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Article information:

To cite this document:

Golnessa Galyani Moghaddam, (2010), "Preserving digital resources: issues and concerns from a view of librarians", Collection Building, Vol. 29 Iss 2 pp. 65 - 69

Permanent link to this document:

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Preserving digital resources: issues and concerns from a view of librarians

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Abstract

Purpose – This paper aims to provide an overview of the challenges imposed on libraries by the presence of digital resources.

Design/methodology/approach – The paper reviews the main challenges and key issues of digital archiving from the point of view of librarians.

Findings – Information technology and the presence of the web are challenging the role of librarians in preserving library materials for future generations. Preserving digital resources is not going to be the same as preserving traditional resources and is absolutely a new responsibility for digital librarians. They are facing many new issues and concerns in digital preservation. These issues can be divided into three areas: technical issues, organisational issues and legal issues.

Originality/value – The paper provides insights into the current issues and challenges in digital archiving.

Keywords Digital libraries, Archives management, Librarians

Paper type General review

1. Introduction

Librarians have traditionally preserved library resources for many centuries with little change in their role. In recent years, technological developments have had a profound impact on library resources and challenged librarians' roles in preserving digital materials. Digital materials include texts, databases, still and moving images, audio, graphics, software and web pages, among a wide and growing range of formats. They require purposeful maintenance and management to be retained. Many of these resources have lasting value and significance, and should be protected and preserved for current and future generations. These ever-growing resources may exist in any language, in any part of the world, and in any area of human knowledge or expression. Preserving digital media is not the same as print media, and there are many issues for librarians to consider. This paper looks at some issues and concerns of preserving digital resources which need to be taken into consideration. These issues fall into three areas:

- 1 technical;
- 2 organisational; and
- 3 legal.

2. Preservation challenges for librarians

Libraries are currently in a transition period from print to digital collections. Traditional libraries are changing to digital libraries, and some libraries are already transformed into digital libraries. Therefore, librarians are walking into new jobs as digital librarians. In the traditional libraries, librarians were responsible for the preservation of library resources for

future use. It seems that while library materials are migrating from print to electronic media, the responsibility of archiving is shared between librarians and other organisations who are the producers of digital materials. In addition to librarians, creators of digital content and institutions that act as long-term repositories for digital materials are also stakeholders of digital preservation. The question is whether continued access in the medium to long term can be safely left to publishers or whether this is better undertaken by an independent repository.

Librarians are also concerned about the archiving of digital resources. They have had centuries of experience in archiving library materials. However, archiving digital resources is not the same as archiving traditional resources. It is absolutely a new responsibility for digital librarians. Librarians have many concerns about preserving digital resources.

Providing permanent access to electronic materials is a complex problem. As has been said, digital material is often unstable and has a brief lifespan because of the limited longevity of information carriers and the software and hardware that make the stored information accessible to users. Safeguarding the integrity and authenticity of the material is therefore a key challenge when dealing with long-term preservation. Regardless of the chosen strategy, permanent access calls for continuous attention and action. The rapid pace of technological change means that the techniques and procedures for long-term storage and accessibility requirements need to be adjusted and improved constantly (Oltmans and Wijngaarden, 2006).

Information is increasingly available in digital form (whether digitised materials or born-digital materials), and it will continue to increase. The increasing proliferation of digital information, combined with the considerable challenges associated with ensuring continued access to digital information, means that it is imperative that there be concerted action to overcome these challenges. There is some evidence that many potentially valuable digital materials have already been lost. With the rapid increase of digital

The current issue and full text archive of this journal is available at www.emeraldinsight.com/0160-4953.htm



Collection Building
29/2 (2010) 65–69
© Emerald Group Publishing Limited [ISSN 0160-4953]
[DOI 10.1108/01604951011040152]

Received: October 2009
Accepted: January 2010

information, digital preservation in libraries has become increasingly important. Libraries all around the world have to deal with fast-growing amounts of digital materials that need to be safeguarded. It is essential for libraries to preserve and make accessible all kinds of publications in digital form – online or on CD, digitised images, and born-digital objects.

It is interesting to note that the *Handbook* of the Digital Preservation Coalition[1] 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. The Digital Preservation Coalition points out that the richer interpretation means that there will have to be more thought and preparation given to which resources are stored, how they are maintained and subsequently accessed, and by whom. They have consider three leading issues for digital preservation:

- 1 technical issues;
- 2 organisational issues; and
- 3 three legal issues.

This paper follows the same pattern to discuss these issues.

3. Technical issues

3.1 Print and digital media

Library resources were for many years mostly preserved in paper format. Librarians used to send journal volumes for binding and storage in the library. Microforms were used for some time. The information in a paper society was not as vulnerable to loss and destruction as digital media. Preservation in paper formats worked for a long time in the history of librarianship. The lifetime of the paper format was long, while the lifetime of digital formats seems to be very short. In a paperless society it is not easy to keep up to date with one format for a long time. Librarians have to be concerned about the fragility of digital media. The media on which digital materials are stored is inherently unstable and without suitable storage conditions and management can deteriorate very quickly, even though they may not appear to be damaged externally. In order to cope with this problem, the Digital Preservation Coalition gives some precautions to reduce the danger of loss:

- storage in a stable, controlled environment;
- implementing regular refreshment cycles to copy onto newer media;
- making preservation copies (assuming licensing/copyright permission);
- implementing appropriate handling procedures; and
- transferring to “standard” storage media.

Even with these precautions the problem will not be solved because technology changes very quickly. So, even if the media is preserved in a stable condition, it may not be possible to access the information it contains yet because new technology will make the present media obsolescent. Of course, responsible care can make it easier to manage technological changes. In the volatile electronic environment, what is certain is that librarians are very much dependent on new technology for digital preservation.

As digital resources are machine dependent, it is not possible to access the information unless there is appropriate

hardware and associated software which will make it intelligible. Everyone knows 5¼ inch floppy disks have been superseded by 3½ inch floppy disks. Now floppies are becoming obsolete with the arrival of filch memories/data storage. The obsolescence applies to software too. There have been several upgrades to the Windows operating software since it was first introduced. Converting software from an earlier version to the current version is not always easy. Moreover, thousands of software programs common in the early 1990s are now extinct and unavailable.

It is obvious that technology will frequently change, and it is therefore not surprising that collection managers quoted in the Research Libraries Group (RLG) survey cited technological obsolescence as the greatest threat to successful digital preservation.

The different nature of digital media means that a radically different approach is required in managing digital materials from managing paper-based materials, one in which action needs to be taken, and planned for, at regular intervals.

3.2 Authority and quality control

While information technology brought many new features and capabilities for digital resources, they made the task of illegal copying and distribution easier. Now, it is possible to make changes in electronic resources without notice and permission. Duranti (2000) 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, which refers to the quality of the record itself and its essential contextual information). Authentication refers to the originality of a resource, while authenticity refers to the quality of the resource. Both of these issues need to be taken into consideration for digital archiving. The librarian should make sure that archived materials are safe based on their originality and quality in the digital environment. This task is not very easy if technology makes it very simple to make changes in electronic documents.

3.3 Scale

The scale of digital preservation is an important issue for any library that is going to undertake digital archiving. Librarians should make it clear to what extent they want to store their library’s materials. The capacities of machines such as computers, CDs, filch memories, etc., are important for preservation. Although computer storage is increasing in scale and its relative cost is decreasing constantly, the quantity of data is also increasing and this challenges the capabilities of the library to capture it. Some libraries rely on repository systems for archiving; however, even some repositories still face significant challenges in developing and maintaining scalable architectures and procedures to handle the huge quantities of data generated from sources such as satellites or the web. The technical and managerial challenges in accessioning, managing and providing access to digital materials on this scale should be carefully considered.

3.4 Strategies

Strategies of digital archiving should be designed with care. In 1999, Feeney developed three approaches to digital archiving as follows:

- 1 Preserve the original software (and possible hardware) that was used to create and access the information. This is known as the “technology preservation” strategy. It also involves preserving both the original operating system and hardware on which to run it.

- 2 Program future powerful computer systems to emulate older, obsolete computer platforms and operating systems as required. This is the “technology emulation” strategy.
- 3 Ensure that the digital information is re-encoded in new formats before the old format becomes obsolete. This is the “digital information migration” strategy (Feeney, 1999).

It seems that these strategies worked for some time and are tested over time, but technology will continue to develop and will continue to raise new issues. But these strategies may never meet the new technological developments and a range of strategies appropriate to different categories of digital materials may need to be employed. It may be better if a parallel strategy is employed with the paper environment, which also utilises a range of preservation strategies (de-acidification, microfilming, appropriate storage and handling, etc.).

4. Organisational issues

4.1 Costs of preservation

The cost of digital preservation is an important organisational issue, and cannot be easily isolated from other organisational expenses. 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. The cost of digital preservation seems to be much greater than traditional preservation. Access to digital resources is not easy in the context of rapid technological changes and needs expert staff and considerable expenditure on technological needs. Calculation of the costs of digital archiving is complex; however, it is a valuable and necessary task to establish a cost-effective and reliable business model. The costs of 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”. Noted that other issues such as organisational mission and goals, including the type and size of collections, the level of preservation committed to, the quantity and level of access required, and the time frame proposed for action should also be taken into consideration.

4.2 Expertise

Digital preservation needs highly skilled staff, while in traditional archiving the scenario was different. It is obvious that the ability to employ and develop staff with appropriate skills is made more difficult by the speed of technological change and the range of skills needed. Continuous training and “learning by doing” are methods that can be adopted, but both methods have their limitations. Libraries need to ensure that their existing staff and members can develop and continue to develop the range of competencies they need to manage the digital materials in their care.

4.3 Selection

Speed of publication in the print area has been increasing steadily, but the speed of electronic publication and the quantity of digital information is very high. The huge quantity of information being produced digitally, its variable quality, and the resource constraints on those taking responsibility for preserving long-term access make selectivity in preservation

inevitable. Selecting quality materials for long-term retention is an important issue for librarians.

Traditionally, lack of selection for preservation may not necessarily mean that the item will be lost, but in the digital environment non-selection for preservation may well mean that the item is lost. While not all resources can or need to be preserved forever, some will not need to be preserved at all, others will need to be preserved only for a defined period of time, and a relatively small sub-set will need to be preserved indefinitely. This decision should be made as early as possible to help to save resources for the most valuable digital assets.

In digital preservation, where there are multiple versions of an item, decisions must be made in selecting which version is the best for preservation, or whether more than one should be selected.

In traditional preservation, some level of redundancy with multiple copies was inevitable in different repositories, but this story is different in the electronic environment. Theoretically, in a digital environment a single institution can provide worldwide access and accept preservation responsibility, although there is a debate as to whether a level of redundancy should exist in the digital environment. In order to avoid the danger of losing access over time, at least one copy of the material should be stored in various repositories. Librarians should make clear who is responsible for preservation, and for what period of time. Formulating appropriate documentation for each level of preservation, selection process and responsibility can give some assurance of a successful preservation strategy.

5. Legal issues

5.1 Intellectual property rights (IPR)

Copyright and other intellectual property rights are two important issues because of their substantial impact on digital preservation. We know that copyright law was originated and created a long time ago, when there was no thought of the worldwide web. It seems that legal issues such as copyright were established well for traditional archiving, while for electronic materials this has not been the case. Copyright and intellectual property rights issues for digital materials are more complex and significant than for traditional media and, if not addressed, can prevent preservation activities. Both the contents of digital resources and their associated software need to be taken into consideration. Migration from print to digital media has made the following activities easier:

- simply copying (refreshing) digital materials onto another medium;
- encapsulating content and software for emulation; and
- migrating content to new hardware and software, etc.

Rights holders are particularly concerned with controlling access and potential infringements of copyright.

The results of a study by Adrienne Muir (2004) 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).

Regarding electronic scholarly journals, Anne Kenney and colleagues 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 the e-literature go unprotected (Kenney *et al.*, 2006).

There are other legal issues to consider at the time of digital preservation. For example, voluntary deposit arrangements were introduced recently in some fields, including library and information science. Voluntary arrangements need to be negotiated, and policies need to be established.

5.2 Business models and licensing

In addition, business models for the dissemination of electronic materials and the range of stakeholders also impact on intellectual property rights and preservation. Although libraries traditionally owned the resources forever once they paid the publisher, in the digital environment, electronic publications (particularly electronic journals) are not physically owned by the subscribers, who license access from the publisher. Licenses are an agreement for the legal use of electronic resources, not for ownership, and publishers remain the owners of electronic resources. Libraries as subscribers are therefore concerned that publishers consider the archiving and preservation of these works and include archiving and perpetual access to back issues in the licensing of these works.

The Digital Preservation Coalition considers electronic resources to be the result of investment by two groups:

- 1 financial investment by public funds (e.g. research councils) and/or publishers; and
- 2 intellectual investment by individual scholars and authors.

It is obvious that each of these stakeholders may have an interest in preservation; the archiving organisation will need to acquire permissions from them to safeguard and maximise their financial investment and the intellectual and cultural value of the work for future generations. Collaboration and cooperation among all stakeholders can lead to legal and successful digital preservation. Stakeholders may manifest their interests through contract, license, and grant conditions or through statutory provision such as "moral rights" for authors.

6. Preservation strategies

The Digital Preservation Coalition divides preservation strategies into primary and secondary preservation strategies. It defines primary preservation strategies as "strategies [that] might be selected by an archiving repository for medium to long-term preservation of digital materials for which they have accepted preservation responsibility".

According to the Digital Preservation Coalition:

... secondary preservation strategies are those which might be employed in the short to medium term either by the repository with long-term preservation responsibility and/or by those with a more transient interest in the materials. Chronologically, secondary strategies may precede primary strategies. Some secondary strategies may substantially defer the need for, or alternatively greatly strengthen, primary preservation strategies so describing them as secondary strategies does not necessarily imply their inferiority.

It is widely acknowledged that the most cost-effective means of ensuring continued access to important digital materials is to consider the preservation implications as early as possible, preferably at creation, and to plan actively for their

management throughout their lifecycle. Therefore, the major cause of concern in the digital environment is that failure to address the long-term access requirements of digital materials at a very much earlier stage than for paper materials will almost inevitably result in their permanent loss. Establishing preservation strategies in the early stages of stepping into digital libraries will ensure the success of digital preservation.

All technical, organisational and legal issues that are discussed in this paper need to be considered in developing preservation strategies. Each of the stakeholders in digital materials may have an interest in preservation; all their interests should be addressed and documented in preservation strategies. There needs to be an assurance that responsibility for preservation will be taken, and a clear understanding of who will take that responsibility and for what period of time. Of course, in all successful preservation strategies it may well be necessary to repeat steps in each level of the preservation process, with appropriate documentation.

7. Storage and maintenance

Storage of digital resources refers both to access and preservation. Again, storage media and the way of accessing digital preserved resources seem to be very different from traditional preservation. Depending on the needs of the organisation and the media, it may be necessary to create both preservation and access copies and to have strategies for each. Strategies play a crucial role for access to and preservation of digital library materials. Although there is no single solution that can be applied for the preservation of any digital resource, an approach based on good management practices, begun as early as possible in the lifecycle of a resource, will safeguard the initial investment and facilitate authorised access, at least for the short to medium term.

Regardless of the organisation and media, at the very least the following issues need to be addressed in the strategy of storage:

- whether storage and/or preservation will be undertaken by the host institution or under contract to a trusted third party;
- which resources justify preservation, and for what period of time; and
- which media and file formats should be selected.

The selection of media and file formats is an important issue in digital preservation, as they will be subject to the influence of continued technological change. It is important to have an understanding of the various media for storage because they require different software and hardware for access, and have different storage conditions and preservation requirements. There is an essential management component for all digital media to avoid media degradation and to facilitate longer-term preservation strategies.

Environmental conditions are a relevant issue, even in traditional preservation. Appropriate environmental conditions will increase the longevity of digital storage media and help prevent accidental damage to a data resource or its documentation.

Many digital materials are being stored in fragile digital media, so appropriate care and handling will protect fragile digital media from damage. There needs to be an assurance that the resource has not been inadvertently or deliberately changed following refreshment and/or migration procedures, and the readability and integrity of the data must be checked over time.

While physical space for preservation was a big problem in traditional libraries, this problem is much less acute in the electronic environment, and computer storage is decreasing in cost and increasing in capacity all the time. However, while storage is much less of a problem than it was, it is good practice to establish policies and procedures that clarify what digital resources need to be accessible online or offline.

8. Standards

Standards can play an important role in digital preservation. Perhaps some libraries think of digital archiving mainly in terms of reformatting existing paper materials. Good training programs exist to ensure reasonably efficient procedures for digital archiving. Although some issues remain, long-term digital archiving of text-based materials seems reasonable.

In his paper, Seadle (2004) notes that the standards and methods for multimedia preservation remain far more volatile. Older multimedia material that is currently stored in analogue form on magnetic tape or on colour film is more seriously endangered than all but the most acidic books. As with books, those items with a particularly high economic value tend to have many more copies, but the inevitable loss in each generation of analogue copies sets a threshold of quality, and even modern colour film has some tendencies to fade.

9. Technology watch

As mentioned earlier, the greatest threat to successful digital preservation is technological obsolescence, so there is an essential need to maintain a register of hardware and software capacity in the institution and preservation metadata to enable a formal process of “technology watch”. “Technology watch” was not a big issue for traditional librarians. Traditional methods of archiving were used for many years, while digital librarians need to keep abreast of technological developments that affect their file formats and preserved materials.

Deborah Woodyard (1999) describes how preservation metadata was gathered by the National Library of Australia (NLA) to determine what hardware and software were required by its digital holdings. A list of hardware and software available in the NLA was also developed and maintained. This is used to flag potential changes in technology and the requirement to retain hardware and software still needed by the collection until migration has occurred.

Failure to implement an effective technology watch will risk potential loss of access to digital holdings and higher costs.

10. Conclusion

The digital preservation of library resources has challenged the librarians’ role in many ways. They are facing technological, organisational and legal issues and concerns. Technology is developing at a very high speed and technological obsolescence is considered the greatest threat to successful digital preservation. Digital librarians need to work hard to keep themselves and the resources they have preserved up-to-date. They need to have a frequent

technology watch. In addition to technological challenges, there are also numerous challenges that relate to the capabilities of organisations to integrate the management of digital materials into their organisational structure. Legal issues such as copyright, intellectual rights management and licensing still need to be discussed. There is an increasing need to go beyond the limitations of individual organisations, or even countries, to maximise the benefits of the technology, address issues such as copyright, and also to overcome the challenges in a cost-effective manner. All public institutions such as archives, libraries, and museums should be involved in applying their professional skills and expertise to the long-term preservation of digital materials, just as they have taken a role in the preservation of traditional materials. Cooperation and collaboration among different organisations and libraries can lead to successful digital archiving.

Note

- 1 The Digital Preservation Coalition (DPC) was formed in July 2001 to raise awareness of the issues raised by the need to keep and to re-use for a decade or more digital assets and resources that institutions have created or purchased. Further information on the DPC is available from its website (see www.dpconline.org/).

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1. Marietjie De Beer, Marieta Van der Merwe, Liezl Ball, Ina Fourie. 2016. Legal deposit of electronic books – a review of challenges faced by national libraries. *Library Hi Tech* 34:1, 87-103. [[Abstract](#)] [[Full Text](#)] [[PDF](#)]