Preserve Scientific Electronic Journals: A Study of Archiving Initiatives

by

Golnessa GALYANI MOGHADDAM (M.LISc, Ph.D)

Assistant Professor, Dept. of Library and Information Science, Shahed University, Tehran, IRAN, E-mail: g_galyani@yahoo.com

Abstract:

This paper seeks to review the archiving initiatives of scientific journals created and supported by various organizations or institutions. A review of nine archiving initiatives including JSTOR, Portico, E-Print Repositories, Open Access Model, LOCKSS, OCLC Digital Archive, JISC PubMed Central and KB e-Depot was carried out. The paper focuses mainly on the initiatives by an analytical approach. The paper provides a useful starting-point to anyone who wants to know about the preserving scientific electronic journal, enabling him/her quickly to achieve an overview of the existing archiving initiatives to date.

Keywords: Digital Preservation, Electronic Archiving, Archiving Challenges, Scholarly Journals, Electronic Journals, Archiving Initiatives

Introduction

Scientific journals have played a very prominent role in the scholarly communication system for many years. With a migration from print to digital environment, scientific communication is not possible without reliable access to the accumulated scholarship of the past, therefore, preserving scientific electronic journals became one of the important concerns for digital librarians in the recent years. Many stakeholders of scientific publishing have begun to consider importance of electronic archiving and take initial steps to meet their responsibility effectively. The new concerns of electronic archiving led to a series of meetings over the past few years among

publishers, librarians, and technologists sponsored by a variety of organizations. In order to manage the archiving issues, different initiatives and projects were created by various organizations and institutions. As librarians are concerned about what should be archived, who should be responsible for the archiving process, how the materials should be archived and where they should be archived, so the study of various existing archiving models is essential for digital librarians. Some of these initiatives and models such as JSTOR, Portico, E-Print Repositories, Open Access Model, LOCKSS, OCLC Digital Archive, JISC, PubMed Central and KB e-Depot were studied by an analytical approach in this paper.

Background

The preserving of scientific electronic journals is a complex issue with various aspects and is largely different from archiving of print-based scientific journals. With a broad view, preserving of scientific journals has social, economics, legal, organizational and technical dimensions.

Today, scientific journals with a three century established roles, are being migrated from print to electronic format. This migration brought many changes in the traditional system of publishing, distributing, accessing, using, and archiving. Though, there are many born-digital scientific journals, the publishing of print scientific journals became faster and easier than before. Some of these print scientific journals are being published both in print and electronic versions and some of them are shifted towards electronic only versions. Distributing of journals electronic version is possible with a very low cost on the Web (Varian, 1997). With the help of technological advances, there are many developments in accessing to scientific electronic journals on the networks especially on the Internet. Even, pattern of use of electronic journals is changing in recent years (Liu, 2005). As a consequence, the archiving of scientific electronic journals is different in digital era as well.

The word of ‘archiving’ often refers to the process of storing physical objects, generally though not exclusively paper-based, in a physical location, such as a room or a

building, to maintain that object's physical integrity and its intellectual context as could be represented by other objects within the archive (Seadle, 2006).

Digital archiving has little to do with physical objects or physical storage and it is different from the traditional meaning of 'archive', even some experts prefer to use 'digital preservation' instead of 'digital archiving'; For example, handbook of Digital Preservation Coalition uses the term 'digital preservation' to define all the activities employed to ensure continued access to digital resources which have retained properties of authenticity, integrity and functionality. According to this handbook the term 'archiving' can be substituted for preservation provided this definition remains but 'archiving' is usually interpreted within the computing industry simply to indicate that something has been stored and is no longer immediately accessible. Digital Preservation refers to the series of managed activities necessary to ensure continued access to digital materials for as long as necessary. This is a broad and richer definition of 'digital preservation' and refers to all of the actions required to maintain access to digital materials beyond the limits of media failure or technological change (Beagrie and Jones, 2002).

Some concepts such as 'authenticity' in digital archiving has a very different meaning than for physical objects. Peter Hirtle (2000) explained the issues in the following way:

> "As with the paper records used in the Constellation example, the fact that digital information is found within a trusted repository may become the base upon which all further assessments of authenticity build".

Duranti (2000) also makes a useful distinction between 'authentication' (the means used to prove that a record is what it purports to be at a given time) and 'authenticity' (a concept already familiar in archival science and which refers to the quality of the record itself and its essential contextual information). 'Authentication' refers to originality of a resource while authenticity refers to quality of the resource. Both of these two issues need to be taken into consideration for digital preservation.

Copyright and other intellectual property rights (IPR) are two important issues because of their substantial impact on digital preservation. We know that copyright law

was originated and created ling time ago, when there was no thought of the World Wide Web. It seems that legal issues such as copyright were established well for traditional archiving, while for electronic materials is not the case. The copyright and intellectual property rights issues in digital materials are more complex and significant than for traditional media and if not addressed can prevent preservation activities. Both contents of digital resources and their associated software need take into considerations. Copyrights issues have not got a quick solution in digital preservation, as copyright law allows only fair use and it can prohibit a successful preservation to some extents. Some experts suggest to put away copyright in digital preservation or make some changes in law, though it is not easy to do. They reason if current law does not allow copying for digital preservation, the most obvious solution is to change the law and if libraries want to preserve information, they need to be able to carry out the required activities (Muir, 2004).

The results of a study by Adrienne Muir indicated that libraries other than legal deposit libraries will probably want to take responsibility for digital preservation of material they create or purchase. However, there is a lack of awareness of what the law allows. The current legal situation in the publishing industry needs to be clarified and changes to the law could be considered if necessary. Changing copyright law to facilitate legal deposit is one possibility and this is being pursued in some countries such as the UK, but this will not help the vast majority of libraries because legal deposit collections are collections of last resort (Muir, 2004).

The archiving initiatives which will be described later in this paper, have adopted many divergent approaches to preserving intellectual contents over time because of complexity of copyright law in digital environment.

It may be noted here that there has also been a shift in archiving responsibilities from libraries to publishers and producers of scientific journals in electronic environment. Magie Jones (2003) has pointed out that

> "the transition from purchasing print journals, which the library then owned forever, to licensing access to e-journals for a defined period of time has major implications for libraries and publishers. In terms of archiving responsibilities, there are no longer any clear-cut distinctions between who should

be doing what. There is a lack of clarity regarding responsibilities and uncertainty about precisely what libraries are paying for when they license journals. This has meant that the transition from print to electronic has been more problematic than it might otherwise have been."

When subscribing to electronic journals, libraries no longer possess a local copy as they did with printed journals. They effectively lease the content of the electronic journals they subscribe to by remotely accessing it on publishers' servers over the computer network. The problem with this common practice is that access to entire back runs of electronic journals could be lost to academic libraries when subscriptions are cancelled or when journals cease publication. It is been argued that the uncertainty of continuing access is a major barrier preventing libraries from moving to electronic-only subscriptions (Hockx-Yu, 2006).

In a recent paper by Anne R. Kenney and others they have argued that current license arrangements are inadequate to protect a library's long-term interest in electronic journals, that individual libraries cannot address the preservation needs of e-journals on their own, that much scholarly e-literature is not covered by archiving arrangements, and that while e-journal archiving programs are becoming available, no comprehensive solution has emerged and large parts of e-literature go unprotected (Kenney and et al., 2006).

The other important issue in digital preservation is cost which associated with organizational issues as well. Digital preservation is essentially about preserving access over time and therefore the costs for all parts of the digital life cycle are relevant. Of course, digital access has many advantages over paper-based or microform access in terms of convenience and functionality, however, providing continued access is an important concern for digital librarians. Cost of digital preservation seems to be much further than traditional preservation. Access to digital resource with the rapid technological changes is not easy and needs expert staff and considerable expenditure on technological needs.

Mary Feeney (1999) gives a thorough breakdown of cost considerations based on one of the studies commissioned by the Digital Archiving Working Group (DAWG). She pointed out:

> "One clear message that has emerged is that a great deal of money can be wasted if digitization projects are undertaken without due regard to long-term preservation. It is now relatively easy to produce digital versions of texts or images. However, if there is no plan in place for archiving the digital files, long-term preservation will be expensive, or may even result in the work having to be repeated."

Calculation of costs for digital archiving is complex, however, is a valuable and necessary task to establish a cost-effective and reliable business model. Costs for maintaining the digital copy also need to be considered from the beginning whether those materials are produced as a result of digitising analogue materials or whether they are 'born digital'. It may be noted that other issues such as organizational mission and goals including the type and size of collections, the level of preservation committed to and the quantity and level of access required, and time frame proposed for action should take into consideration.

One of present's challenges in providing for the long-term availability of scientific literature is the need for an acceptable archiving solution for electronic publications. A number of efforts are currently underway to develop such a solution, including the following initiatives described in this paper. These models may be considered as a social aspect of electronic archiving.

Archiving Initiatives and Models

1. JSTOR

JSTOR (Journal Storage) is a scholarly journal archive. JSTOR was established as an independent not-for-profit organization in 1995. It began as an effort to ease the increasing problems faced by libraries seeking to provide adequate stack space for the long runs of backfiles of scholarly journals. The JSTOR has been successful in

combining library's needs for assurances on preservation without threatening the publishers' business models.

The JSTOR model was originally based on making digital copies of print journals and making these available to members who can access material on the basis of a "moving wall", however, this is considered as a weakness of this model as it was not designed for born-digital journals.

"Born digital" materials require very different models, systems, and processes, therefore, in 2002, JSTOR launched a project which has now become Portico, a new, not-for-profit electronic archiving service established to address the scholarly community's critical need for a reliable means to preserve scholarly electronic journals. Portico is focused on preserving the intellectual content of electronic journals through source file normalization and format migration (Fenton, 2006).

2. Portico

Portico is a new, not-for-profit electronic archiving service established in 2002 by JSTOR. Portico began as the JSTOR Electronic-Archiving Initiative launched by JSTOR with a grant from The Andrew W. Mellon Foundation and was intended to build upon the Foundation's seminal e-journal archiving programme [1].

The charge of the initiative was to build an infrastructure and economic model able to sustain an electronic journal archive. Portico's archival approach for electronic journals is managed preservation focused on the publisher' e-journal source files. Source files are the electronic files containing graphics, text, or other material that comprise an electronic journal article, issue, or volume. All libraries supporting the Portico archive have campus-wide access to archived content when specific trigger events occur, and when titles are no longer available from the publisher or other source. Trigger events include when a publisher ceases operations; or ceases to publish a title; or no longer offers back issues; or suffers catastrophic and sustained failure of a publisher's delivery

platform. All publishers participating in the archive have also full access to their own content and any content for which a trigger event prevails (Fenton, 2006).

The Portico archive relies upon the co-operative participation of both publishers and libraries. To participate in Portico, a publisher:

1. signs a non-exclusive archiving licence that gives Portico the right to ingest, normalise, archive, and migrate the publisher's content
2. indicates whether Portico will serve as a perpetual access mechanism
3. supplies electronic journal source files in a timely way, and
4. makes an annual financial contribution.

To participate in the Portico archive, a library:

1. signs an archiving licence agreement
2. makes an annual support payment, and
3. provides IP or other relevant information for user authentication purposes.

According to Fenton, till April 2006, nine publishers have committed more than 3,200 journals to the Portico archive. Participating publishers include Elsevier, John Wiley & Sons, Oxford University Press, American Mathematical Society, American Anthropological Association, University of Chicago Press, UK Serials Group, Berkeley Electronic Press, and Symposium Journals (UK) (Fenton, 2006).

It may be noted here that normalization of format is a risk to damage the original content and this issue can be considered as a weakness for this initiative. Any transformation of digital content can introduce inadvertent errors, but even when normalization works without errors, the process strips away some aspects of the presentation of the original. The loss may seem unimportant today, but judgments change over time (Seadle, 2006). It is noteworthy that even the Portico save the source file as received, normalizing to a standard format would change the original look of the resource. Many authors may not like to see any changes in the look of their works.

3. E-Print Repositories

The rapid escalation of e-print repositories has been regarded by some of its champions as a potential replacement for more traditional scholarly communication provided by licensed electronic journals. The emphasis to date has been on encouraging scholars to deposit content into the archives, rather than on preservation requirements.

To Self-archive is to deposit a digital document in a publicly accessible web site, preferably an Open Archive Initiative-compliant Eprint Archive. The purpose of self-archiving is to make the full text of the peer-reviewed research output of scholars/scientists and their institutions visible, accessible, harvestable, searchable and useable by any potential user with access to the Internet.

Eprints are the digital texts of peer-reviewed research articles, before and after refereeing. Before refereeing and publication, the draft is called a 'preprint.' The refereed, accepted final draft is called a 'postprint.' Eprints include both preprints and postprints. Researchers are encouraged to self-archive them all. The OAI tags keep track of all versions. All versions should contain links to the publisher's official version of record.

To give an example of this initiative, E-Print Repository (E-LIS) based in Spain and Italy, in the field of Library and Information Science (LIS), can be considered as an open access archive. E-LIS is an open access archive for scientific or technical documents, published or unpublished, on Librarianship, Information Science and Technology, and related areas. E-LIS relies on the voluntary work of individuals from a wide range of backgrounds and is non-commercial. It is not a funded project of an organization. It is community-owned and community-driven. E-LIS serves LIS researchers by facilitating their self-archiving, ensuring the long-term preservation of their documents and by providing word-wide easy access to their papers. At the time of writing this paper more than 5,000 articles are available at E-LIS and the number of full text articles is rapidly increasing [2].

Though E-LIS is considered as a digital archive in LIS but it can not be a safe place for all scientific literature in this particular field. The reason is its voluntary nature because there is no obligation for authors to deposit theirs works to E-LIS. There are

many authors who are not willing to deposit their works and of course sometimes the copyright agreement with publishers will not allow for open archive.

The other weakness of this initiative is lack of authority control. For example if an author abbreviate name of a journal, his/her article may index separately and as a consequence all papers of one particular journal will not come together. The software is not very intelligent, as a small mistake at the time of deposit such as a minor mistake in name of a journal prevents correct indexing of journal.

4. Open Access Model

The open access model imposes a charge on the individual researcher, or their institution, for submitting a research article. Exponents of this model argue that it is a more logical and fairer distribution of research funding, benefiting both academics, whose works are disseminated freely, and institutions who fund that research. In terms of assured ongoing access, the assumption is that making material freely accessible and providing hosting by trusted partners will provide the necessary guarantees (Jones, 2006).

In general, if an article is 'Open Access' it means that it can be freely accessed by anyone in the world using an internet connection. This means that the potential readership of Open Access articles is far, far greater than that for articles where the full-text is restricted to subscribers. Evidence shows that making research material Open Access increases the number of readers and significantly increases citations to the article - in some fields increasing citations by 300% [3].

An alternate way of providing Open Access is to publish in an Open Access Journal. These journals make their articles available for free through charging for the publication services *before* publication, rather than *after* publication through subscriptions. Open Access publication charges can be often included within the costs of research funding, so the money for access comes through the research funder, rather than through the library budget. Of course, the initial source of the money is often the same (from government funding), but the economics of this model means that the overall cost is lower. There are a growing number of Open Access Journals, with a journal available in most disciplines. [4]. PubMed Central is a special example in the field of medical

sciences and is considered an Open Access initiative that has committed to preserving content. PubMed central will be described later in this paper.

Some universities and institutions make Open Access journals accessible for their users; for example, the Directory of Open Access Journals at the University of Lund in Sweden [5]. In India, Open Access Journals made available through JGate [6].

In UK, there are at least two projects for open access including RoMEO and SHERPA. SHERPA (Securing a Hybrid Environment for Research Preservation and Access) is a developing open-access institutional repositories in a number of research universities to facilitate the rapid and efficient worldwide dissemination of research. This project has finished (January 2006). Much of its work in advocacy and assistance in the establishment of institutional repositories is continuing under SHERPA Plus [7].

The RoMEO Project (Rights MEtadata for Open archiving) is funded by the Joint Information Systems Committee for one year (1 August 2002 - 31 July 2003) to investigate the rights issues surrounding the 'self-archiving' of research in the UK academic community under the Open Archive Initiative's Protocol for Metadata Harvesting. The RoMEO project aimed to develop simple rights metadata by which academics could protect their research papers in an open-access environment and also to develop a means by which OAI Data and Service Providers could protect their open-access metadata. RoMEO proposed to show how such rights solutions might be disclosed and harvested under OAI-PMH [8].

It may be noted that there are some debates over the Open Access model as an archiving initiative. Some people reason that the Open Access is about 'access' not preservation. The author believes that though the Open Access is originally about 'access' and its purpose is different from preservation, it is practically functioning as an archive. This may be considered as a potential aspect of information technology used in Open Access models. This is definitely a new area of discussion and research need to be explored.

5. LOCKSS (Lots of Copies Keep Stuff Safe)

The LOCKSS model, based at Stanford, creates low cost, persistent caches of journals content which are housed at the institutions authorized to license content from them. The LOCKSS effectively permits the institutions licensing content to "own" the content they are paying for, as they do with print. The concept behind the LOCKSS system is based on simple rules. Acquire lots of copies. Scatter them around the world so that it is easy to find some of them and hard to find all of them. The goal of the LOCKSS project is to enable libraries to take custody of the material to which they subscribe--in the same way they do for paper--and to preserve it permanently (Madison,,2001).

LOCKSS is open source, peer-to-peer software that functions as a persistent access preservation system. Information is delivered via the web, and stored using a sophisticated but easy to use caching system. LOCKSS software allows the libraries to collect, store, preserve, and archive authorised content locally. The local copies serve as back-ups and can be accessed when the publishers' site becomes unavailable. LOCKSS retains the libraries' traditional custodial role of scholarly information and allows libraries to "own" the content they have paid for in much the same way as in the printed environment (Seadle, 2006).

The LOCKSS system uses a crawler to collect e-journal content from the publishers' websites as it is published. Both written and machine-readable permissions from the publishers are required for this. Publishers are encouraged to grant libraries legal permission to cache and archive their content via language in licenses or terms and conditions. Helen establishing

> "A number of publishers have participated in LOCKSS testing, for example Blackwell, Project Muse, British Medical Journals Publishing, Oxford University Press. The additional Mellon funding is intended to support the next stage of LOCKSS, to manage content as bibliographic entities rather than as web-addressed files. Like JSTOR, LOCKSS has developed a relationship of trust with publishers. "

LOCKSS is building a community base and has over seven years of experience with archiving electronic journals. LOCKSS works and has been tested (Seadle, 2006). It may be noted that the strength of the LOCKSS is archiving of the whole Web site same as it is. According to Seadle "LOCKSS archives the whole Web site that it crawls as a bitstream. This is the digital equivalent of the archival principle of preserving the original object in its context without rebinding, retouching, or other transformations that later generations may regret" (Seadle, 2006).

LOCKSS is also working with small publishers to preserve their works. He believes that this is far more work than getting agreement with a few big publishers and preserves materials that will almost certainly vanish when the original small publisher ceases (Seadle, 2006).

6. OCLC Digital Archive

The OCLC (Online Computer Library Center) have been actively involved in undertaking research into digital preservation for a number of years. The OCLC is a not-for profit library cooperative with an international membership. The OCLC Digital Archive is a fee-based service available to any cultural heritage institution. Its initial implementation focuses on capture and description of Web Sites and Web pages, and on reformatted materials from digitization projects (Surface, 2005).

OCLC staff have collaborated with RLG (Research Libraries Group) on two working groups, one developed a framework for preservation metadata (and will now move into developing recommendations and best practices for implementing preservation metadata) and the other was in defining attributed and responsibilities for Trusted Digital Repositories. Jones (2006) believes that

> "It seems logical that OCLC should extend its range of services to include archiving. They have worked hard at building up a good relationship with publishers and offer a range of funding options for participants. There are currently 4,500 primarily research journals under contract to OCLC, covering a range of subject areas."

She also recommended toundertake a more detailed analysis of the potential role of OCLC and JSTOR as trusted third party providers, for UK licensed content (Jones, 2006).

In 2006, OCLC joins the LOCKSS Alliance in support of its collaborative effort to explore new uses of the LOCKSS technology to benefit the community and to build new capabilities for digital preservation. OCLC will work collaboratively with LOCKSS to explore the expansion of the LOCKSS technology to operate with different types of digital content.

The strenght of OCLC model is its focus on the issue of incentives. The latest OCLC report is based on the assumption that economics are fundamentally about incentives. It suggests that necessary first steps in building sustainable digital archives must start with an examination of conditions under which there are insufficient incentives to preserve, and determining how this can be remedied. Lavoie put the issue as follow:

> "…as digital preservation moves beyond the realm of small-scale, experimental projects to become a routine component of a digital asset's life-cycle management, the question of how it can be shaped into an economically sustainable process begins to overshadow other concerns" (Lavoie, 2003).

7. JISC (Joint Information Systems Committee)

JISC is an electronic journals archive in UK. It has been involved with national site licensing of journals since 1995. As a key funding body for both the provision and development of digital content for Higher and Further Education in the UK, JISC has a critical role to play in its long-term preservation and access, in collaboration with a number of partners. JISC funded a consultancy to evaluate previous licenses; explore with publishers and other stakeholders archiving and access provisions; and evaluate future options for archiving of licensed electronic journals and access arrangements (Jones, 2006).

Ensuring long-term preservation of, and continuing access to, scholarly and educational resources is an important strategic area for JISC. As an organization working on behalf of the funding councils and the academic community, JISC has undertaken various activities to help institutions address the challenges of digital preservation and to advance the UK digital preservation agenda. Digital preservation is not only an issue for JISC but an activity that involves many stakeholders. JISC has formed collaboration and partnerships with various organizations such as the Digital Preservation Coalition and the UK Web Archiving Consortium to jointly tackle the challenges of long-term digital preservation (Hockx-Yu, 2006).

According to Jones, JISC staff had difficulties in negotiations on behalf of the community but problems were encountered in reaching acceptable deals with publishers in a timely manner. Furthermore, JISC journal negotiation operates as a loose consortia, and it was time consuming and complex to negotiate deals needed by the community. Another critical aspect of journal negotiation is in ensuring regular feedback to the community, to ensure they are kept informed of the progress of deals (Jones, 2006).

JISC revealed a fundamental dilemma facing both libraries and publishers in deciding to move to e-only access. If it is accepted that maintaining a parallel print copy (even assuming the electronic and print versions are identical) is not sustainable, then the question remains, how can the electronic version be relied upon? Costs are not yet well understood, particularly in terms of large-scale digital preservation programmes, but are assumed to be substantial. Roles and responsibilities are not nearly as well defined as they are in the print environment. This is particularly true of licensed e-journals, where libraries licence access to the content which is under the control of publishers (Jones, 2006).

8. PubMed Central

"PubMed Central" (PMC), an Open Access model in US, is a free digital archive of life sciences journal literature, developed, and managed by the National Center for Biotechnology Information (NCBI) at the U.S. National Library of Medicine (NLM). It was launched in February 2000 with content from the *Proceedings of the National Academy of Sciences* and from *Molecular Biology of the Cell.* It is the database of choice,

for researchers and clinicians alike, to locate relevant articles and, in many cases, link directly to a publisher's site for the full text.

Access to PubMed Central is free and unrestricted. Peer reviewed research articles from participating journals are made available, with time delays determined on the publisher. Other content, such as reviews, essays and letters, is also made available at the discretion of the publisher so PubMed Central is not an exact replication of the journal [9].

A journal is guaranteed access to a copy of its deposited data upon request, at no cost. PubMed Central does not claim copyright on any material deposited in the archive. Copyright remains with the journal publisher or with individual authors, whichever is applicable. The strength of PubMed Central, in addition to its role as an archive, lies in what can be done when data from diverse sources is stored in a common format in a single repository [10].

There is also a recent development in PubMed Central International where allow countries to use the NCBI software to keep a mirror copy of the PMC content. Portable PMC (pPMC) is a software package being developed by NLM's National Center for Biotechnology Information (NCBI). When complete, it will be available for use by any organization or individual wishing to manage and provide access to a collection of journal articles and related material in a manner similar to that of NLM's PMC system [11].

Participating by publishers in PubMed Central (PMC) is voluntary, although participating journals must meet certain editorial standards, and this can be considered as a weakness of this initiative as voluntary efforts will not cover all publications.

9. KB e-Depot

The National Library of the Netherlands, the KB, (Koninklijke Bibliotheek) established e-Depot as an electronic extension of its national depository responsibility. The technical architecture of the e-Depot (hardware and software) was created through a partnership between IBM and the KB in 2002. The infrastructure of the e-Depot consists of both components that were specifically developed for processing, archiving, and

maintaining e-publications, and typical digital library functions. It is now fully operational and embedded in the KB organization. Collaborations between IBM and the KB staff can be considered as strength of this initiative as librarians are experienced in archiving since many years ago.

Content of the e-Depot is predominantly driven by the archiving agreements with publishers. In the Netherlands, deposit is on a voluntary basis. Nevertheless, because of the KB's good relationships with publishers, 95% of all regular publishers deposit their collections with the KB. At present, the e-Depot is receiving two types of electronic publications: offline media (e.g., CD-ROMs that are completely installed before they are loaded into the e-Depot, including operating systems and additionally required software); and online media such as high-volume electronic articles deposited by publishers (Dale, 2005).

Currently, e-Depot has a general agreement with the Dutch Publisher's Association and individual archiving agreements with Elsevier Science, Kluwer Academic, BioMed Central, and Blackwell Publishers. It has established archiving agreement conditions and access policies and allows for interlibrary loan in the Netherlands; other users have only onsite access. Open access materials are freely available, including off-site access. The depository will provide access for any licensee should publishers not be able to meet their obligations (calamities or bankruptcy) (Kubilius and Walton, 2005).

Having agreements with leading publishers of electronic journals can be considered another strength of this initiative as publishers are one of the important stakeholders of publishing industry. It is hoped that these agreements are a step forward to solve copy right issues with publishers in digital archiving.

Discussion and Conclusion

The archiving of scientific electronic journals is a complex issue with social, economics, legal, organizational and technical dimensions. Although there are groups working at the international levels to determine the best practices for digital archiving, the problems are complex and the stakeholders are many. Understanding the issue of digital archiving is important for librarians at all levels (local, national, regional,

international) as local collection development and preservation decisions are being made. At the present, there are no standards and no agreed-upon solutions. Librarians should know whom the stakeholders are, the technological problems involved in archiving and retrieving digital information, the current recommendations for archiving digital information, the costs involved, and some of the groups working for a solution.

The literature review shows that the move in recent years towards provision of scholarly journals in electronic form has greatly enhanced the access to and availability of scholarly publications. However the arrangements for preserving long-term access to electronic journals are far from satisfactory.

This study showed that at least two organizations including the Mellon Foundation in US and the KB (Koninklijke Bibliotheek) in the Netherlands have been actively working on digital preservation of scientific journals. The work of OCLC as a third party in digital archiving is also notable. Seven e-journal archiving pilot studies were funded by the Mellon Foundation in US universities for one year during 2001-2002 and a number of potential business models were explored with publishers during this planning phase. Two very different models (LOCKSS and JSTOR) have subsequently been funded by Mellon to build on the work of the earlier studies.

In the other study by the author, it is found that in addition to the Mellon Foundation in US, the KB (Koninklijke Bibliotheek) is also been working with leading publishers of electronic journals in order to achieve a secure electronic archive. A landmark electronic archiving agreement was drawn up with Elsevier Science in August 2002. The agreement gave the KB and its e-Depot the responsibility for preserving approximately 1,500 journals covering all areas of science, technology and medicine. As new journals are published by Elsevier, they too are added to the e-Depot. The agreement also covers journals digitized as a part of Elsevier's retrospective digitization project.

After the agreement with Elsevier, the KB concluded similar agreements with Kluwer Academic Publishers (2003), BioMed Central (2003), Blackwell (2004), Oxford University Press (2004), Taylor & Francis (2004), Sage (2005), Springer (2005) and Brill Academic Publishers (2005). It may be stressing that the KB e-Depot is a solution for

those in the Netherlands, but not for other subscribers who are looking for assurance that journals from Elsevier and other publishers will be preserved for them.

In addition, the agreements that the KB has made with major publishers are an interesting development. While these types of agreement may address issues of preservation and persistent access, other solutions may also be necessary. We should have keep in mind that whether international publishers will have to comply with legal deposit or deposit voluntarily in many countries and make a series of interim arrangements with different preserving institutions.

At the other side, libraries as one of the important stakeholders of electronic resources need to be commited in archiving initiatives. The only way a library can ensure that it will have continued access to subscribed content is through membership or participation in some of of the e-journal archiving initiatives described in this paper.

As it mentioned earlier, one of present's challenges in providing for the long-term availability of scientific literature is the need for an acceptable archiving solution for electronic publications. They have adopted different approaches to preserving intellectual content. Each model has its own strengths and weaknesses. However, at the present there is no single working preservation model and set of technologies that work for all repositories. Finally, it can be concluded that though a number of initiatives, projects and models for digital archiving are currently underway, many works needs to be done to achieve an acceptable archiving model for electronic journals.

It may be pointed here that the author believes in limitation of discussion on archiving initiatives. Because information technology is changing in very fast speed, many more initiatives may create and develop by various institutions.

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