cost of publication and online maintenance for which the institution will get a certain percentage as reimbursement through government depending upon the citation index of the journal. As such, the government will ensure that India's research scientists publish high quality papers. It also proposed that the government should establish a specific fund for open access research publications. At the end of each fiscal year, money should be transferred to each OA journal depending upon the number of papers published by the Indian authors. With these two initiatives, the government would provide incentives to authors for producing high quality papers.

2.7 Other Open Access Scholarly Works (National and International)

Although the open access journals are important agents of

implementing open access phenomenon, yet there are plenty of other scholarly communication formats which are not published through these and are reported elsewhere. They provide a significant momentum to the OA movement along with the open access journals. These non-journal OA material can be in the form of ebooks, digital libraries offering digitized content, databases, open coursewares, etc. Some of the significant developments pertaining to alternative resources of open access are discussed below:

2.7.1 Open Access Books and Digital Libraries:

Open access ebooks are also as important as the open access journals. There are many projects and initiatives which facilitate free access to ebooks. One of such significant initiative is Project Gutenberg (PG) which is considered to be the first and largest single collection of free electronic books (eBooks). Michael Hart, the founder of Project Gutenberg, invented eBooks in 1971. Most of the items in its collection are the full texts of books in public domain. The project tries to make these as free as possible, in long-lasting, open formats that can be used on almost any computer. Till February 2009, Project Gutenberg claimed over 27,000 items in its collection. Project Gutenberg is affiliated with many projects of independent organizations which share the same ideals. Unlike some other digital library projects, Project Gutenberg[53] does not claim new copyright on titles it publishes. Instead, it encourages their free reproduction and distribution. Another ebook project is Google Book Search[54] that allows searching the full text of books that Google scans, converts to text using optical character recognition and stores them in its digital database. It allows public-domain works and other out-of-copyright material to be downloaded in PDF format. Internet Archive is a non-profit and the second largest book scanning project after Google. Till

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53. Free eBooks by Project Gutenberg. (n.d.). Retrieved July 27, 2010, from http://www.gutenberg.org/wiki/Main_Page
54. Google Books. (n.d.). Retrieved July 27, 2010, from http://books.google.com/

November 2008, it had over 1 million full-text public domain scanned works online. Europeana[55] is a search platform to a collection of European digital libraries with digitized paintings, books, films and archives. The project was initiated by the European Commission as a strategic goal within the European Information Society i2010 Initiative[56]. Europeana is to host about 3 million digital objects including video, photos, paintings, audio, maps, manuscripts, printed books and newspapers from the past 2,000 years of European history from over 1,000 archives in the European Union. The project aims to have 10 million works by 2010, when Europeana is due to be fully operational. Another ambitious project in this direction is creation of the 'World Digital Library'[57] which aims to make significant primary materials from cultures around the world, including manuscripts, maps, rare books, musical scores, recordings, films, prints, photographs, architectural drawings and other significant cultural materials available on the Internet, free of charge and in multilingual format.

In India, two important digital library initiatives are the Digital Library of India[58] and the Traditional Knowledge Digital Library(TKDL)[59]. The Digital Library of India is digitizing books, journals, newspapers and manuscripts in several subject areas like Astrophysics, Biology, Chemistry, Education, Law, Mathematics, Mythology, Religion, etc. The languages covered are Sanskrit, English, Bengali, Hindi, Kannada, Marathi, Tamil, Telugu and Urdu. The project has scanned document starting from 1850. TKDL is a collaborative project between Council of Scientific and Industrial Research (CSIR), Ministry of Science and Technology and Department of AYUSH, Ministry of Health and Family

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55. Europeana - Homepage. (n.d.). Retrieved July 27, 2010, from http://www.europeana.eu/portal/
56. I2010 EUROPA. (n.d.). Retrieved July 27, 2010, from http://ec.europa.eu/information_society/eeurope/i2010/index_en.htm
57. World Digital Library Home. (n.d.). Retrieved July 27, 2010, from http://www.wdl.org/en/
58. Digital Library of India: Indian Institute of Science. (n.d.). Retrieved July 27, 2010, from http://www.new.dli.ernet.in/
59. TKDL:Traditional Knowledge Digital Library. (n.d.). Retrieved July 27, 2010, from http://www.tkdl.res.in/tkdl/langdefault/common/Home.asp?GL=Eng

Welfare and is being implemented at CSIR. It involves documentation of the traditional knowledge available in public domain in the form of existing literature related to Ayurveda, Unani, Siddha and Yoga in digitized format in five international languages namely English, German, French, Japanese and Spanish.

2.7.2 Open CourseWare (OCW):

An OpenCourseWare is a free and open digital publication of high quality educational materials organized as courses[60]. It contains educational material and resources that are offered freely and openly for anyone to use and under some licenses to re-mix, improve and redistribute. It aims to support learning and teaching programme significantly. Learning material in an OCW provides learners an opportunity to gain knowledge beyond their routine classroom environments. These are in the digital form which can be accessed online, thus breaking the barriers of time and distance. It provides open access to the primary teaching materials for educational institutions and promotes free and unrestricted access to knowledge.

At the international level, the MIT OpenCourseWare[61] has become very popular. It contains 1900 courses spanning all the disciplines. The material include lecture notes, exams, audio-video courses, etc. It offers a web-based publication of virtually all MIT course content and is a permanent MIT activity. Two main OCW/OER (open educational resources) initiatives in India are eGyankosh and National Program on Technology Enhanced Learning (NPTEL). eGyanKosh is a National Digital Repository of Indira Gandhi National Open University (IGNOU)[62] to store, index, preserve, distribute and share the digital learning resources including online courses and opencourseware. NPTEL is being carried

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60. OCW Consortium. (n.d.). Retrieved July 27, 2010, from http://www.ocwconsortium.org/
61. Free Online Course Materials | MIT OpenCourseWare. (n.d.). Retrieved July 27, 2010, from http://ocw.mit.edu/index.htm
62. eGyanKosh: Home. (n.d.). Retrieved July 27, 2010, from http://www.egyankosh.ac.in/

out by seven Indian Institutes of Technologies (IIT's), the Indian Institute of Science and other premier institutions around the country and being funded by the Human Resource Ministry. Its objective[63] is to enhance the quality of engineering education by developing curriculum-based video and web courses for the students. Faculty from these institutions are involved in developing their course material in the electronic form.

National Knowledge Commission has also recommended to support the production of quality content by a select set of Indian institutions and to undertake a large scale e-Curriculum development effort directed toward adaptation and adoption support[64]. It has recommended that India must develop a network enabled delivery infrastructure with a focus on two primary areas - access and delivery. For access to the network, high bandwidth connections across institutions and a national backbone that provides advanced networking capabilities are major requirements. For the delivery of OER content, NKC has suggested creation of distributed repositories of educational resources, upkeep and preservation of educational content, increasing the availability of educational applications such as "Learning Management Systems", integration of OER into university curricula and organizational structures and developing new OER to bridge the gap of the human resources trained in the universities par excellence and the other universities. The working group has suggested the creation of the Institute for Virtual Knowledge Resources and Management (VIKRAM) to monitor and support the implementation, adoption and sustainability of the network-based education resources.

2.7.3 Open Access Data:

More and more organizations are now becoming information intensive depending heavily on processing of data. For research

63. National Programme on Technology Enhanced Learning(NPTel) Home. (n.d.). Retrieved July 27, 2010, from http://nptel.iitm.ac.in/
64. NKC: Recommendations: Open Educational Resources. (n.d.). Retrieved July 27, 2010, from http://www.knowledgecommission.gov.in/recommendations/oer.asp

organizations, data centres are becoming more and more important along with the research publications. Even the publications in the field of empirical sciences is based on data. Research data can be integrated in publications and can be made available in the form of independent data sets. Apart from R&D institutions, data is also generated and collected in universities and other higher education institutions which conduct research thus becoming an important source for providing open access to data and its re-use. Research in STM is particularly data-intensive, for example, work in disciplines such as bioinformatics, geoscience and environmental sciences is based primarily which is collected, analyzed and interpreted collaboratively. GenBank[65] and the Protein Databank[66] are two successful examples of OA data. Advantages of open access data include research results based on data can be verified and critically examined, unnecessary duplication of research work can be avoided, data can be analyzed comprehensively and made use of in follow-up projects, research process can be accelerated through data sharing, new findings can be achieved by merging data from different sources, merging of data brings an informal added value and yields higher-quality data products[67].

2.8 Open Access Strategies:

There are two ways to make research open access: first involves publishing in open access journals and the second is self-archiving in institutional repositories.[68] The golden road refers to the primary publication of scholarly and scientific articles in Open Access journals.

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65. GenBank Overview. (January 2010). Retrieved July 27, 2010, from http://www.ncbi.nlm.nih.gov/genbank/
66. RCSB Protein Data Bank. (July 2010). Retrieved July 27, 2010, from http://www.rcsb.org/pdb/home/home.do
67. Informationsplattform Open Access: Open Access to data. (March 2009). Retrieved July 27, 2010, from http://open-access.net/de_en/general_information/what_does_open_access_mean/open_access_to_data/
68. Stevan, Harnad. (n.d.) *Mandates and Metrics: How Open Repositories Enable Universities to Manage, Measure and Maximise their Research Assets* [PowerPoint slides]. Retrieved from http://www.ecs.soton.ac.uk/~harnad/Temp/openaccess.ppt

The green road to OA refers to self-archiving of digital documents in an openly accessible institutional or subject-based repositories. Self-archived texts mainly include preprints as well as postprints, the other material being monographs, research reports, conference proceedings, etc. The green road offers freedom and control in hands of the authors, whereas the authors depends upon the policies of the publishers in the golden road . The two roads to OA are complementary, the green road being the faster and surest way to reach immediate 100% OA. Some organizations have used more number of colours to describe the types of open access. Repositories Support Project (RSP) has used additional Blue, Yellow, White colours apart from Green & Gold[69]. The original colour code was established by the JISC-funded RoMEO project in 2003 and has been continued by the SHERPA-RoMEO service[70] as a way of presenting a standardised approach to the different rights, permissions, and restrictions that are imposed by different publishers. Precise and specific details of each publisher's permissions can be found within the publishing contracts which each author signs. Thus, the open access rainbow can be summarized as follows:

Publishing colours	Gold	open access publishing/journals
Archiving colours	Green	can archive pre-print and post-print
	Blue	can archive post-print (i.e., final draft post-refereeing)
	Yellow	can archive pre-print (i.e., pre-refereeing)
	White	archiving not formally supported

Table 2.1 Colours of open access

2.9 Flavors (Flavours) of Open Access:

69. Hubbard, Bill. (2007). Green, Blue, Yellow, White & Gold: A brief guide to the open access rainbow. Retrieved from http://www.sherpa.ac.uk/documents/oa_rainbow_guide.pdf
70. SHERPA/RoMEO Home - Publisher copyright policies & self-archiving. (n.d.). Retrieved July 27, 2010, from http://www.sherpa.ac.uk/romeo/

Some authors have chosen the term "Flavors" to describe the various facets of OA. While Ann Okerson has given six flavors[71] of OA, John Willinsky has given the following ten flavors[72] of open access:

S.No.	Type of Open Access	Economic models	Journal or portal example
1	Home page	University department maintains home pages for individual faculty members on which they place their papers and make them freely available.	http://www.econ.ucsb.edu/~tedb
2	E-print archive	An institution or academic subject area underwrites the hosting and maintenance of repository software, enabling members to self-archive published and unpublished materials	arXiv.org E-Print Archive
3	Author fee	Author fees support immediate and complete access to open access journals (or, in some cases, to the individual articles for which fees were paid), with institutional and national memberships available to cover author fees.	BioMed Central
4	Subsidized	Subsidy from scholarly society, institution and/or government/foundation enables immediate and complete access to open access journal.	First Monday
5	Dual-mode	Subscriptions are collected for print edition and used to sustain both print edition and online open access edition.	Journal of Postgraduate Medicine
6	Delayed	Subscription fees are collected for print edition and immediate access to online edition, with open access provided to content	New England Journal of Medicine

71. Okerson, A., & Bakker, T. (2004). Six Flavors of Open Access: Successes and Possibilities for STM Journals. *Liber Quarterly: The Journal of European Research Libraries*, 14(1-4), 339-347. Retrieved from http://www.library.yale.edu/~okerson/ASO-LIBER-2004.htm
72. Willinsky, J. (2009). The Access Principle: The Case for Open Access to Research and Scholarship (Digital Libraries and Electronic Publishing). London: The Mit Press.

		after a period of time (e.g., six to twelve months).	
7	Partial	Open access is provided to a small selection of articles in each issue— serving as a marketing tool — whereas access to the rest of the issue requires subscription.	Lancet
8	Per capita	Open access is offered to scholars and students in developing countries as a charitable contribution, with expense limited to registering institutions in an access management system.	HINARI
9	Indexing	Open access to bibliographic information and abstracts is provided as a government service or, for publishers, a marketing tool, often with links to pay per view for the full text of articles.	ScienceDirect
10	Cooperative	Member institutions (e.g., libraries, scholarly associations) contribute to support of open access journals and development of publishing resources.	German Academic Publishers

Table 2.2 Flavors of open access

2.10 OA Quality-Assurance Models:

In traditional academic publishing, quality assurance usually results from anonymous refereeing by others working in the field (peer review). In course of this process, manuscripts are usually edited and improved which are finally published. This traditional process is equally applicable in case of open access publications without change. The additional advantage of Open Access is that referees have unlimited access to other relevant OA publications and it offers scope for new interactive approaches to quality assurance thus diluting the myths regarding the quality of OA literature. The different quality-assurance approaches which are applicable or already in use for OA publications can be peer review, collaborative peer-review, moderation,

automatic assessment and assessment by readers[73].

Peer review is a well-established model based on editors and anonymous specialist referees in which articles are only published after a non-public specialist review and revision process. In collaborative peer review, the publication and review process takes place publicly in two or more stages, starting with the preprint or discussion stage. While original manuscripts are being reviewed by editors and anonymous or known referees, readers can offer additional comments. With the editors' approval, the authors have the chance to publish improved versions on the basis of the reviews and comments.[74] Under the moderation method, submitted manuscripts receive only a casual review by a moderator. The original manuscript is published if it appears not to contain any gross defects. In automatic assessment, publication of the manuscript goes ahead without any kind of quality assurance. Under assessment by readers, publication of the manuscript does not ensure quality assurance and is based upon readers comments which are published with the manuscript. In practice, a whole variety of combinations of the above models are used.

2.11 Conclusion:

As the saying goes "necessity is the mother of invention", the academic community has found an answer to the scholarly communication crisis in the form of open access. It can bring a revolutionary change in the traditional scenario of scholarly communications where everything was in control of the publishers and the authors' were deprived of their basic rights. The libraries were loosing their purchasing power as the publishers had raised subscription

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73. European Commission (2008b), *Open Access – Opportunities and Challenges, A Handbook.* Retrieved Dec 2009 from http://ec.europa.eu/research/science-society/document_library/pdf_06/open-access-handbook_en.pdf
74. Peer review. (2010, July 25). In *Wikipedia*, The Free Encyclopedia. Retrieved July 27, 2010, from http://en.wikipedia.org/w/index.php?title=Peer_review&oldid=375416674

charges steeply. The worst sufferers being the readers who were unable to access the knowledge they needed. With the advent of open access, the grim situation has gradually started to improve as more and more scholarly works in the form of journal articles, open courseware, theses and dissertations, conference papers, presentations, reports, etc. are freely available online. A number of initiatives are being undertaken by various academic institutions, discipline oriented research organizations, learned societies, governments of various countries and many international LIS associations like IFLA, ALA, SPARC, etc. These initiatives have also led to an impact on the commercial publishers to think alternative publishing model to help the authors who want their scholarly work to be in public domain without harming their commercial interests. The authors are now getting the freedom to publish in open access journals and/or submit their works in the open access institutional repositories. If the author's organization does not have an institutional repository, they can deposit the article in a disciplinary archive. But these initiatives are not sufficient to bail out the budget starving libraries. Hence, more efforts have to be made to create free and conducive environment encouraging knowledge creation, rapid dissemination and maximum sharing leading to advancement of global knowledge and ultimate progress of the world.