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New Initiatives for Electronic Scholarly Publishing: Academic Information Sources on the Internet

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Abstract

This paper will trace the evolution of scholarly communication from the 17th century up to electronic journals, e-prints, e-scripts, electronic theses and dissertations and other digital collections of grey literature that emerge, with different degrees of acceptance in several disciplines, in the context of the new publishing models of the present day. The "open access or archiving/depositing" of electronic copies of scientific and scholarly research papers, theses and dissertations and other academic materials into networked servers, aims to ensure the widest possible dissemination of their contents by making them freely available on the public Internet, facilitating full use by readers without financial, legal or technical barriers, other then those related with gaining access to the Internet itself. The free and unrestricted online availability of this literature gives readers an opportunity to find and make use of relevant literature for the advancement of science and technology. From the point of view of authors, open archiving brings increased visibility and widens the readership and impact of their research work. For researchers in poorly resourced organizations and/or countries, access to this open archive material has great potential value, as it facilitates the retrieval of research results through the Internet. At the same time, it also allows scientists in these organizations/countries to participate in the development of the global knowledge base. The paper will outline the strategic factors that impact on the acceptance of these scholarly materials, available through "open access or archiving/depositing". Several international initiatives aiming at the creation of a global network of cross-searchable research materials are underway. Some of the more relevant ones will be reviewed. The impact that the availability of these novel scholarly materials is having, on changing roles and responsibilities of information managers, will also be highlighted.

1.0 Introduction

One of today's most rapidly evolving and pervasive aspects for library and information managers is the growth of published material appearing first, or only, in electronic/digital format; this is particularly true of scientific research publications. More and more authors are placing their papers directly on the Web, traditional publishers are moving into the electronic publishing business, and other companies, new to the sector, are moving into electronic publishing (Oppenheim 1997).

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In a relatively short period of time (since the 1970s), electronic information resources have expanded from a few dozen computerized bibliographic databases to include the overwhelming diversity of services and products created by the electronic publishing industry. These are available in digital formats like CD-ROM and DVD, as well as through the Internet. In parallel, new publishing models, using the Internet, are being evolved, within the scholarly communication environment. The latter are being motivated by the opportunities created by the information technologies and Internet development, in parallel with the changing economics of publishing. A strong movement, among researchers and academics (user community), seeks to free scientific information and provide unrestricted access to it for all scientists, scholars, students and the interested public.

This means that a wide range of materials is made available through the Internet and can be accessed without using the library. These include preprints (e-prints), research manuscripts (working papers, technical reports and memoranda, the so called e-scripts), Electronic Theses and Dissertations (ETDs), all freely available in electronic format.

For their part, scientific publishers, as part of their strategy to attract customers, are making freely available, high quality, current and authoritative material, *e.g.* full listings of titles, tables of contents, sample copies of journals, as well as supporting the development of e-print servers, etc. They are even creating online communities around an area of shared interest, *e.g. BioMedNet* (http://www.bmn.com, the website for biological medical researchers, owned by Elsevier Science), *ChemWeb* (http://www.chemweb.com/, owned by Elsevier, which is a resource covering a wide range of information for those in research chemistry, the chemical industries and related disciplines.

The availability of these novel electronic resources has altered the traditional longstanding links between information professionals and their clients (Fecko 1997:6). In the past, the library was the interface between the user and a vast amount of published and unpublished information (Oppenheim 1997: 398), which was made available in hard copy, via online databases or in CD-ROM format.

Nowadays, information managers are handling an increasing proportion of new electronic/digital materials. These are produced by the electronic publishing industry and increasingly, in the case of Special and Academic Libraries, by authors using the alternative publishing models mentioned previously.

This paper will present an overview of the evolution of scholarly communication, from the dawn of the scholarly journals up to the new electronic publishing models. It will discuss e-prints repositories, proposing a classification that illustrates the different approaches to content and its creation. The benefits of e-prints, as well as the evolving prior publication policies of scholarly journals, regarding e-prints, will be discussed.

The challenges of launching, building, maintaining and developing digital libraries of scholarly materials, including Electronic Theses and Dissertations, will also be introduced.

The paper concludes by pointing out how these publishing genres are bringing new challenges and creating new opportunities in the evolving roles of contemporary librarians and information managers.

2.0 Evolution of scientific communication

The origins of formal scholarly publishing date back to the 17th century, to the correspondence among scholars (Boyle's Invisible Colleges) in England (Meadows 1998: 5; Oppenheim 2000: 361). Groups of scholars used to meet regularly to present papers and discuss research results, under the auspices of the Royal Society. They were also corresponding by private letters, publishing short accounts of the work in progress to update those members who were unable to attend the meetings. As the volume of correspondence grew, various scholarly journals emerged as a more efficient means to exchange information in a broader sense. *Journal des Sçavans* and the *Philosophical Transactions of the Royal Society of London* were amongst the first titles to be published (Schauder 1994; Meadows 1998: 6 - 8).

The scholarly journal may have started in the 17th century as a means of communication –dissemination of important research findings to the wider research community– but throughout the 18th and 19th centuries the "nature of journals slowly changed, resulting in a relative decline in the importance of learned society proceedings, and the successful creation of more specialised journals, reflecting the fragmentation of knowledge into more specialised disciplines" (Day 1999). The scholarly journal soon assumed the additional functions of registering "ownership" - the "scientific paternity", according to Guedon (2001) - establishing "priority" over a particular scientific discovery or advance, and of "packing" current communication into an indexed and readily accessible archive - a "public registry of scientific innovation" (Guedon 2001).

In the 19th century, yet another function was added. Publication of articles in journals came to be the prime indicator of professional standing for research professionals and the organizations that employed them (Schauder 1994: 75). Thus, while primarily allowing academics to inform peers of their findings and to be informed by them, the peer-reviewed journal also fulfilled other requirements (Boyce 2000: 404; Day 1999; Rowland 1997):

- author evaluation – providing a means for judging the competence and effectiveness of authors;
- author recognition - publication in refereed journals, raising an author's profile, improving chances of funding for future research contracts, tenure or promotion;
- validation of knowledge and quality control – through the process of peer review of submitted papers;
- historical record – maintaining the record of progress of science through the years;
- archive – providing a repository for the body of knowledge about a particular field.

The appearance and success of the electronic journal should be seen in the context of the development of electronic information systems evolving from the application of early electronic computers to scientific and technological information management.

In fact, the appearance of a large number of scientific documents produced by the Allies during World War II and the acquisition of the Axis documents following the War, triggered the need for new ways of organizing, storing and accessing this enormous body of information. Vannevar Bush, a former President of the Massachusetts Institute of Technology (MIT) and Director of the US Wartime Office of Scientific Research and Development, in his paper published in 1945, envisioned a system to store information (such as books, pictures, articles, newspapers and business correspondence) and which could be searched from a scientist's desktop, using a series of navigational links (Bush 1945). Although the Bush system – *MEMEX* - was microform based, it can be considered as the precursor to the modern hypertext systems of the Web (Large, Tedd and Hartley 1999: 43).

The expansion of research, since World War II, brought an exponential growth in the number of scientists over the years due to the increase of R&D activity, financed by industry, in parallel with that sponsored by public funds; the nature of research also evolved, over time, from specialized to interdisciplinary. All of these trends gave rise, over the decades, to different methods of scientific communication (Tenopir and King 2000: 18 - 21).

Since the 1960s, several government agencies in USA, United Kingdom, the Union of Soviet Socialist Republics and Japan, have been supporting a significant research effort aiming to find solutions to a number of problems within scientific (and technical) communication in general and scientific journals in particular. The problems addressed include the "information explosion", increasing publishing costs (and therefore prices), delays in publishing and distribution inefficiencies - the *serials crisis* (Tenopir and King 2000: 21 - 22; Large *et. al.* 1999: 43 - 44).

Many innovations have been considered and introduced, such as electronic publishing, digital processing of information and storage of large sets of data. These gave rise to the electronic journal, abstracting and indexing journals produced electronically and the emergence of electronic databases of bibliographic information linked

to the printed product (such as, *Chemical Abstracts*, *Engineering Index*, *Index Medicus*, etc...) (Large, Tedd and Hartley,.. 1999: 43).

In the 1980s, the R&D efforts to address the problems within scientific and technical communication, funded by government organizations, were terminated. New research projects, aiming to prove the feasibility of the electronic journal, were financially supported by publishers and, in the UK, by the British Library Research and Development Department (BLRDD). Several electronic journal experiments were launched over this period, for example (Tenopir and King 2000: 24):

- *ADONIS* - a journal article delivery service using the CD-ROM as the medium (a project of Elsevier, Springer and Blackwell Science, sponsored by British Library and the European Commission) (http://www.adonis.nl/index.htm); and others as
- *Red Sage*, *BLEND*, *ELVYN* and *TULIP* (Elsevier, http://www.elsevier.nl/homepage/about/resproj/tulip.htm?mode=tulip)

The development of the Internet and then the Web, in the '90s, has had a significant impact on the decline of the traditional printed journal as the pre-eminent vehicle for scholarly communication. These enabling technologies aroused the interest of some imaginative researchers who in a vociferous and radical way sought to convince the academic community that the printed journal would disappear, within a few decades (Harnad 1990; Odlyzko 1995) (quoted in Tenopir and King 2000: 24). Despite the fact that many journal publishers had begun to set up Web-based services, to give access to electronic versions of their existing printed journals, these radical proponents of electronic communication assumed that this is just replicating, in the new medium, the *status quo* of the print version. Several models of self-publishing (sometimes called self-archiving) have been proposed, using the new enabling technologies as a means of returning the responsibility and ownership of scholarship to its creators (Okerson 1992).

One of the key assumptions behind this movement, "to develop innovative publishing models for scientific communication is that, when scholars and scientists publish in peer-reviewed journals, they are not interested in monetary reward (royalties) but in having their work read, used, built-upon and cited" (Harnad and Hemus 1998). Researchers and academics are only too aware that job opportunities, tenure, promotion and merit pay are all dependent on the attention their papers receive; consequently authors of journal articles seek impact instead of royalties (Cronin and Overfelt 1995; Walker 2002).

As a result, the established scholarly journal system has been experiencing significant challenges to its continuing pre-eminence, due to several factors. Some of these are pointed out by Sompel and Lagoze (2000) and include:

- the rapid advances in most scholarly fields means that the turnaround time of the traditional publishing model is an impediment to the speedy dissemination of R&D results among peers (Tenopir and King 2000);
- the traditional model, requiring full transfer of intellectual property rights from author to publisher, works against the promotion and wide dissemination of results and obtaining peer recognition and visibility among colleagues (Bachrach *et al.* 1998);
- the current peer review, as an essential feature of the scholarly review process, is too rigid as it stands at present and often works against the expression of new ideas, by favoring publication of papers originating from authors in the more prestigious organizations and by causing unacceptable delays in publication (Harnad 1998; 1999; 2000);
- the disparity between increases in journal subscription rates, often exceeding rates of inflation and affordable library budgets (Tenopir and King 2000; Walker 1998); the so called "serials pricing crisis", which is seriously jeopardizing the economic viability of the printed system of

scholarly communication, stems from several contributing factors, as Bot and Burgemeester (1998) point out:

> General inflation and increase in size – (more pages per issue, more issues per volume, more volumes per year) - in conjunction with a dramatic decrease in personal subscriptions, which started in the 1970s. Publishers have apparently addressed this fall in revenue by increasing institutional subscription rates, thereby causing a vicious circle of cancellations and further increases in institutional rates.

This environment has encouraged the emergence of novel publishing models for formal and informal communication among scientists, based on Internet technologies for the dissemination and communication of research materials, with functionalities that far exceed those existing in print world. As well as promoting rapid access to information existing in scientific documents, in many cases without a fee, they also facilitate access to large amounts of multimedia materials on the Web and stored in databases, like biological sequences, time series, videos, etc.

The new publishing models being tested in different disciplines include, as outlined recently by Kling, Specter and McKim, (2002):

- *electronic journals* – an edited package of articles that is distributed to most of its subscribers in electronic form. Articles from an e-journal may and probably will be printed for careful reading; they might be stored in libraries in a printed form, for archival purposes. However, e-journals are accessed primarily in electronic form (Kling and McKim 1999: 891). Examples of peer reviewed, pure electronic journals are: *Florida Entomologist* (http://www.fcla.edu/FlaEnt/) and those produced by the *Entomological Society of America* (http://www.entsoc.org/pubs) (Walker 2002);
- *hybrid –paper electronic* (or the *p-e*) *journal* – (this is usually the electronic version of a paper journal) - it is a package of peer-reviewed articles available through electronic channels, but whose primary distribution channels are paper based. Examples of *p-e journals* include: *Science Online*, *Nature* (http://www.nature.com/); or the *e-p* journal *(hybrid e-p)* which is primarily distributed electronically and has a limited distribution in paper form (Kling and McKim 1999: 891);
- *author's self posting* - author's posting their articles on their Web-sites (Okerson and O'Donnell 1995);
- *field wide e-print repositories* (Ginsparg 1996; Holtkamp and Berg 2001, Brown 2001a, 2001b).

In their paper, Kling, Spector and McKim (2002) have also proposed the Guild Publishing Model (GPM) as an important scholarly communication model. This is derived from the formal research manuscript series (the *e-script* series) that are sponsored by academic departments and research institutes and which finds counterparts in the electronic environment, in the areas of economics, business, demography, higher energy physics, logic and information systems. Authors quoted the following, among others, as illustrative of the *GPM*:

- *Harvard Business School Research Manuscript Series* (Business research) (http://www.hbs.edu/dor/papers.index.html);
- *The University of Western Ontario Discussion Paper Series* (Demography) (http://www.ssc.uwo.ca/sociology/popstudies/dp.html).

Some of these new electronic publishing models - based on self/open-archiving (*e.g.* deposit of a digital documents in a publicly accessible website) - have been tested by scholars, in several disciplines and are sponsored by academic departments or research institutions in response to the rising costs of materials produced by the traditional publishing industry.

There is a strong international movement that, at least in some scientific areas, seeks to make research papers available by this method. Academics and researchers, worldwide, visit them, as the first place to look, before deciding to obtain the original document. This is especially useful for countries and/or organizations where financial restrictions prevent access to a wide range of commercially published journals.

The *Free Online Scholarship* (FOS) newsletter (http://www.earlham.edu/~peters/fos/index.htm), published by Peter Suber, is a highly useful resource for keeping up to date with developments in all areas related to electronic scholarly publishing.

The frequently updated *Scholarly Electronic Publishing Bibliography* (http://info.lib.uh.edu/sepb/sepb.html), published by Charles Bailey (1992/2002), since 1992, includes two sections with relevant articles, one on *New Publishing Models* and other on *Technical Reports and E-prints*.

Discussion lists about issues surrounding the freeing of scientific literature are available at:

- *American Scientists forum on freeing the refereed scientific literature* (http://amsci-forum.amsci.org/archives/september98-forum.html);
- *Nature's Forum on future e-access to the primary literature* (http://www.nature.com/nature/debates/e-access/),

where the points of view of different stakeholders, in the movement to develop innovative publishing models for scholarly materials, can be appreciated by following the debates taking place electronically.

3.0 E-Prints

3.1. Introduction

As discussed above, the advent of the Internet enabled researchers and academics to recognize that the information and communication technologies gave them efficient ways to share results, to combat the rise in journal costs fast outpacing a library's ability to afford them (serials crisis), to overcome the barriers raised by the full transfer of Intellectual Property Rights from author to publisher and to improve on the hitherto slow turnaround of traditional publishing. While several of their initiatives began as *ad hoc* vehicles for dissemination of preliminary results, a number of them have evolved into a more formal means for the efficient sharing of research results among peers in the field (Correia and Neto 2002).

The term *e-print* encapsulates a wide range of meanings. Originally it was defined as an electronic preprint circulated among colleagues and field specialists to obtain feedback; the concept of *e-print* was then generalised to include any electronic version of academic research manuscripts circulated by the author outside of the traditional scientific publishing environment. They may be journal articles, conference papers, book chapters or any other form of research output (Lucc 2001).

An "*e-print archive*" is simply an online repository of these materials, which is publicly accessible. Some *e-prints* may be peer reviewed before being posted on the servers; others are posted without peer review and authors request feedback on the results submitted (Garner, Horwood and Sullivan 2001: 250).

Some authors prefer to make the distinctions between the two forms, using the terms "*pre-prints*", for papers before they have been refereed and unpublished papers which are usually submitted for publication, or "*post-prints*", for final peer-reviewed and published versions of papers (as such they incorporate any changes or corrections necessary to ensure publication). In some cases, the e-prints are loaded onto servers, but are also submitted to traditional journals that have a peer review process. This procedure varies depending on the discipline (*e.g.* physicists, mathematicians, computer scientists and astronomers *vs.* bio-medicine and chemistry) (Kling, Spector and McKim 2002: 2; Brown 2001a: 188) and on the prior publication policies of

some journals towards publication and subsequent publication of e-prints (Brown 2001a:188), as will be discussed later in this paper.

Typically, an e-print archive is normally made freely available on the web, with the aim of ensuring the widest possible dissemination of its contents, to inform colleagues about research in progress and to seek expert comment (Pinfield, Gardner and MacColl. 2002).

The first *e-print* server was the *Los Alamos Physics Archive*, presently known as *arXiv.org*, which was created in 1991 by Ginsparg (Ginsparg 1996; Luce 2001; McKiernan 2000) at the Los Alamos National Laboratory, to give access to pre-prints in the domain of high-energy physics. Since July 2001, this archive has been located at Cornell University. During the last decade, it has evolved to become the primary means of scholarly communication and the largest non-peer review research works deposit available, worldwide. It is a fully automated electronic archive for research papers in physics and related disciplines, mathematics, non-linear sciences and computational linguistics. The *arXiv.org* archive is mirrored in more than a dozen countries.

The success of this new method of scientific communication and its acceptance among researchers and academics can be appreciated from the following data:

- In the beginning of 1999, *arXiv.org* contained 100,000 articles and the number of articles downloaded, yearly, exceeded 7 million, indicating that each article is downloaded at least 70 times, on average (this value refers only to the *Los Alamos* server and excludes the mirrors) (Odlyzko 2002);
- Two years later (2001), the number of articles made available by *arXiv.org* was some 150,000 and is growing at about 30,000 papers per year (Harnad 2001b).

Additionally, those in the domains of management, business and finance circulate "working papers" in a similar way to the physics preprints, which led to the creation of the *RePEC – Research Papers in Economics* service. Even allowing for existing differences between disciplines, in relation to the degree of adoption of electronic communication, as Kling and McKim (2000) have described, there are already, in most disciplines, examples of services providing access to electronic research papers. The following paragraph attempts to characterize the several approaches to create such services.

3.2 Classification of e-prints collections

This is an attempt to illustrate the diversity of approaches towards *e-prints* archives existing at present, the scope of the content and the tools to facilitate access to e-prints repositories and other grey literature available in any given scientific domain. The approach used here is to provide examples, which illustrate the broad groupings:

a) Subject/discipline specific and field wide *e-prints* repositories (*e.g. arXiv* (http://www.arxiv.org), firstly in high-energy physics, latterly extended to the whole of physics, mathematics and computer sciences; *CogPrints* (http://cogprints.soton.ac.uk/), covering cognitive sciences (namely, psychology, neuroscience, linguistics, and biology); *RePEc – Research Papers in Economics* (http://repec.org), in the field of economics (Krichel 2000; Cruz and Krichel 2002); *AgEcon Search: Research in Agricultural and Applied Economics* (http://agecon.lib.umn.edu), in the field of agriculture economics, including sub disciplines such as agribusiness, food supply, natural resources economics, environmental economics, etc. (Letnes and Kelly 2002); *The Mathematics Preprint Server* (http://www.mathpreprints.com/ math/Preprint/show/index.htt)

b) Central *vs.* Distributed institutional e-prints repositories
E-prints repositories are either,
   - Centralised subject-based, single e-prints repositories based at single institutions [*e.g. arXiv*, at Cornell University; *CogPrints*, at Southampton University), where authors from any

institution are required to submit their papers to archive, remotely by email or using a self-archiving procedure online (Pinfield, Gardner and MacColl. 2002), or

- Distributed institutional e-prints archives – whose aim is to offer academics and researchers of faculties and participating organizations, a central location for depositing their pre-publication scholarship, *e.g.*
  - *Nottingham ePrints* (http://www-db.library.nottingham.ac.uk/eprints/), University of Nottingham (Pinfield *et. al.* 2002);
  - *Glasgow ePrints Service* (http://eprints.lib.gla.ac.uk:333/, University of Glasgow;
  - *University of California eScholarship Repositories* (http://repositories.cdlib.org/), University of California;
  - *The Australian National University Electronic Pre and Post Print Repository*, (http://eprints.anu.edu.au/index.html), The Australian National University.

Centralised subject-based e-prints repositories have only been taken up by a limited number of subject communities. In their turn, the institutionalised models have an interest for those institutions that decide to promote themselves in the scientific and academic community.

c) Acceptance (or not) of non-refereed papers
There are *e-prints* repositories which accept deposit of non-refereed papers without any peer review process and in many cases invite commentary from peers, together with the final peer reviewed version (*e.g. ArXiv*; *CogPrints, Netprints, Glasgow ePrints Service*). Others are repositories which only accept refereed papers (e.g. *PubMedCentral*, *BiomedCentral*, *e-BioSci*). The latter are particularly relevant in the areas of medicine.

d) Infrastructures to make research output electronically (which can be considered a special case of distributed institutional e-prints repositories) for academic publications of faculties and participating organizations, *e.g.*
- *ARNO* (NL) (http://www.uba.uva.nl/en/projects/arno), University of Twente, University of Amsterdam and Tilburg University (Bentum *et. al.* 2001); as Prinsen (2001) states,

  it aims to build an infrastructure to make research output electronically available based on distributed archives that are interlinked by subject, connected with the existing national library infrastructure, linked with the production process of publishers, and linked with digital learning environments.

e) Portals to facilitate access to domain specific grey literature, including e-prints repositories, individual and institutional web pages:
- *PhysNet - The Physics Departments & Documents Network* (http://physnet.uni-oldenburg.de/PhysNet/ (Severins *et al.* 2000);
- *MATH NET – Internet Information Services for Mathematicians* (http://www.math-net.de/)
- *MareNet – Marine Research Institutions and Documents Worldwide* (http://marenet.uni-oldenburg.de/MareNet/)

f) e-prints repositories produced by commercial publishers, in response to e-prints initiatives by researchers; among others,

- *CPS - Chemistry PrePrint Server* (http://www.chemweb.com/preprint?url=/CPS), created by the *ChemWeb.com* (the online community for chemists operated by *ChemWeb*, a subsidiary of *Elsevier Science*), making available preprints and conference proceedings (pre-conference abstracts and post conference reports) in all areas of chemistry (Wilkinson 2000; Warr 2001);

- *ERA – Electronic Research Archive.*(http://www.thelancet.com/era), *The Lancet,* free electronic research archive in international health, for "electronic publication of unreviewed and expanded papers publish an open comment on these papers" (McConnell and Horton s/d). This archive allows medical researchers to deposit papers addressing health issues of relevance to many developing countries (Chan and Kirsop 2001);
- *NetPrints*: *Clinical Medicine & Health Research* (http://clinmed.netprints.org/home.dtl), sponsored by the *British Medical Journal* (Delamothe *et al.* 1999).

3.3 Benefits provided by the publication in *e-prints* servers

For scholars and academics, there are several benefits to be gained from archiving their scientific work in eprint repositories. The following are highlighted from the point of view of the researcher, as contributor/reader of the literature:

- lowering impact barriers and increasing visibility – papers become freely available for others to consult and cite (Pinfield, Gardner and MacColl 2002). Lawrence (2001 a; 2001b) and Goodrum *et al.* (2001) provide evidence that work that is freely available is more cited;
- rapid dissemination of information to a wider audience – depending on what document types are accepted in the archive (pre-prints or post-prints), online repositories help to accelerate dissemination of the research findings (Pinfield, Gardner and MacColl 2002);
- better quality and improved efficiency in the R&D activity (by avoiding duplication) and faster communication, between academia and industry (Warr 2001);
- improved archiving of scientific data - regarding this aspect, Internet technologies offers advantages of the multimedia and the supporting files, as Garner, Howard and Sullivan (2001: 252) point out,

  (...) They have the potential to improve the way the results are portrayed by including large data sets such as digitised images and the results of failed experiments (...) It is beneficial to have systems that can help scholars and scientists to learn from each other's experiences, both successes and failures. (Garner *et. al.* 2001: 252).

The e-prints offer substantially more features than their print equivalents: for example, in some cases, annotation facilities are provided to allow commentaries by peers to be posted.

As referred to above, from the institutional point of view, institutions benefit by ensuring that their research output is widely disseminated; it helps to enhance their reputation, to attract high quality researchers and obtain further research funds.

The benefits referred to are of great importance to all scientists, both as readers and contributors and to research institutions (Pinfield, Gardner and MacColl 2002).

Furthermore, the e-prints repositories bring added benefits for scientists in poorly resourced organizations or countries. By accessing e-prints repositories available anywhere in the world, they are provided with access to the global knowledge base. Equally important are the opportunities created by the *e-prints* servers which offer the possibility, for scientists in less resourced countries or organizations, to distribute local research in a highly visible way and without the difficulties and bias associated with publishing in traditional journals, which tend to favour the publication of papers from well known authors or from known organizations in more developed countries (Chan and Kirsop 2001).

3.4 Prior publication policies

Currently, policies differ between journal publishers regarding the acceptance of preprinted articles for publication in their journals. For some publishers, the posting of an article in an e-Prints service is considered as prior publication, whilst for others, it is not.

Even *ChemWeb* (http://www.chem.com), the largest online chemical community in the world, owned by the commercial publisher *Elsevier*, is encouraging all publishers to reach a firm decision on this issue (Warr 2001:1).

For its part, *NetPrints* (http://clinmed.netprints.org/home.dtl), the preprint server sponsored by *BMJ - British Medical Journal*, which is a repository of non-peer reviewed original research within the scope of clinical medicine and health, supplies on its website lists of journals in the domain of clinical medicine, (http://clinmed.netprints.org/misc/policies.shtml) that,

- will accept submissions that have appeared on preprint servers (*e.g. BMJ, Breast Cancer Research, Genome Biology, Journal of Biological Chemistry, the Lancet, Nature*, etc...) and
- will not accept submissions that have appeared on preprint servers (*e.g. American Journal of Clinical Nutrition, Biology of Reproduction, JAMA, Science*, etc...).

In turn, Brown (2001a; 2001b) has investigated how e-prints are cited, used and accepted in the literature of physics and astronomy, and examined the philosophies of approximately 50 top-tier physics and astronomy journals regarding e-prints. This author concludes that, "e-prints have evolved into a valid facet of the physics and astronomy literature" and that although the degree of acceptance stated by journals' editors and policies, as given in journals' instructions to authors, concerning the citing of e-prints, were found to differ, the research showed that the citation rate of e-prints is increasing. (Brown, 2001b: 187, 197-198).

Generally speaking, across the disciplines, there are publishers who refuse to consider manuscripts that have been posted on web archives. These include *American Chemical Society* and *New England Journal of Medicine* and *Science*, while others, within the same discipline, do not refuse to publish papers that have appeared on e-prints repositories – like the *Royal Society of Chemistry*, the *Journal of Neuroscience* (Garner, Horwood and Sullivan 2001: 253).

3.5 Issues and misconceptions

Some misconceptions about the newly established e-prints repositories are still hindering support for these initiatives. These misconceptions may be grouped around the following issues:

i) fears that *e-prints* may give rise to some sort of vanity publishing and consequently have an adverse effect on research quality

Since any individual can publish material on the Internet, there is a concern that low quality materials will appear on the e-prints archives giving rise to some "vanity press" that has not undergone the normal quality control procedures (Chan and Kirsop 2001).

Pinfield and other authors have, however, disagreed with this point of view, by harking back to the experience of more then ten years, with the *arXiv* repository; this indicates that researchers are always concerned with their reputation and professional credibility and that quality of research has not been at stake. Publication in a preprint server is a good way to expose the paper to widespread scrutiny (Pinfield 2001a).

Furthermore, some *e-prints* servers have implemented facilities that enable the user to exercise clear options for selectively retrieving material (*OpCit*), to discuss and rank the articles, access the most recent, the most viewed, the most discussed and the highest ranked articles [as in *Chemistry Preprint Server* (Warr 2001:2)]. These facilities enhance the potential for critical scrutiny and clearly separate vanity publishing from the rest. Even so, many authors prefer to post their papers on e-prints repositories only after they have been through the refereeing process, as they do not want to jeopardise prospects for grants and promotions or the possibility of rejection by those journals of high standing, which may still have restrictive policies regarding e-print publication. This is particularly true of the medical community, where some professionals have even gone so far as to say that pre-refereed material may be dangerous in their field, if used as a basis for clinical practice.

ii) Intellectual Property Rights (IPR), particularly copyright

The issues of IPR and copyright are complex. There is uncertainty as to the ownership of research copyright and the debate is still ongoing. In most Higher Education Institutions, accepted custom and practice is that academic authors are permitted to claim and dispose of the copyright themselves. The problem is that commercial publishers of many research journals require the authors to assign copyright to the publisher before publication. A movement taking shape within the e-print community is that authors should be encouraged to retain their IPR by submitting to journals that do not require signing over the copyright or will agree to the author distributing the papers through e-prints repositories (e -distribution rights). (Pinfield, Gardner and MacColl, 2002).

Summing up, the message to authors is loud and clear; they do not necessarily need to stop submitting their work to high-profile traditional journals. They should continue to do so but at the same time retain their copyright, to enable them to make their work available in an e-prints archive.

3.6 International initiatives towards the creation of a global network of cross-searchable research materials archives

3.6.1. OAI -Open Archives Initiative

In order to fully exploit the expansion in the number of e-prints repositories distributed across the Internet and to develop a global network of cross-searchable scholarly and research information sources, it was soon recognised that there was a need to ensure that searches could be made across different e-prints archives.

The *OAI - Open Archives Initiative* (http://www.openarchives.org/) addresses this issue; the initiative emerged from the Santa Fe Convention held in 1999. The *OAI* aims to create cross-searchable databases of research papers and make them freely available on the web by developing and promoting interoperability standards that will facilitate the efficient dissemination of content (Pinfield 2001b). Using these standards, institutions can put content on the Internet in a manner that makes individual repositories interoperable.

At the centre of this work is the *OAI Metadata Harvesting Protocol* (http://www.openarchives.org/ OAI/openarchivesprotocol.htm). This creates the potential for interoperability between e-prints archives by enabling metadata from a number of archives to be harvested and collected together in a searchable database. The metadata harvested is in the Dublin Core format and normally includes information such as author, title, subject, abstract, and date (Pinfield, Gardner and MacColl 2002).

The *eprints.org* (http://www.eprints.org/), at the University of Southampton, provides free software that enables any institution to install OAI-complaint archives (i.e. using the OAI metadata tags). It is designed to run centralised, discipline-based as well as distributed, institution-based archives of scholarly publications (Chan and Kirsop 2001).

OAI-compliant e-prints servers provide value-added facilities. They can compile statistics which show authors how many times their papers have been accessed; they can also produce an online publications list by author or by academic department. Furthermore, developing services such as the *OpCit – The Open Citation Project* (http://opcit.eprints.org) (a project funded by the *Joint NSF-JISC International Digital Libraries Programme* - http://www.dli2.nsf.gov/internationalprojects/intlprojects.html), aim to provide integration and navigation through citation linking; these are value-added services in e-prints repositories, as they provide enhanced reference linking and give authors citation and impact analysis of their work (Nottingham ePrints, *About Nottingham ePrints*. Value added services).

3.6.2 BOAI - Budapest Open Access Initiative

A meeting was convened in Budapest by the Open Society Institute (OSI), on December 1-2, 2001. Its aim was to accelerate progress in the international efforts to make scientific and scholarly research results freely available on the Internet.

The participants represented many viewpoints, academic disciplines and nations. They brought first-hand experience of many of the ongoing initiatives that make up the open access movement. They discussed how best the separate initiatives could be coordinated to achieve better progress. They examined the most effective and affordable strategies for serving the interests of research, researchers, and the institutions and societies that support research. Finally, they explored how OSI and other foundations could use their resources most productively, to aid the transition to open access and to make open access publishing economically self-sustaining.

As a result, the *BOAI-Budapest Open Access Initiative* (OSI) was announced (http://www.soros.org/openaccess/) which is a "statement of principle, a statement of strategy, and a statement of commitment".

In the first instance, BOAI addresses, specifically, peer-reviewed journal articles and preprints; nevertheless, it can be extended quite naturally to

> all content for which authors do not expect payment, namely scholarly monographs on specialized topics, conference proceedings, theses and dissertations, government reports and statutes and judicial opinion. (*BOAI public statement*, in BOAI FAQ 2002 http://www.earlham.edu/~peters/fos/boaifaq.htm).

In an article posted at *Nature's Forum on future e – access*, Butler points out that:

> Research institutions and funding agencies that sign up to the *BOAI* commit themselves to making policy changes, such as creating local open-access electronic repositories, and making it compulsory for grant recipients to deposit their papers there. Individual signatories agree to deposit their research in freely available electronic repositories, and to support alternative journals as authors, editors and referees (Butler 2002).

So far (May 2002), there have been ca. 2500 individuals and ca. 150 organizations signatories to the *BOAI - Budapest Open Access Initiative* (http://www.soros.org/openaccess/view.cfm).

3.7 Roles for librarians regarding self-publishing by researchers

The creation of e-prints archives is a response to a number of structural problems in the academic publishing industry. The library and information services at universities or research organisations should also be the natural place for e-prints services.

However, this development does not take place in isolation. Librarians must be involved. Strong alliances should be forged between librarians, scholars, scientists and researchers and those that have the responsibility for the development of the infrastructure. In this tripartite alliance, activities for librarians and information managers should be:

- supporting users (scholars, scientists and researchers) to e-publish their materials, to facilitate self publishing and to smooth the path for potential contributors;
- exploring the document types that e-prints services can accept and that may be relevant for the nature of research in their organisations;
- providing advice to those who wish to post their documents on the e-prints services with regard to the evolution of prior publication policies of journal publishers;

- increasing awareness of the possibilities and facilities provided by e-print archives;
- persuading institutional managers and policy makers of the benefits to be gained by creation of e-prints services in their organizations.

These are major challenges but they represent the future for librarians and information managers.

4.0. Electronic theses and dissertations

Theses and dissertations assume a central role in scholarly communication, as they are sometimes the only tangible deliverables, after long and expensive periods of research. As such, they are a major source of new knowledge and contain valuable research results which, when published, are extremely useful to other groups working in the same field (Gonçalves *et. al.* 2001).

The creation of digital libraries of theses and dissertations generates an environment, which significantly increases the availability of students' research for scholars and empowers universities to unlock their information resources. This environment gives rise to a number of beneficial activities (Fox 1999; Moxley 2001: 61; Suleman *et al.* 2001b):

- Improving graduate education – where universities require Electronic Theses and Dissertations (ETDs) for graduation they inspire and instigate faculty and graduate students to experiment with new mentoring models; in the past, few (printed) theses and dissertations were read, beyond the evaluation committee. Works, archived in Digital Libraries, are read by thousands, potentially millions of people worldwide;
- Empowering students to convey a richer message through the use of multimedia and hypermedia tools, animation and interactive features;
- Endowing graduates with new capabilities and eliciting the preparation of the next generation of scholars as effective knowledge workers, by providing opportunities for students to produce electronic documents, training future graduates in the emerging forms of digital publishing and information access;
- Lowering the costs of submitting and handling theses and dissertations (eliminating binding costs and shelf space);
- Increasing accessibility, visibility and readership of students' work and at the same time, this exposure attracts to the University promoting ETD, the most innovative future candidates; those who are keen to have their theses and dissertations read are often likely to obtain the best professional offers;
- Helping universities to build their information infrastructure and extend and advance digital library impact.

The *Networked Digital Library of Theses and Dissertations – NDLTD* - is an on going project which was conceived in 1987 and realized, in part, in 1997 through the efforts of Virginia Tech's Ed Fox, Gail McMillan and John Eaton (Moxley 2001: 62).

It aims to develop a federation of digital libraries, providing free access to graduate students' theses and dissertations and is a collaborative effort of universities around the world, which promotes creating, archiving, distributing and accessing ETDs (Suleman *et. al.* 2001a; 2001b).

One of the main objectives of the federation is to "provide transparent and integrated services that span NDLTD members' ETD collections, while keeping with the general desire, at each site to maintain their individual collections" (Gonçalves and Fox 2001:15).

NDLTD aims to help coordinate the international efforts related to electronic theses and dissertations; at present, it embraces thousands of students, faculty and staff at hundreds of universities on a global scale, as well as numerous companies, government agencies and other organizations (Suleman *et al.*, 2001b).

By the end of 2001, the number of members was over 120, varying from a wide range of individual universities, libraries and consortia at the state (OhioLINK), regional (Catalunya), and national (Australia, Germany, India, Portugal, South Africa) levels (Gonçalves and Fox 2001:15).

The growth of NDLTD as a truly international consortium has been fuelled by some political decisions, which were taken recently. For example, several countries – like Australia, Germany, France and India - are implementing policies at national level to guide and standardize the development of local ETD initiatives. These initiatives have been taking different forms, like the French Minister of Education who, in 2001, distributed a public letter to every university president and graduate school announcing his desire to implement ETD's at the national level; in Germany, the Conference on University Rectors distributed a similar statement (Moxley 2001: 62).

A guide to help those interested in the ETD initiative – *The Guide for Electronic Theses and Dissertations*, funded in part by UNESCO, is available online (http://etdguide.org/) as a "living document" written by ETD scholars throughout the world (Moxley *et. al.* 2001/2). It is being updated regularly and will be translated into many languages. It is an important reference work for all those interested in research and e-publishing.

Current NDLTD research developments are focusing on the creation of a union database that will provide a means to search and retrieve ETDs from the combined collections of *NDLTD* member institutions (Suleman 2001a). In order to bridge the gap between existing distributed institutional archives and a unified collection of ETDs, a metadata standard especially suited to ETDs was developed. Additional research efforts include:

> advanced search mechanisms, semantic interoperability, the design and development of multi- and cross-lingual search systems, authors' files and software modules that support the development of higher-level services to aid researchers in seeking relevant ETDs (Suleman *et. al.* 2001b).

There is no cost for institutions interested in joining the NDLTD. It is sufficient to send a letter (see: http://www.ndltd.org/join/) to the NDLTD indicating that intention. Joining only requires agreement with the goals and objectives of *NDLTD*. For members to fully benefit from services provided, it is essential to follow the standards developed by NDLTD and participate in the Union Catalogue of ETDs (http://hercules.vtls.com/cgi-bin/ndltd/chameleon) and make their content available through the NDLTD library: (http://www.theses.org)

To increase the potential benefits of a University ETD project, and enable graduate students to create richer theses and dissertations, there is a need to provide training workshops for faculty and students to complement their knowledge on word processing tools, use of templates, hyper-linking, image insertion, etc.

Ultimately, within the ETD environment, creative researchers will challenge the traditional concept of academic writing. What the ETDs are proving is that linear text is giving way to hyper textual writing, streaming multimedia, interactive chat spaces, three-dimensional modeling and features we can't even imagine right now (Moxley, 2001: 63). This will bring about a true (r)evolution in scholarly communication, as we know it today.

4.1 Networked University Digital Library

A related project is the *Networked University Digital Library NUDL*. a worldwide initiative that again is taking advantage of digital library technology. The NUDL looks beyond ETDs and focuses on the challenges of launching, building, maintaining and developing a digital library for the totality of scholarly materials, including ETDs (http://www.nudl.org). It addresses the task of making the intellectual capital produced in

universities, around the world, "more accessible, stimulating technology transfer, international collaboration and knowledge sharing across all disciplines" (Gonçalves and Fox, 2001: 14).

NUDL is focused on making available the work of scholars, writing in diverse languages, for wider use; it seeks to improve the sharing of knowledge and availability of university works, providing electronic storage and preservation (*OpCit.* 2001: 14).

NUDL builds upon the foundations of the NDLTD and expands its objectives by supporting graduate students, other university related activities and materials and specialised services for different disciplines and communities. At present, the requirements of two communities are receiving special attention: Computing and Physics (*OpCit.* 16-7)

4.2 Roles for librarians and information managers regarding ETDs

Academic librarians and information managers have a very important future role to perform within their organizations, regarding ETDs and other intellectual material produced by academics and scholars.
The following services provide access on a commercial basis to Theses and Dissertations:

- *UMI's Dissertation Services* (http://www.umi.com/hp/Support/DExplorer/)
- *Dissertation.com* (http://dissertation.com/)
- *Diplomica.com* (http://www.diplomica.com/)

Academic librarians and information managers, responsible for access, use and preservation of information available in the Higher Education institutions, should also be active promoters of digital scholarship. To this end, they can collaborate with the Computing departments to:

- advocate to the Boards/Presidents/Rectors the potential of embracing ETDs and the advantages of being members of NDLTD;
- facilitate training to meet faculty and student needs as authors and as supervisors in the digital environment;
- study and propose solutions regarding archiving and preservation of the evolving ETD genre;
- complete the metadata provided by ETD authors in order to promote efficient retrieval.

Librarians and information managers should also be the champions of promoting University collaboration at state, national and international level, contributing to the definition and establishment of open, internationally accepted standards that would increase access to the wealth of scholarly information existing in ETDs. They must be aware of these developments in Electronic Scholarly Publishing and prepare their user-community to take full advantage of the benefits to be gained.

5.0. Other digital collections of grey literature – Digital libraries of S&T research reports

The birth of report literature, one of the first types of grey literature, is associated with the development of aeronautics, the sector in which the first set of reports was produced. *Reports & Memoranda* were published by the UK's *Advisory Committee for Aeronautics* in 1909 and the first report published in the USA was in 1915, by the *National Advisory Committee of Aeronautics* (NACA) (Luzi 2000).

With the build-up of scientific research to support the war effort, in the1940s, the use of report literature to exchange information expanded greatly in countries such as Germany, UK and USA. As every researcher, practitioner and academic knows, a considerable amount of valuable scientific information is being produced at all levels of government, academia, business and industry, in print and electronic formats, outside the normal channels of publication and distribution. It is often the case that security, privacy or confidentiality arrangements make identification and access to these resources difficult, if not impossible. Diluted and delayed

accounts may appear in journal articles or in books but in many cases, the original report or account paper is the only source of the research results (Correia and Borbinha 2001; Correia and Neto 2002).

Over the past few years there has been a political will to encourage cross-sectoral collaboration in the drive for a knowledge society and to increase productivity. Alongside this political background, the explosion in the use of Internet is facilitating a common and accessible information and communication tool (Needham 2001:30). In this environment, digital libraries of research reports assume an important place in the context of engineering communication and several projects are in place to promote the efficient circulation of this information, including following:

- *MAGiC – Managing Access to Grey Literature Collections*, UK (http://www.magic.ac.uk), a project aiming to provide UK engineering community with a greater awareness of and access to key collections of technical reports (Needham 2001);
- *National Advisory Committee for Aeronautics (NACA) Technical Report Server*, NASA, USA (http://naca.larc.nasa.gov/) (Nelson 1999);
- *Networked Computer Science Technical Reference Library* (http://www.ncstrl.org) - provides unified access to technical reports and e-prints from computer science departments, institutes and laboratories. (Davis and Lagoze 2000);
- *Caltech Computer Science Technical Reports* (http://caltechcstr.library.caltech.edu/information.html).

6.0. Conclusion

There are unmistakable signs of a (r)evolution in scholarly communication – scientists, researchers, academics and librarians are taking charge to produce information products and services over which they retain control, maintaining their independence from commercial, for-profit publishers. This implies that the information professional has to become skilled in the use of new applications, including:

- creation and management of collections integrating resources in a variety of formats;
- establishing links between library catalogs and the new electronic scholarly materials available on the Internet;
- address new issues created by the long term preservation of these new scholarly materials;
- increasing scientists' awareness of these new sources; this is increasingly relevant at a time when the budgets allocated to buy external scientific information is reducing for most S&T worldwide;
- supporting potential authors by providing training on electronic publishing;
- enhance user-created metadata.

Librarians and information managers should be looking for the opportunities, created by the availability of these novel scholarly materials, to play a significant part in the creation of new knowledge.

7.0. References

American Scientists forum on freeing the refereed scientific literature. [Online]. Available: http://amsci-forum.amsci.org/archives/september98-forum.html [4 June 2002].

Bachrach, S. *et. al.* (1998). Intellectual property: who should own scientific papers, *Science* 281 (5382):1459 - 60. [Online]. Available: http://www.sciencemag.org/cgi/content/full/281/5382/1459 [4 June 2002].

Bailey, C. (2002). *Scholarly electronic publishing bibliography* (version 42, 19 April). [Online]. Available: http://info.lib.uh.edu/sepb/sepb.html [4 June 2002]. *New publishing models.* [Online]. Available:

http://info.lib.uh.edu/sepb/models.htm *Technical reports and e-prints*. [Online]. Available: http://info.lib.uh.edu/sepb/techrep.htm

Bentum, M., Brandsma, R., Place, T. and Roes, H. (2001). Reclaiming academic output through university archive servers. *New Review of Information Networking*, (forthcoming). [Online]. Available: http://cwis.kub.nl/~dbi/users/roes/articles/arno_art.htm [4 June 2002].

Bot, M. and Burgemeester, J. (1998). *Costing model for publishing an electronic journal*, Utrecht: PricewaterhouseCoopers. [Online]. Available: http://cwis.kub.nl/~dbi/users/roes/erclaw/ejclwp6a.pdf [4 June 2002].

Boyce, P. (2000). For better or for worse. Preprints are here to stay. *College and Research Libraries News*, 61 (5): 404 - 407 (414).

Brown, C. (2001a). The Coming of age of e-prints in the literature of physics. *Issues in Science and Technology Librarianship*, Summer 2001. [Online]. Available: http://www.library.ucsb.edu/istl/01-summer/refereed.html [4 June 2002].

Brown, C. (2001b). The e-volution of preprints in the scholarly communication of physicists and astronomers. *Journal of the American Society for Information Science and Technology* 52 (3): 187 - 200.

Brown, C. M. (1999). Information seeking behaviour of scientists in the electronic information age: astronomers, chemists, mathematicians, and physicists. *Journal of the American Society for Information Science* 50 (1): 929 - 943.

Bush, V. (1996/1945). As we may think. *Interactions*, 3 (2): 35 - 46. Originally published in *Atlantic Monthly* 176 (1): 101 - 108. [Online]. Available: http://www.theatlantic.com/unbound/flashbks/computer/bushf.htm [4 June 2002].

Butler, D. (2002). Soros offers open access to science papers. *Nature Web Debates*, 14 February 2002. [Online]. Available: http://www.nature.com/nature/debates/e-access/ [4 June 2002].

Chan, L. and Kirsop, B. (2001). Open archiving opportunities for developing countries: towards equitable distribution of global knowledge. *Ariadne* 30. [Online]. Available: http://www.ariadne.ac.uk/issue30/oai-chan/intro.html [4 June 2002].

Correia, A. M. R. and Borbinha, J. (2001). Deposit scientific and technical gray literature: a case study. In ISAÍAS, P. (ed.). *New Developments in Digital Libraries: Proceedings of the 1st International Workshop on New Developments in Digital Libraries, NDDL 2001*, in conjunction with *ICEIS 2001 – 3rd International Conference on Enterprise Information Systems*. Setúbal, July 2001, 8 - 19.

Correia, A. M. R. and Neto, M. C. (2002). The role of *ePrint* archives in the access to and dissemination of scientific gray literature: *LIZA* – A case study by the National Library of Portugal. *Journal of Information Science* 28 (3) (forthcoming).

Cronin, B. and Overfelt, K. (1995). E-journals and tenure. *Journal of the American Society for Information Science* 46 (9): 700 - 703.

Cruz, J. M. and Krichel, T. (2002). Automated extraction of citation data in a distributed digital library. Isaías, P. (ed.) *New developments in Digital libraries. Proceedings of the 2nd workshop on New developments in Digital libraries (NDDL 2002)* in conjunction with *ICEIS 2001 – 4th International Conference on Enterprise Information Systems*, Universidade de Castilla e La Mancha, Apr. 2002.

Davis, J. and Lagoze, C. (2000). NCSTRL: Design and deployment of a globally distributed digital library. *Journal of the American Society for Information Science* 51 (3): 273 - 280.

Day, M. (1999). The scholarly journal in transition and the Pub Med Central proposal. *Ariadne* 21. [Online]. Available: http://www.ariadne.ac.uk/issue21/pubmed/intro.html [4 June 2002].

Day, M. (2001). Eprint services and long-term access to the record of scholarly and scientific Research. *Ariadne* 28. [Online]. Available: http://www.ariadne.ac.uk/issue28/metadata/ [4 June 2002].

Delamothe, T. *et. al.* (1999). Netprints: the next phase in the evolution of biomedical publishing. *British Medical Journal* 319: 1515 - 6. [Online]. Available: http://www.bmj.com/cgi/content/full/319/7224/1515 [4 June 2002].

eprints.org. Available: http://www.eprints.org/ [4 June 2002].

Fecko, M. B. (1997). History and evolution of electronic resources. In Fecko, M. B. *Electronic Resources: access and issues* (1 – 14). East Grinstead: Bowker-Saur.

Fox, E. (1999). *Contribution by Edward A. Fox regarding Networked Digital Library of Theses and Dissertations (NDLTD)*. Paris: UNESCO Meeting, Paris, 27 – 28 Sep. [Online]. Available: http://www.unesco.org/webworld/etd/contributions/fox.rtf [4 June 2002].

Free Online Scholarship (FOS) Newsletter. [Online]. Available: http://www.earlham.edu/~peters/fos/index.htm [4 June 2002].

Garner, J., Horwood, L. and Sullivan, S. (2001). The place of eprints in scholarly information delivery. *Online Information Review* 25 (4): 250 - 256.

Ginsparg, P. (1996). *Winners and losers in the global research village*. Invited Contribution, UNESCO, Paris, 19 - 23 Feb. 1996. [Online]. Available: http://xxx.lanl.gov/blurb/pg96unesco.html [4 June 2002].

Gonçalves, *et. al.* (2001). Flexible interoperability in a federated digital library of theses and dissertations. In *Proceedings of the 20th World Conference on Open Learning and Distance Education, "The Future of Learning - Learning for the Future: Shaping the Transition", ICDE2001*, Düsseldorf, Germany, 01 - 05 Apr. 2001. [Online]. Available: http://www.nudl.org/papers/ICDE2001.pdf [4 June 2002].

Gonçalves, M. A. and Fox, E. A. (2001).Technology and research in a global Networked University Digital Library. *Ciência da Informação* 30 (3): 13 - 23. [Online]. Available: http://www.ibict.br/cionline/300301/3030301.pdf [4 June 2002].

Goodrum, A. *et. al.* (2001). Scholarly publishing in the Internet age: a citation analysis of computer science literature. *Information Processing Management* 37: 661 - 675.

Guedon, J. (2001). *In Oldenburg's Long Shadow: Librarians, research scientists, and the control of scientific publishing*. Annapolis Junction, MD: ARL. [Online]. Available: http://www.arl.org/arl/proceedings/138/guedon.html [4 June 2002].

Harnad, S. (1990). Scholarly skywriting and the prepublication continuum of scientific inquiry. *Psychological Science* 1: 324 - 343. [Online]. Available: http://cogsci.soton.ac.uk/~harnad/Papers/Harnad/harnad90.skywriting.html [4 June 2002].

Harnad, S. (1998). Learned inquiry and the Net: the role of peer review, peer commentary and copyright. *Learned Publishing* 11 (4): 183 - 192. [Online]. Available: http://www.cogsci.soton.ac.uk/~harnad/Papers/Harnad/harnad98.toronto.learnedpub.html [4 June 2002].

Harnad, S. (1999) Free at last: the future of peer reviewed journal. *D-Lib Magazine* 5 (12). [Online]. Available: http://www.dlib.org/dlib/december99/12harnad.html [4 June 2002].

Harnad, S. (2000). The invisible hand of peer review. *Exploit Interative* 5. [Online]. Available: http://www.exploit-lib.org/issue5/peer-review/ [4 June 2002].

Harnad, S. (2001a). Research access, impact, and assessment. *Times Higher Education Supplement*, 1487: 16. [Online]. Available: http://www.cogsci.soton.ac.uk/~harnad/Tp/thes1.html [4 June 2002].

Harnad, S. (2001b, April 26). The self-archiving initiative. *Nature*, 410: 1024 - 5. [Online]. Available: http://www.cogsci.soton.ac.uk/~harnad/Tp/nature4.htm [4 June 2002].

Harnad, S. and Hemus, M. (1998). All or none: no stable hybrid or half-way solutions for launching the learned periodical literature into the post-Gutenberg galaxy. In: Ian Butterworth (ed.). *The impact of electronic publishing on the academic community*. London: Portland Press. [Online]. Available: http://tiepac.portlandpress.co.uk/books/online/tiepac/session1/ch5.htm [4 June 2002].

Holtkamp, I. and Berg, D. A. (2001). *The impact of Paul Ginsparg's ePrint arXiv (formely known as xxx.lanl.gov) at Los Alamos National Laboratory on Scholarly Communication and Publishing: a selected bibliography*. [Online]. Available: http://lib-www.lanl.gov/libinfo/preprintsbib.htm [4 June 2002].

Kling, R. and McKim, G. (1999). Scholarly Communication and the continuum of electronic publishing. *Journal of American Society of Information Science* 50 (10): 890 - 906.

Kling, R. and McKim, G. (2000). Not just a matter of time: field differences in the shaping of electronic media in supporting scientific communication. *Journal of the American Society for Information Science* 51: 1306 - 1320. [Online]. Available: http://xxx.lanl.gov/ftp/cs/papers/9909/9909008.pdf [4 June 2002].

Kling, R., Spector, L. and McKim, G. (2002). *Locally controlled scholarly publishing via the Internet: the Guild Model*. Indiana: CSI, WP 02 - 01.[Online]. Available: http://www.slis.indiana.edu/csi/WP/WP02-01B.html [4 June 2002].

Krichel, T. (2000). Working towards an Open Library for economics: The RePEc project. *In* PEAK. *The Economics and Usage of Digital Library Collections*, Ann Arbor, Mi, 23 - 4, Mar. 2000. [Online]. Available: http://openlib.org/home/krichel/myers.html

Large, A., Tedd, L. and Hartley, R. J. (1999). *Information seeking in the online age: principles and practice*. London: Bowker-Saur.

Lawrence, S. (2001a). Free online availability substantially increases a paper's impact. In *Nature web debates*, 2001. [Online]. Available: http://www.nature.com/nature/debates/e-access/Articles/lawrence.html [4 June 2002].

Lawrence, S. (2001b). Online or Invisible? *Nature* 411 (6837), 521. [Online]. Available: http://www.neci.nec.com/~lawrence/papers/online-nature01 [4 June 2002].

Letnes, L. and Kelly, J. (2002). *AgEcon Search*: Partners build a Web resource. *Issues in Science and Technology Librarianship* 34, Spring 2002. [Online]. Available: http://www.istl.org/02-spring/article3.html [4 June 2002].

Luce, R. (2001). E-prints intersect the Digital Library: inside the Los Alamos arXiv. *Issues in Science and Technology Librarianship* 29, Winter 2001. [Online]. Available: http://www.library.ucsb.edu/istl/01-winter/article3.html [4 June 2002].

Luzi, D. (2000). Trends and evolution in the development of grey literature. The *International Journal on Grey Literature* 1 (3): 106 - 116.

McConnell, J. and Horton, R. (s/d) *The dawn of a New Era: The Lancet Eelectronic Research Archive in international health and e-print server*. [Online]. Available: http://www.thelancet.com/era [4 June 2002].

McKiernan, G. (2000). arXiv.org: the Los Alamos National Laboratory e-print server. *International Journal of Grey Literature* 1 (3): 127 - 138.

Meadows, A. J. (1998). *Communicating research*. San Diego, Ca: Academic Press.

Moxley, J. (2001). Universities should require electronic theses and dissertations. *Educause Quarterly* 3: 61 - 63.

Moxley, J. *et. al.* (2001/2). *ETD Guide*, USF. [Online]. Available: http://etdguide.org/ [4 June 2002].

NATURE. *Future e-access to the primary literature web debate* 2001 - 2. [Online]. Available: http://www.nature.com/nature/debates/e-access [4 June 2002].

Needham, P. (2001). *The MAGiC Project – Interim Progress Report: October 2000 – August*. Cranfield: Cranfield University. [Online]. Available: http://www.bl.uk/concord/pdf_files/magicprogress.pdf [4 June 2002].

Nelson, M. (1999). *A Digital Library for the Advisory Committee for Aeronautics*. Hampton, VA: NASA Langley Research Centre. [Online]. Available: http://techreports.larc.nasa.gov/ltrs/PDF/1999/tm/NASA-99-tm209127.pdf [4 June 2002].

Nottingham ePrints. [Online]. Available: http://www-db.library.nottingham.ac.uk/eprints/Nottingham ePrints. *About Nottingham ePrints*, Value added services. [Online]. Available: http://www-db.library.nottingham.ac.uk/ep1/information.html [4 June 2002].

OAI. *Open Archives Initiative*. [Online]. Available: http://www.openarchives.org/OAI. Frequently Asked Questions. *What is the mission of the Open Archives Initiative*. [Online]. Available: http://www.openarchives.org/documents/FAQ.html [4 June 2002].

Odlyzko, A. M. (1995). Tragic loss or good riddance? The impending demise of traditional scholarly journals. *International Journal of Human-Computer Studies* 42: 71 - 122. [Online]. Available: http://www.dtc.umn.edu/~odlyzko/doc/tragic.loss.txt [4 June 2002].

Odlyzko, A. M. (2002). The rapid evolution of scholarly communication. *Learned Publishing* 15 (1): 7 - 19. Also to appear in *Bits and Bucks: Economics and Usage of Digital Collections*, W. Lougee and J. MacKie-Mason (eds.), MIT Press, 2002. [Online]. Available: http://www.dtc.umn.edu/~odlyzko/doc/rapid.evolution.pdf [4 June 2002].

Okerson, A. (1992). Publishing through the network: the 1990 debutante. *Scholarly Publishing* 23 (3): 170 - 177, quoted in Day, M. (1999). The scholarly journal in transition and the Pub Med Central proposal. *Ariadne* 21. [Online]. Available: http://www.ariadne.ac.uk/issue21/pubmed/intro.html [4 June 2002].

Okerson, A. and O'Donnell, J. (eds.) (1995). *Scholarly journals at the crossroads: a subversive proposal for electronic publishing*. Washington, D.C.: Association of Research Libraries. [Online]. Available: http://www.arl.org/scomm/subversive/index.html [4 June 2002].

OpCit: The Open Citation Project. [Online]. Available: http://opcit.eprints.org/ [4 June 2002].

Oppenheim, C. (1997). Towards the Electronic Library. In Scammell, Alison (ed.). *Handbook of special librarianship and information work* (397-407). 7th ed, London: Aslib.

Oppenheim, C. (2000). The Future of Scholarly Journal Publishing. *Journal of Documentation* 56 (4): 361 - 398.

OSI. *Budapest Open Access Initiative.* [Online]. Available: http://www.soros.org/openaccess/view.cfm *Budapest Open Access Initiative: Frequently Asked Question.* [Online]. Available: http://www.earlham.edu/~peters/fos/boaifaq.htm [4 June 2002].

Pinfield, S. (2001a). How do physicists use an e-print archive? Implications for Institutional E-Print Services. *D-Lib Magazine* 7 (12). [Online]. Available: http://www.dlib.org/dlib/december01/pinfield/12pinfield.html [4 June 2002].

Pinfield, S. (2001b). Managing electronic library services: current issues in UK higher education institutions. *Ariadne* 29. [Online]. Available: http://www.ariadne.ac.uk/issue29/pinfield/intro.html [4 June 2002].

Pinfield, S. Gardner, M. and MacColl, J. (2002). Setting up an institutional e-print archive. *Ariadne* 31. [Online]. Available: http://www.ariadne.ac.uk/issue31/eprint-archives/intro.html [4 June 2002].

Prinsen, J. (2001). A challenging future awaits libraries able to change: highlights of the international Summer School on Digital Library. *D-Lib Magazine* 7 (11). [Online]. Available: http://www.dlib.org/dlib/november01/prinsen/11prinsen.html [4 June 2002].

Rowland, F. (1997). Print journals: fit for future? *Ariadne* 7. [Online]. Available: http://www.ariadne.ac.uk/issue7/fytton/intro.html [4 June 2002].

Schauder, D. (1994). Electronic publishing of professional articles: Attitudes of academics and implications for the scholarly communication industry. *Journal of the American Society for Information Science* 45 (2): 73 - 100.

Severins, T. *et. al.* (2000). PhysDoc – A distributed network of Physics Institutions Documents. *D-Lib Magazine* 6 (12). [Online]. Available: http://www.dlib.org/dlib/december00/severiens/12severiens.html [4 June 2002].

Sompel, H. and Lagoze, C. (2000). The Santa Fe Convention of the Open Archives Initiative. *D-Lib Magazine* 6 (2). [Online]. Available: http://www.dlib.org/dlib/february00/vandesompel-oai/02vandesompel-oai.html [4 June 2002].

Suleman, H. *et. al.* (2001a). Networked Digital Library of Thesis and Dissertations – Bridging the gaps for global access – Part 2: Services and research. *D-Lib Magazine* 7 (9). [Online]. Available: http://www.dlib.org/dlib/september01/suleman/09suleman-pt2.html [4 June 2002].

Suleman, H. *et. al.* (2001b). Networked Digital Library of Thesis and Dissertations – Bridging the gaps for global access – Part 1: Mission and Progress. *D-Lib Magazine* 7 (9). [Online]. Available: http://www.dlib.org/dlib/september01/suleman/09suleman-pt1.html [4 June 2002].

Tenopir, C. and King, D. W. (2000). *Towards electronic journals: Realities for scientists and publishers.* Washington: Special Libraries Association.

Walker, T. (1998). Free Internet access to traditional journals, *American Scientist* 86 (5). [Online]. Available: http://www.sigmaxi.org/amsci/articles/98articles/walker.html [4 June 2002].

Walker, T. J. (2002). Two societies show how to profit by providing free access. *Learned Publishing* (forthcoming). [Online]. Available: http://csssrvr.entnem.ufl.edu/~walker/epub/ALPSPmsDS2.pdf [4 June 2002].

Warr, W. (2001). *A report on the presentation "Chemistry Preprint Server: a revolution in Chemistry Communication*, Spring 2001 National ACS Meeting (CINF Division) San Diego, USA. [Online]. Available: http://www.chemweb.com/docs/cps/cps.pdf [4 June 2002].

Wilkinson, S. (2000). Chemistry Preprints Come Into Vogue. *Chemical Engineering News* 78 (23): 15 - 6. [Online]. Available: http://pubs.acs.org/isubscribe/journals/cen/78/i23/html/7823notw5.html [4 June 2002].