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# OPEN ACCESS REMODELING SCHOLARLY COMMUNICATION

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## Abstract

*Open Access is being increasingly projected as a solution to the crisis in access to scholarly research triggered by the high cost of periodical publications. This paper sets the movement against the backdrop of factors that contributed to the OA, examines the major solutions practiced and proposed to overcome the barriers to access scholarly research. The paper also highlights some of the issues that are being raised which need to be addressed*

## 1. Introduction

The community of scientists has always considered communication and dissemination of research as a necessary and integral part of science and has recognized the importance of scholarly communication in the process of generation of new knowledge. The emergence of the 'journal' in the 17<sup>th</sup> Century is a direct consequence of this belief among the members of the scientific community who published the results of their research in the 'journals' without seeking any payment for their efforts. The 'scientific journal' served two very important objectives:

- It served to show the faith of the scholarly community in the need for sharing information and knowledge for enhancing knowledge and science by serving as a tool for dissemination of results of scientific research
- It also helped the scholar(s) achieve recognition among members of the peer group. It helped establish the researcher's claim to a piece of research and also enabled other researchers to build upon them and carry research forward

A number of developments in the last two decades have threatened to defeat the very purpose for which the scientific community invented the scholarly communication system. A substantial proportion of the scholarly periodicals being published today (including those which are published on behalf of societies and professional bodies) are controlled by a limited number of large commercial publishing houses; a few conglomerations control the publishing industry. The publishing industry has witnessed some major mergers, take-overs, etc since the 1990s. A direct consequence of all this has been a sharp increase in the cost of subscription to journals in the last two decades; this combined with the growth in the number of periodicals, the falling purchase power of currencies of developing countries have resulted in a crisis in which academic and research institutions can no longer afford access to the full range of required periodicals. Institutions have been forced to cancel subscriptions, divert book budgets for purchase of periodicals, etc.

The scientific journal has grown and become a major component of scholarly communication system primarily because the scientists have always donated the outputs of their scholarly research for dissemination without expecting any money; recognition by the peer group has been the only reward expected in return for this. However, in recent years it is increasingly being felt that the conventional model of scholarly communication has failed to make information accessible and usable especially for the developing world.

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## 2. What is Open Access ?

'Open Access Initiative' is a comparatively recent development. The Budapest Open Access Initiative probably offers the most comprehensive definition of Open access: "... By 'open access' to ... literature, we mean its free availability on the public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited." Broadly it suggests building and operating mechanism for free online access to electronic versions of scholarly research literature. The Wikipedia defines 'open access' as: "An effort to grant access to a large variety of up-to-date information sources for free." Scholarly research literature generally takes one of the following forms:

- Papers in periodicals
- Conference papers
- Technical / Research Reports
- Theses & Dissertations

The 'crisis' in scholarly communication referred to in the previous section began roughly in the 1970s, although the principal issues that dominate the discussions on the crisis have changed from time to time. The discussions at present centre on journal price inflation in the STM disciplines. Unfortunately for all, owing to the diversity among the different stakeholder groups a viable and acceptable (to all the stakeholders) reform proposal is yet to emerge. Open access is believed to have the potential to completely turn around this situation. It is seen as an alternative way conceived by scientists to overcome the crisis in scholarly research communication and share their research. The scholarly community also looks at it as a cost-effective means of providing free and unlimited access to research by effectively using the Internet technology. Subscription to the concept of open access implies that the copyright holder agrees to unrestricted reading, downloading, storing, printing, and hyper-linking to the document with minimal or no restrictions on the use. To put briefly and succinctly Open Access is based on two major premises:

- The present scholarly communication system with scientific journals as its major component is technologically inadequate for research and education purposes;
- The system is financially unsustainable even for large university and research libraries in developed countries.

### 2.1 New Model of Communication and Access:

Open access implies the availability of scholarly literature in digital form. The mechanisms that have been conceived and built to realize open access to scholarly literature adopt one of the following two broad approaches:

- **Open Access Periodicals:** A number of open access periodical publications have been initiated in recent years. Advocates of *open access* encourage scholars to publish their research in these open access periodicals
- **Open Archives through self-archiving (Digital Repositories):** Many digital repositories have been initiated and authors are encouraged to submit- e-prints of their publications (preprints or post-prints) for archiving in such depositories. These usually take one of the following forms:

- Institutional Repositories
- Discipline-Specific Open Archives
- Material-type-specific digital repositories

Many authors also post their research papers on their personal / institutional websites. However, measured purely in terms of their ability to maximize the possibility of a researcher finding open access material, certain mechanisms represent a more organized and conscious approach to realizing the goals of open access. We shall discuss these mechanisms in some detail. However, before discussing these it is necessary to clear certain misconceptions about open access. The principal objectives of Open access are to address:

- Barriers to access: Price Barriers such as cost of subscription, licensing, per article fees, etc
- Barriers to use: Restrictions imposed by copyright or license agreements

Open Access does not mean an end to the system of communication that has been in force since the emergence of the scientific journal more than three hundred years ago. Open access also does not necessarily mean an end to the peer review system that has been in operation in science journals for so long as a mechanism for quality control and assurance. The open access mechanisms that are in vogue are fully compatible with peer review system. There are however, certain issues that need to be addressed in this regard. We shall return to this later. Again, Open access is not the same as free access. An e-journal that is freely available on the Internet is not necessarily an open access material if it carries conventional copyright statements. Open access materials typically use the Creative Commons Attribution license in addition to a copyright statement to indicate the uses permitted.

### 3. Mechanisms for Open Access

Several mechanisms (channels) are in use to provide open access to scholarly material. These should not be perceived as alternative ways of providing open access. In reality they are complementary to one another. Scholarly resources accessible via more than one open access mechanism have a much greater chance of reaching the end users than what is made available via a single channel. Each channel also serves a different purpose. An overview of the major mechanisms that are in operation today is provided in the following table.

Mechanism	Description	Examples
Domain-specific / Institutional / Material-Specific repositories	Authors Deposit e-copies of their research publications in an OA repository	<ul style="list-style-type: none"> <li>• arXiv</li> <li>• Indian Institute of Science</li> <li>• LDL (DRTC)</li> <li>• Vidyanidhi (University of Mysore)</li> </ul>
Open Access Periodicals♣	Complete and unrestricted access to web-based OA journals	<ul style="list-style-type: none"> <li>• D-Lib Magazine</li> <li>• PLoS Biology</li> <li>• PLoS Medicine</li> </ul>
Limited Access	Conventional periodicals that allow open access to certain sections of their issues (but not all the items in the issue)	Nature

Delayed OA version	Periodicals going open access after a specified period of time from the date of publication	HighWire Press (Stanford University)
Dual Mode	Subscription-based print-on-paper edition along with OA online edition	British Medical Journal
State of Economy-based open access	Conventional periodicals made available as OA periodicals to countries based economic criteria; Publishers of these periodicals donate subscriptions to e-versions based on their GDP per capita ♦	HINARI, AGORA

*Table: Channels for Providing Open Access*

### 3.1 Open Access Periodicals

Recognizing the need for providing wider access to papers in periodicals especially to those who cannot afford to subscribe to the journals, several periodicals have adopted a policy of allowing authors to make available e-prints of their papers on open archives. There are also several periodicals, which have gone 'open access' and make available freely their electronic versions.

It has been estimated that nearly 75% of all scholarly periodicals are available in electronic form in addition to the print-on-paper version. Besides, there are over a thousand peer-reviewed periodicals that are available only in electronic form. Some of the conventional periodicals have also adopted a policy of providing free access to back issues after a certain specified period from the date of publication. For example, the New England Journal of Medicine provides free access six months after initial publication. Some other periodicals have implemented a policy of simultaneous publication of an open access online version while the print-on-paper version is available only to those pay for it and subscribe. There are also periodicals that have adopted an open access policy for certain portions of what they publish and limiting full and complete access only to subscribers. Many new open access periodicals have also started.

The Directory of Open Access Journals (DOAJ) (<http://www.doaj.org/>) defines open access journals as "journals that use a funding model that does not charge readers or their institutions for access". Open access journals are very similar to conventional journals in that they have editors and editorial boards, they publish scholarly papers, and have a peer-review process in place. The differences, however, relate to:

- They are generally e-only journals to keep production costs low
- They use Creative Commons Attribution license<sup>8</sup>.

As of 18<sup>th</sup> January 2006 the DOAJ had listed 2000 open access journals. This is one sector that is rapidly growing. For inclusion of titles in its directory, DOAJ has accepted the criteria laid down in the Budapest Open Access Initiative which recognizes the right of "users to read, download, copy, distribute, print, search, or link to the full texts of these articles" as mandatory for a journal to be included in the directory. However, most of the periodicals require the authors to pay a certain fee for this purpose (the fee varies from journal to journal), although more often than not, this fee is met out of the research grant of the author(s). A few funding agencies have built this into the terms of their research grants.

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Several Indian periodicals, especially in the sciences and medicine, have adopted the open-access policy. For example, all the periodicals of the Indian Academy of Sciences are *open access* journals. Interestingly, the Indian journals do not charge the author or institution for submission or publication of their work (Charging author fee for publishing papers is a common practice among many open access journals published in the developed countries). Two important requirements for effective implementation of open access by conventional periodicals are:

- Transition from *print-on-paper* to electronic publishing
- Digitization of back runs of the periodical

### 3.2 Digital Repositories

Digital open access repositories complement open access periodicals and are the only means of providing open access to certain types of scholarly literature. Digital repositories could be of different types depending on their function and scope. They could be domain-specific, material-specific, institution-specific or even open access digital repositories of research output of an author created by the authors themselves. The first major step in this direction began at the Los Alamos National Laboratory in the U.S.A. in 1991 when a physicist working in the laboratory initiated an effort to create a digital repository of research papers in high-energy physics. In a recent paper, Taranum and Urs (2005) provide a comparative overview of ten major repositories.

There are several domain-specific digital repositories initiated by the members of the concerned scientific communities. To mention a few domain-specific open access digital repositories:

- **arXiv** (<http://arxiv.org>) covering physics and related disciplines.
- **NCSTRL** (Covering computer science)
- **RePEc** (Research papers in Economics)

The Documentation Research & Training Centre, Bangalore and the University of Arizona maintain open access digital repositories of e-prints in LIS. Domain-specific digital archives, although maintained as a centralized facility by some institution / organization depend for their effectiveness, on authors depositing e-prints of their papers (pre-prints or post-prints) with the archives for open access.

#### 3.2.1 Institutional Repositories

Institutional repositories are digital collections that capture and preserve the scholarly output of an institution of higher education / research. Mark Ware (2004) defines an institutional repository (IR) as “a web-based database (repository) of scholarly material which is institutionally defined (as opposed to a subject-based repository); cumulative and perpetual (a collection of records); open and interoperable (e.g. using OAI-compliant software); and thus collects, stores and disseminates (is part of the process of scholarly communication). In addition, most would include long-term preservation of digital materials as a key function of IRs.”

In this sense they seek to address important issues that triggered the open access movement:

- Ensuring that control over the scholarly output of an institution rests with the institution / authors rather than large commercial journal publishers
- Ensuring that access to research is expanded to overcome barriers imposed by high economic cost of journals
- Ensuring enhanced visibility of an institution's research output

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In addition, long-term preservation of the scholarly output of an institution is seen as an important goal of institutional repositories. Another indirect benefit is that they could serve as indicators of the quality of the research output of an institution. Institutional repositories have largely been created and managed by universities as they provide an effective mechanism for disseminating scholarly output of a university besides being an appropriate mechanism for providing access to such scholarly material as theses and dissertations, research reports that are outcome of sponsored research, etc.

Authors may also create repositories of their research by self-archiving their research papers. It is common practice among the members of the scientific community to provide access to their e-prints and other digital publications on their personal websites. However, in terms of reach, domain-specific digital archives and institutional repositories score significantly over authors' personal websites. These repositories are generally built to support submission of scholarly papers in a wide variety of formats; however, often the systems support conversion to a preferred format such as PDF for viewers.

A limitation of many such repositories is that they are based on self-archiving and the submissions are not peer reviewed before becoming available. However, digital repositories have come to occupy an important role as major players in the open access movement. The fact that universities are funding many of these ventures suggests that these are also seen as a means for enhancing the visibility of an institution's (as well as the authors') research output besides being an effective medium for dissemination of research.

#### **4. Interoperability**

Wikipedia defines interoperability as "the ability of products, systems, or business processes to work together to accomplish a common task. The term can be defined in a technical way or in a broad way, taking into account social, political and organizational factors". In the present context: "Interoperability is the ability of systems, services and organizations to work together seamlessly toward common or diverse goals". Interoperability is a key issue in the open access movement. It is considered here primarily in the context of resource discovery and access with the primary objective of facilitating wide dissemination and communication of scholarly information in open access repositories via a very low-barrier interoperability framework. Quite early in the development of open access digital archives two key interoperability problems were identified as affecting their value and utility:

- Search and resource discovery were not easy as users had to use multiple search interfaces
- Sharing the metadata was difficult

The community associated with building digital archives of scholarly papers recognized the benefits and advantages that would result from ensuring interoperability between the distributed e-print archives. Interoperability is supported by open standards for resource description. It is therefore not surprising that the Open Archives Initiative (OAI) promotes interoperability standards. Essentially these standards enable service providers to harvest metadata from resources in open access repositories to provide better search capabilities in their value-added services. The metadata of each article (the title, authors, and other bibliographic details) is exposed in a format compliant with the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). The OAI-PMH gives a simple technical option for data providers to make their metadata available to services, based on the open standards HTTP and XML (Extensible Markup Language). The metadata that is harvested may conform to any metadata set acceptable to the community; however, unqualified Dublin Core is specified in many digital repositories to provide a basic level of interoperability. A service provider can gather metadata from many sources distributed in several repositories into a single database and provide services using this harvested data.

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## 5. Technology:

This is one aspect of open access publishing in which a wide range of solutions seems to exist. For creating and maintaining institutional repositories open source software are easily available. EPrints, software made freely available for creating and maintaining digital institutional repositories (developed by the Department of Computer Science, University of Southampton) appears to be the most favoured software. Software such as D-Space for maintaining digital repositories are also freely available. Incidentally the University of Southampton also provides detailed guidelines on its website for creating IRs. Similarly MySQL seems to be the preferred backend database widely used by digital repositories.

## 6. Suggestions and Discussion

Undoubtedly, open access movement has been one of the most significant developments and may well represent a turning point in the scholarly communication system. Several benefits have accrued to the scientific community and associated institutions as a result of the open access movement:

i) There is evidence to suggest that papers that are self-archived are cited more often than those that are not. There is at least a twofold increase in citation rate. In some subject areas it is even higher. Steven Harnad (2004a, 2004b) and his colleagues, in an attempt to promote open access are gathering data to show that open access journals have higher impact factor compared to print-on-paper periodicals or proprietary full-text databases. This means that Open Access research papers have much more impact. This form of Open Access means that research has much more impact than before. Moreover, the research cycle – where work is published, read, cited and then built upon by other researchers – is enhanced and accelerated when results are available on an Open Access basis. Would you not prefer to be able to access all the articles you need to read and use for your research, easily and without restriction?

ii) Additionally, open access significantly accelerates and enhances the publication and use of new research by reducing the time lag between the actual completion of a piece of research and its publication. It makes full use of the powers of technology to hasten the publication process (This is so even if it involves refereeing).

iii) It is probably the open access movement that triggered the emergence of the library consortia model of subscription, which is essentially a package offering access to online versions of most or all the periodicals of a publisher. For the libraries and the community served by the library, this has significantly expanded access and collection base.

**6.1** There are, therefore strong reasons for both the community of scholars served by libraries as well as the library / information community to carry the open access movement forward. Suber and Arunachalam have explored the benefits and relevance of open access especially to the developing countries. As already mentioned several Indian periodicals especially in science and medicine have opted for open access publishing. Wider accessibility of our journals has helped in increasing the citations to our research papers. Unfortunately, however, Indian science publishing is not as strong as the Indian science itself. Good quality research done in India is often published outside India. Thus even if all the journals from India adopt open access, Indian scientists will still not be able to easily access the research papers of their colleagues if the journals where Indian scientists publish do not adopt open-access publishing. To a significant extent this problem could be overcome if universities and research organizations are encouraged to develop institutional repositories. A few institutions have initiated such an action; but this needs to be vastly expanded. Secondly, even in those institutions that have set up their own institutional repositories, the response from the community of authors has been far from encouraging. Probably there are reasons for this state of affairs. These need to be addressed if the movement has to grow and succeed. Further, academic and research libraries should be encouraged to join such coalitions as SPARC (The Scholarly Publishing and Academic Resources Coalition) that promote OA.

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**6.2** An area that requires immediate attention of those concerned with communication of scholarly research in India has to do with doctoral research, sponsored research funded by funding agencies and papers presented to conferences. Much of the research output of these activities, viz., theses and dissertations, research reports and conference papers are far less accessible when compared with papers in periodicals. Funding agencies such as UGC, CSIR, DBT, ICSSR, DAE, etc should make it mandatory for these to be accessible in institutional repositories. UGC and some universities appear to have initiated some action with regard to theses and dissertations. The argument in favour of free access to research funded using public funds (with appropriate exceptions) quite strong. More than 30 countries have signed the OECD Declaration on Access to Research Data From Public Funding. In Feb. 2005, the U.S. National Institutes of Health (NIH) issued its "Policy on Enhancing Public Access to Archived Publications Resulting from NIH funded Research" which requests that all NIH-funded investigators submit to PubMed Central an electronic copy of their final published manuscript within 12 months of publication.

**6.3** While we realize the importance and value of expanding open access to scholarly research, it is equally important to address the many questions that are being raised about the prospects of open access. Any attempt to reform and enhance the scholarly communication process, which is what open access seeks to do, must take these into account if a viable and sustainable model has to be built. Will the open access movement expand enough to include a sizeable proportion of scholarly literature? What shape will Open Access take? Going by the developments in recent years it is most likely it will be a "cluster of loosely coordinated publishing ventures". Its principal strength will continue to derive from technology that enables accessing and sharing of distributed digital resources by the community of scientists. We must realize that open access movement is being carried forward on several fronts: journal publishers are being encouraged to adopt open access; new open access periodicals are being started; digital repositories are being set up.

**A.** There is the important question related to current journal publisher policies on self-archiving and copyright, which vary widely from publisher to publisher. Malone and Coleman (2005) in an editorial that reports the current status of self-archiving policies of 200 periodicals in Library & Information Science employed a three point scale to measure the level self-archiving supported by the journal publishers. It was found that very few periodicals support full archiving (author's websites, institutional repositories and open access archives). It has been estimated that one-third of journals formally support self-archiving of preprints and only 20% support self-archiving of the refereed post-print.

**B.** The present models in operation have two very important features:

- The copyright rests with the authors / institutions that agree to make available their scholarly papers for open access;
- The financial support for meeting the cost of publishing scholarly papers in open access journals shifts from subscription to other sources; some of the models in operation are:
- The authors paying for publishing their scholarly literature
- The institutions (to which authors are affiliated) meeting the cost
- The publishers (of open access journals) / institutions maintaining digital repositories meeting the cost

Interestingly enough the advocates of open access movement do not appear to suggest open access as an alternative to the existing scholarly communication model. The important question is the financial viability and sustainability and also the limitations of these models. For example, if open access has to be supported by payments from authors, many authors may be compelled to take into consideration the quantum of fees to decide where to publish. If, on the other hand, institutions were to meet the cost, it is doubtful if smaller and poorer institutions, especially in the developing countries will be able to do so.



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**C.** Long-term preservation of digital resources is another important issue. Institutional repositories will also have the additional responsibility of long-term preservation of resources. The long-term costs of doing so are still unknown, and therefore IRs also mean a major commitment for institutions to preserving all these diverse and ever changing formats forever.

**D.** Another important requirement to carry the movement forward will be to expand the user base of OA resources. OA resources should become a part of the information universe. While tools such as OAister (<http://oaister.umdl.umich.edu/o/oaister/>), a search tool for freely available for academically-oriented digital resources serves as a gateway to over three hundred digital collections, it is important to ensure that major secondary tools adequately cover and index OA resources in their databases.

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