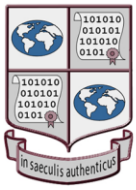

InterPARES 3 Project

International Research on Permanent Authentic Records in Electronic Systems

TEAM Canada

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Annotated Bibliography

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1.2	2010-09-28	S. Kovynev	Added new content.
1.3	2013-10-31	R. Preston	Minor content and copy edits for public version.

The Cost-Benefit Analysis of Digital Preservation: Annotated Bibliography

Author: Ashley, Kevin
Title: "Digital Archive Costs: Facts and Fallacies"
Publication Details: DLM Forum '99 (October 1999)
Publisher: European Commission, Brussels, Belgium
Web Address: http://ec.europa.eu/archives/ISPO/dlm/fulltext/full_ashl_en.htm

Abstract
The author challenges two major myths related to the costs involved in digital preservation. The first is that archive costs depend primarily on the volume of data to be stored, and the second is that data storage costs are very high. Both beliefs are unfounded as storage costs are not the primary cost involved in a digital preservation program. The primary influences are in fact analogous with those associated with traditional forms of archival storage. The costs actually lie in the various types of preservation services that can be made available. Variables in cost arise in activities such as acquiring materials, preservation and access issues. The more services offered and the more activity involved in providing access, the higher the cost. In the author's own experience, it is staff and not data volume that is the biggest influence on cost.

Annotation
This article provides a more practical look at the concerns of preservation. In essence, this pragmatic approach is a welcome response to some digital preservation concerns, as it answers some of the most basic fears of many organizations. By focusing on the requirements of the information and the users of that information, we can get a clearer picture of the nature of digital archive costs.

Keywords
Digital archives costs is the main topic of the paper. In face of an increasing volume of public or internal demands for access to modern archival material, it is difficult to decide how much such a service might cost. Although the creation of digital surrogates involves a very specific set of costs which are not applicable to records which are 'born digital' many of the ongoing costs - preservation, access, support for users - are very similar in overall character. Part of the difficulty in understanding costs has been the lack of working examples from which to learn and the difficulty in extrapolating costs from pilot projects to full-scale public services.

Publishers: Charles Beagrie Ltd, JISC
Title: "Keeping Research Data Safe Factsheet"
Publication Date: September 2010
Web Address: http://www.beagrie.com/KRDS_Factsheet_0910.pdf

Abstract
This factsheet illustrates some of the key findings and recommendations from the JISC-funded Keeping Research Data Safe (KRDS1) and Keeping Research Data Safe 2 (KRDS2) projects. It covers the following major areas:

- Cost issues in digital preservation (what costs most, impact of fixed costs, declining costs over time)
- Benefits from digital preservation (benefits taxonomy, direct benefits, indirect benefits, near-term benefits, long-term benefits)
- Institutional issues (repository models and structures, key cost variables, data collection levels)

Annotation
The factsheet is an overview of the cost issues in digital preservation of research data. It will be relevant to all repositories and institutions holding digital material but of particular interest to anyone responsible for or involved in the long-term management of research data.

Keywords
Cost Benefits: KRDS has defined a few important dimensions and a taxonomy that illuminate the broad contours of the benefits digital preservation investments potentially generate. The KRDS taxonomy for categorising the benefits from long-term preservation of research data is presented.

Author: Beagrie, Neil, Brian Lavoie, and Matthew Woollard
Title: "Keeping Research Data Safe 2"
Publication Details: Report prepared by *Charles Beagrie Limited*
Publication Date: April 2010
Web Address:
http://www.jisc.ac.uk/media/documents/publications/reports/2010/keepingresearchdatasafe2.pdf

Abstract
There are several significant challenges facing the academic community relating to the long-term curation, storage, retrieval and discovery of research data. One of these challenges is developing a better understanding of the costs involved in long-term preservation of research data. The report identifies and analyses collections of long-lived research data and information on associated preservation costs and benefits and provides a larger body of material and evidence against which existing and future research data preservation cost modelling exercises can be tested and validated. The authors believe this work is critical to developing preservation costing tools and cost benefit analyses for justifying and sustaining major investments in repositories and data curation.

Annotation
This is the final report of the *Keeping Research Data Safe phase 2* (KRDS2) project. It presents the results of a survey of available cost information, validation and further development of the KRDS activity cost model, and a new taxonomy to help assess benefits alongside costs. One of the key findings on the long-term costs of digital preservation for research data was that the cost

of archiving activities (archival storage and preservation planning and actions) is consistently a very small proportion of the overall costs and significantly lower than the costs of acquisition/ingest or access activities for all the case studies in KRDS2.

Keywords
Long-term Costs of Digital Preservation: The costs of archiving activities (archival storage and preservation planning and actions) are consistently a very small proportion of the overall costs and significantly lower than the costs of acquisition/ingest or access activities.

Author: Becker, Christoph, et al.
Title: "Systematic planning for digital preservation: Evaluating potential strategies and building preservation plans"
Journal or Book: *International Journal on Digital Libraries (IJDL)*
Publication Details: Vol. 10, no 4 (December 2009)
Web Address: http://www.springerlink.com/content/801685k478136425/

Abstract
This article describes a systematic approach for evaluating potential alternatives for preservation actions and building thoroughly defined, accountable preservation plans for keeping digital content alive over time. In this approach, preservation planners empirically evaluate potential action components in a controlled environment and select the most suitable one with respect to the particular requirements of a given setting. The method follows a variation of utility analysis to support multi-criteria decision-making procedures in digital preservation planning. The selection procedure leads to well-documented, well-argued and transparent decisions that can be reproduced and revisited at a later point of time.

Annotation
The value of the article is in case studies, which the authors use for description of the context and foundation of the approach under discussion. The definition of a preservation plan and explanation of the components necessary to constitute a solid and complete preservation plan might also be very useful for everyone considering digital preservation projects.

Keywords
Digital preservation and preservation planning is at the heart of the article. The authors discuss them in connection of **Open Archival Information Systems** model (OAIS). The OAIS model was published in 2002 and adopted as ISO standard. It has proven to be a very useful high-level reference model, describing functional entities and the exchange of information between them. Because of its growing acceptance in the community, the OAIS model is the most common framework for digital preservation systems.

A **preservation plan**, as opposed to preservation policy, is seen by the authors as an action plan for preserving a specific set of objects for a given purpose. It is defined as a series of preservation actions to be taken by a responsible institution due to an identified risk for a given set of digital objects or records (called collection).

Cost is considered one of the elements of a preservation plan. Cost of preservation action must

not exceed estimated value of digital object. Costs have a significant influence on the choice of a preservation solution, but are inherently hard to quantify. Ultimately, the **Total Cost of Ownership** (TCO) is the guiding figure for deciding whether or not a preservation strategy meets the needs of an institution within the constraints of its budget. Instead of providing a single numeric criterion which is extremely complex to quantify, costs might also be defined as *infrastructure characteristics*, putting an emphasis on cost factors instead of the resulting figures for cost estimates.

Publisher: Blue Ribbon Task Force on Sustainable Digital Preservation and Access
Title: "Sustainable Economics for a Digital Planet: Ensuring Long-Term Access to Digital Information"
Publication Details: Final Report of the Blue Ribbon Task Force on Sustainable Digital Preservation and Access
Publication Date: February 2010
Web Address: http://brtf.sdsc.edu/biblio/BRTF_Final_Report.pdf

Abstract
The sustainability of the long-term access and preservation of digital materials is a well-known challenge, and discussion frequently focuses on the difficult technical issues. Less clearly articulated are the organizational and economic issues implicit in the notion of sustainability which, at the risk of over-simplification, come down to two questions: How much does it cost? and Who should pay? The report makes it clear that sustainable economics for digital preservation is not just about finding more funds. It is about building an economic activity firmly rooted in a compelling value proposition, clear incentives to act, and well-defined preservation roles and responsibilities. Lacking these ingredients, digital preservation efforts—and the materials in their care—have little prospect of persisting over time; with them, our digital heritage will have a sound economic foundation for the future.

Annotation
The Task Forces sought to sample best and current practices in digital preservation and access and to identify major themes and systemic challenges. The Task Force's final report offers findings and actions agendas that will be useful to decision makers as they address these sustainability elements.

Keywords
Economic models are stylized representations of how economic processes work. They are a means to abstract an economic process down to the essential details that are important for 1) understanding how the process works, and 2) identifying the aspects of the process that can be influenced by outside intervention, such as public policy.

Economic models can be distinguished from **cost models** and **business models**, each of which is useful and may be essential for understanding an economic process, but neither of which can be used reliably except in the context of a broader economic model.

Author: Bonn, Maria
Title: "Benchmarking Conversion Costs: A Report from the Making of America IV Project"
Journal or Book: *RLG DigiNews*
Publication Details: Vol. 5, no 5 (October 2001)
Web Address:
http://worldcat.org/arcviewer/1/OCC/2007/08/08/0000070513/viewer/file251.html#feature2

Abstract
A report summarising the findings of the Making of America IV project, undertaken by the University of Michigan University Library, in investigating "the costs and methods of using digital technologies for preserving and deploying monograph materials".

Annotation
The costs reported represent a careful inventory of the activities involved in the big digitization project. It can be used as a benchmark for estimation of future digitization costs.

Keywords
Actual per-page cost: very valuable data on actual cost of digitization per a page of a book being digitized, based on staff salaries, costs of equipment and software and invoices is given.

Author: Caplan, Priscilla
Title: "Building a Digital Preservation Archive: Tales from the Front"
Journal or Book: *VINE: The Journal of Information and Knowledge Management Systems*
Publication Details: Vol. 34, no. 1 (2004)
Web Address: http://www.fcla.edu/digitalArchive/pdfs/buildingDigitalPresentArchive.pdf

Abstract
The article is a story of the evolution of the design of the FCLA (Florida Center for Library Automation) Digital Archive, a preservation repository for the libraries of the public universities of Florida. The idea was to could give the libraries a trusted and cost-effective alternative to building their own archiving facilities or contracting with commercial services. The initial plans of the designers were challenged, while being implemented. The author describes the logic leading to changes in policy and in preservation strategies, as well as the changes in cost.

Annotation
The implications associated with the creation of a preservation digital archives are described in the paper. The changes to the approach that had to be done along the road would be interesting for organizations planning creation of the similar repository in the future.

Keywords
The **costs of archiving** is one of the topics of the article. One of the significant features of the FDA is the assumption that libraries will decide what they want to archive based on their own evaluation of such costs and the value of the material. The author discusses the implications of the approach.

Author: Chapman, Steven
Title: "Counting the Costs of Digital Preservation: Is Repository Storage Affordable?"
Journal of Book: *Journal of Digital Information*
Publication Details: Vol. 4, no. 2 (2004)
Web Address: http://journals.tdl.org/jodi/article/view/100/99

Abstract
The affordability of repository storage is investigated on the examples of the Harvard University Library and the Online Computer Library Center, Inc. (OCLC). Both organizations fully recover operational expenses by charging owners annual rates for managed storage services, regardless of materials use. Formats are significant, but not sole factors in determining preservation costs in these models. Owners' definitions of content integrity and tolerance for risk, which can change over time, are also important variables in the complex equation of preservation costs and affordability.

Annotation
Storage of digitized material is one of the concerns in terms of cost effectiveness of digital preservation policies. The experience of two prominent digital repositories in the US might be of interest in this context.

Keywords
Storage costs are examined in the article in association with pricing. The model in which repositories bill content owners annually for preservation services should be familiar to librarians and archivists at many institutions. Repository storage is particularly important to quantify, then fund with reliable revenue streams, because it represents ongoing costs that apply to all materials designated to receive preservation services—however "preservation" is defined.

Publisher: The Commission on Preservation and Access, and The Research Libraries Group
Title: "Preserving Digital Information: Report of the Task Force on Archiving of Digital Information"
Publication Date: May 1996
Web Address: http://www.oclc.org/research/activities/past/rlg/digpresstudy/final-report.pdf

Abstract
The report provides an analysis of the digital landscape, focusing on features, including stakeholder interests, that affect the integrity of digital information objects and which determine the ability of digital archives to preserve such objects over the long term. The Task Force then introduces the principle that responsibility for archiving rests initially with the creator or owner of the information and that digital archives may invoke a fail-safe mechanism to protect culturally valuable information. The report explores in detail the roles and responsibilities associated with the critical functions of managing the operating environment of digital archives, strategies for migration of digital information, and costs and financial matters.

Annotation
The report includes a chapter on managing costs and finances in digital preservation, providing an overview on cost modeling, with the detailed explanation of one of such models. Cost of digital archives and depository library costs are also explained. Subsection "Obstacles and Prospects of Digital Archives" gives a valuable insight on advantages and disadvantages of digital archiving in terms of costs.

Keywords
The **principal cost factors** of the operating environment are explained in the report. They are associated with selection, accession, storage, use, migration, property rights transactions, and the systems engineering needed to manage migration and to maintain the digital archives within a distributed network infrastructure. Some costs, like those for hardware and software as well as those for intellectual property if rights are purchased rather than leased, will appear as capital costs and will need to be amortized.

Publisher: Consultative Committee for Space Data Systems, National Aeronautics and Space Administration, Washington, DC
Title: "Reference Model for an Open Archival Information System (OAIS): Recommendation for Space Data System Standards"
Publication Details: Blue Book, Issue 1 (January 2002)
Web Address: http://public.ccsds.org/publications/archive/650x0b1.pdf

Abstract
The purpose of this document is to define the reference model for an Open Archival Information System (OAIS). In this reference model, there is a particular focus on digital information, both as the primary forms of information held and as supporting information for both digitally and physically archived materials.

Annotation
The reference model presented addresses a full range of archival information preservation functions including ingest, archival storage, data management, access, and dissemination. It also addresses the migration of digital information to new media and forms, the data models used to represent the information, the role of software in information preservation, and the exchange of digital information among archives. It identifies both internal and external interfaces to the archive functions, and it identifies a number of high-level services at these interfaces. It provides various illustrative examples and some 'best practice' recommendations. It defines a minimal set of responsibilities for an archive to be called an OAIS, and it also defines a maximal archive to provide a broad set of useful terms and concepts.

Keywords
Information preservation: The fast-changing nature of the computer industry and the ephemeral nature of electronic data storage media are at odds with the key purpose of an OAIS: to preserve information over a long period of time. Today's digital data storage media can typically be kept at most a few decades before the probability of irreversible loss of data becomes too high to ignore. Further, the rapid pace of technology evolution makes many systems

much less cost-effective after only a few years.

In order to minimize **lifecycle costs** and enable **effective long-term preservation** of the information, organizations need to be active participants in the long-term preservation effort, and they need to follow the principles espoused in this OAIS reference model to ensure that the information can be preserved for the long term.

Cost-effective archival services are one of the reasons of OAIS implementation. The various alternatives for archive-to-archive associations in order to achieve cost effectiveness are described in the paper.

Authors: Currall, James, Peter McKinney, and Claire Johnson
Title: "Digital Preservation as an Albatross"
Publication Details: IS&T Archiving 2006 conference, Ottawa (May 2006)
Web Address: https://dspace.gla.ac.uk/bitstream/1905/535/1/espida_jcpmcj_albatross.pdf

Abstract
Organisations care about ensuring their continued existence and profitability. Investment is only undertaken after reflection on business cases. In creating a business case most people focus primarily on cost, but there must be a counter-veiling focus on value. There is no point in making an investment unless it has worth to the investor. A good business case will display a strong understanding of the value of information objects that organisations create. Information professionals must ensure that their desire to ensure longevity of information is tied coherently and explicitly to that of the organisation's future and detail why the digital materials are of value to it. Exploring value in this way allows engagement with senior management as it wraps the need for action in the terminology of their strategic vision and allows for a strong and successful business case to be made.

Annotation
This conference paper is about the concept of value in digital preservation and how up to this time it has not been considered enough when developing business cases for digital preservation projects. The authors maintain that value should be considered as a counterpoint to costs and discuss the views developed under the Espida project.

Keywords
Cost: The costs of 'doing something' can be determined relatively easily once certain assumptions have been made. The model presented by the authors points to tools that can help pull together the financial costs but does not offer direct guidance on the use of these. Costs will include the direct costs of the equipment, software and staff and these will consist of both Capital costs and Revenue (or recurrent) costs.

Value: Benefits are the primary reason for making an investment, financial or otherwise. The latent value that is capable of producing benefit is multifaceted. Intangible value is therefore very difficult to deconstruct and communicate.

Author: Davies, Richard, ed.
Title: "The LIFE2 Final Project Report: A JISC-funded joint venture project under 03/06, Repositories and Preservation Capital Programme, and supported by the LIBER Access and Preservation Divisions"
Publication Date: August 2008
Web Address: http://eprints.ucl.ac.uk/11758/1/11758.pdf

Abstract
This report details the work of the LIFE2 project, which ran from March 2007 to August 2008. Included are discussion on the methodology, models and economics and reports on LIFE case studies.

Annotation
The LIFE (Lifecycle Information For E-Literature) project made a major contribution to understanding the long-term costs of digital preservation. The LIFE work models the digital lifecycle and calculates the costs of preserving digital information for future years. Organisations can apply this process in order to understand costs and plan effectively for the preservation of their digital collections.

Keywords
The report discusses possible **Preservation Costing Aims** and different **Preservation Costing Approaches**. Two different approaches have been used to cost digital preservation activity: A) Top-down audit of all preservation and repository activity; and B) Bottom-up lifecycle costing of activities relating to a particular content stream.

Author: Dawes, Sharon S., et al.
Title: "Making Smart IT Choices: Understanding Value and Risk in Government IT Investments"
Publisher: University at Albany/SUNY, Center for Technology in Government
Publication Date: April 2004
Web Address: http://www.ctg.albany.edu/publications/guides/smartit2/smartit2.pdf

Abstract
The Center for Technology in Government is an applied research program at the University at Albany. The guide offers the best center's thinking about how to define an information technology project and make a solid case for needed financial and organizational investments. Process of making smart IT choices is logically divided into three phases. Phase 3 includes analysis of program goals, stakeholders, costs, and technology alternatives. Estimation of possible cost-benefits is an intrinsic element of making of good decisions about when and how to invest in information technology.

Annotation
Although the guide does not deal specifically with digital preservation or managing of digital records, the detailed overview of IT decisions and their risks and benefits can be useful for an organization considering investment in any IT–related project, digitization included.

Keywords
Cost-benefit analysis is described as a process that can be simple comparison of costs and projected savings, or a more detailed financial model.

Publisher: Digital Preservation Coalition, York, UK
Title: "Report for the DCC/DPC Workshop on Cost Models for preserving digital assets"
Publication Date: July 2005
Web Address: http://www.dpconline.org/events/previous-events/137-cost-models

Abstract
The DCC/DPC joint Workshop on Cost Models for preserving digital assets was held at the British Library on 26th July, 2005. Around seventy delegates from the UK, Europe, and the US were treated to a rich and stimulating source of information and discussion on costs and business models with a number of key themes emerging.

Annotation
The document is a concise and useful overview of the current studies on the subject of digital preservation costs. The PDFs of the PowerPoint presentations on particular studies are provided.

Keywords
Digital preservation is placed within a wider context of the business strategy of an organisation. The keynote address of the workshop stressed that there is a need to understand not just the **costs** but also the value of digital preservation.

Publisher: Digital Preservation Committee
Title: "Digital Preservation Cost Centers"
Publication Date: October 2006
Web Address: http://www.library.yale.edu/iac/DPC/DigitalPreservationCostCentersFinal1.pdf

Abstract
Digital preservation activities represent a new cost that is expected to be formidable. Substantial resource commitment has been and will be required to initiate as well as sustain a digital preservation program over time. Forecasting the precise magnitude of these costs, which will depend on factors such as system architecture, length of retention, scale, and preservation strategy is difficult because digital preservation is still very much in its infancy. Because so little is known about the actual cost of digital preservation, this document identifies cost centers, but does not attempt to calculate the related expenses.

Annotation
The document deals with costs related to each of the following areas of responsibility associated with digital preservation: planning, storage, administration, ingest, data management, access.

Keywords
The main cost factors reviewed in the document are as follows:

- **Selection and Evaluation costs;**
- **Data Preparation costs;**
- **Data Storage costs;**
- **Staff costs;**
- **Metadata costs.**

Publisher: ERPANet (Electronic Resource Preservation and Access Network)
Title: "Cost Orientation of Digital Preservation"
Publication Date: September 2003
Web Address: http://www.erpanet.org/guidance/docs/ERPANETCostingTool.pdf

Abstract
Cost is one of the main criteria for people responsible for digital preservation when it comes to funding sustainable preservation infrastructure and related activities, and hence there is a need for understanding the scope, the different perspectives, and essential factors of inherent costs. These costs have to be assessed against the value of digital objects and the benefits of their preservation or the risks of losing them. This instrument is meant to get a better picture on the cost aspects involved in digital preservation.

Annotation
This cost orientation tool will help to think through the costing issues involved in digital preservation. This survey of cost factors does not provide costing information. There is still a lack of sound costing information to build upon. It does not provide calculation methods (or formulas). Every organisation will have to identify its own needs that will be dependent on the business context.

Keywords
Digital preservation is ongoing and active for the whole retention period of an object. Preservation is typically a long-term venture that needs to be financially sustainable.

Costs of digital preservation include all activities from the creation and capture of the digital objects to their disposal (either destruction, transfer to another institution or long term preservation).

Cost factors are identified that should be taken into consideration. They should and can be integrated in the existing business context.

Publisher: ERPANet (Electronic Resource Preservation and Access Network)
Title: "Business Models Related to Digital Preservation: Final Report"
Publication Details: Seminar "Business Models related to Digital Preservation", Amsterdam, (September 2004)
Web Address: http://www.erpanet.org/events/2004/amsterdam/Amsterdam_Report.pdf

Abstract
Effective business models for digital preservation depend on understanding the involved work processes and the related costs, yet this issue is often overlooked by organisations that need to implement digital preservation measures for the sustainable, efficient, and cost-effective operation of their business. Furthermore, experience with digital preservation is very recent and still evolving, with most organisations still very much at the beginning of dealing with effective application of information technology and related digital preservation. Insight into possible business models is fundamental to the establishment of a solid digital preservation and sound financial infrastructure, which in itself is necessary to ensure successful and supported preservation implementation within any organisation. This seminar was established to provide insight into business models in relation to digital preservation in a range of organisations, and to help organisations understand these issues by exploring and discussing experiences so far.

Annotation
Topics covered during the seminar included financial aspects of digital preservation, namely: funding, return on investment, costing. As it is noted in the report, "the several presentations on cost issues made a significant contribution to the current lack of cost models and it was heartening to see several presentations including cost issues at a very granular level."

Keywords
The essential aspects of digital preservation costs discussed in the report are:

- **cost categories**
- **cost centres**
- **costs calculation**

Author: Feeney, Mary, ed.
Title: "Digital Culture: Maximising the Nation's Investment: a Synthesis of JISC/NPO Studies on the Preservation of Electronic Materials"
Publisher: National Preservation Office, UK
Publication Date: 1999
Web Address: http://www.ukoln.ac.uk/services/elib/papers/other/jisc-npo-dig/

Abstract
The book addresses the concern about digital preservation in the library community. The studies on the issue performed in the UK in 1990s form the basis of this book. In 1996, during a seminar at the British Library, which was attended by representatives from the library and archive profession, data archives, and publishers, it was agreed that Joint Information Services Committee of the Higher Education Funding Councils (JISC) would fund a number of studies on digital archiving, in collaboration with the National Preservation Office (NPO), the library, archival and publishing communities. The focus of the book is the program called 'JISC/NPO Studies on the Preservation of Electronic Materials', which was administered by the British Library Research and Innovation Centre.

Annotation
One of the issues the book is trying to address is the cost of digital preservation. Who should pay

for digital preservation? Should users pay fees for access? Or should it be free at the point of use? These are the questions to be answered. Overall, digital archiving is a cost-unknown venture. It must be established more precisely how much it will all cost, by constructing different working models based on different ways of doing it. Any strategy for long-term preservation must also take into account the possibility that the level of resources that may be devoted to digital archiving will not be available over the long term. Chapter 5 discusses the costs involved in digital preservation and proposes a model that can be used to compare the costs of different methods of preservation.

Keywords
Preservation cost is hard to define, because all the aspects and tasks involved in digital collection management are closely interlinked, making it very difficult to identify those elements which relate solely to preservation. For the same reason, it is difficult to isolate that portion of a data centre's budget which is concerned only with preservation. Rather than attempting to isolate a global preservation cost, the authors assume that there are some preservation costs associated with all the elements involved in the lifecycle of a digital resource.

A **cost model** that can be used to establish and compare the costs of the preferred methods of preservation for each category of digital resource is discussed. It defines key areas, based on the life-cycle of the digital resource, which must be addressed by any digital collection policy, of which preservation is one.

Author: Fox, Peter
Title: "Archiving of electronic publications: Some thoughts on cost"
Journal or Book: *Learned Publishing*
Publication Details: Vol. 15, no. 1 (January 2002)

Abstract
It is still far from clear what a long-term commitment to digital archiving will mean in terms of costs, as there are a large number of variables (e.g. the archiving model selected, how responsibility is allocated among institutions, the technical strategy chosen for preservation, and the type of access required). These variables were one of the topics discussed by representatives of the legal deposit libraries and publishers' interests, who tried to set up a voluntary scheme for the archiving of electronic publications. This group drew up a code of practice, which came into effect from Jan. 2000, and many publishers are now depositing their publications in accordance with this code.

Annotation
Estimates of archiving costs of CD-ROMs, e-journals, and e-books given in the article, can be useful for organizations dealing with the same issues in their practice.

Keywords
The **storage costs** include the maintenance and purchase of hardware, software, and the transfer of files from generation to generation of storage media as well as the periodic inspection of stored files and of the storage media itself.

The administrative costs include the requirement to follow any developments in technology and law which will make a difference to preservation of, or the provision of access to, the object, as well as updating the archive, including staff costs (salaries, overheads, training/retraining/skills upgrading).

Author: Hendley, Tony
Title: "Comparison of Methods and Costs of Digital Preservation"
Publisher: British Library Research and Innovation Centre
Publication Date: 1998
Web Address: http://www.ukoln.ac.uk/services/elib/papers/tavistock/hendley/hendley.html

Abstract
The number of digital documents and resources to be managed and preserved is growing at a tremendous rate. Almost inevitably, the number of approaches being taken to the management and preservation of digital documents and resources is also growing rapidly. In this study, the author draws up a matrix of data types and categories of digital resources; creates a decision model for assessing the agreed categories of digital resources to determine the most appropriate method of long term preservation; and he tries to develop a cost model for comparing the costs of the preferred methods of preservation for each category of digital resource.

Annotation
The study is intended for digital collection managers or caretakers. The author defines "preservation" in digital – why we need to preserve digital resources and what is involved in actually "preserving" digital resources. He also investigates potential digital preservation strategies and the range of data types and the categories of digital resources.

Keywords
Data preservation - safeguarding the information content of any digital resource from the ravages of time, technological change and decaying magnetic media. Preservation requirements will impinge on how digital resources are structured, documented, stored and validated and possibly even on the conditions and methods by which digital resources can be accessed by end users.

Cost model - the consultancy analyses the modules in the framework and tries to identify all the generic cost elements contained within each module, which relate directly or indirectly to the preservation of digital resources. This will serve as the basis for discussion and debate from which a greater consensus will emerge on how best to attribute costs.

Cost elements identified in the study are as follows:

- Creation Costs;
- Selection & Evaluation (Acquisition) Costs;
- Data Management Costs;
- Resource Disclosure Costs;
- Data Use Costs;
- Data Preservation Costs;
- Rights Management Costs

Author: Kingma, Bruce R.
Title: "The Costs of Print, Fiche, and Digital Access: The Early Canadiana Online Project"
Journal or Book: *D-Lib Magazine*
Publication Details: Vol. 6, no. 2 (February 2000)
Web Address: http://www.dlib.org/dlib/february00/kingma/02kingma.html

Abstract
The study examines the economics of digital, microfiche, and print access for the Early Canadiana Online (ECO) project. ECO is a digital library of selected books and pamphlets from pre-1900. The ECO project includes over 3,000 titles and 500,000 images. The paper reports the cost estimates for digital, microfiche, and print access. The report also includes an examination of the economic theory of digital information and pricing alternatives for the ECO project.

Annotation
Previous studies that investigated the costs of digitization measured the marginal costs per image of primarily in-house scanning. They provided accurate estimates of local scanning projects and the additional costs of increasing existing digitization activities. By comparison, this study includes all costs including management and overhead, construction, utilities, and all other costs associated with the production, cataloguing, and sales of texts in microfiche or digital format.

Keywords
Cost estimates are necessary to determine efficient investments in digitization of print or microfiched information products. The author of the paper focuses on estimating and comparing the costs of three methods of information delivery: print, microfiche, and digital.

Cost of Access to Digital Information is also discussed. Access to digital information includes the personal computer, network connection, and space used by the patron.

Author: Lavoie, Brian F.
Title: "The Incentives to Preserve Digital Materials: Roles, Scenarios, and Economic Decision-Making"
Publisher: OCLC Online Computer Library Center, Dublin, Ohio
Publication Date: April 2003
Web Address: http://www.oclc.org/research/activities/past/orprojects/digipres/incentives-dp.pdf

Abstract
The fundamental economic issue associated with digital preservation concerns the incentives to preserve digital materials. The paper discusses these incentives to preserve that can be characterized as perceived motivation sufficient to 1) induce a party to recognize a need to take action to secure the long-term viability of digital materials in which they are a stakeholder, and 2) induce a party to develop and implement technologies aimed at ensuring the long-term viability of digital materials.

Annotation
A thorough understanding of the nature and extent of the incentives to preserve is fundamental to more focused research into the economics of digital preservation. The author overviews the existing work relevant to the economics of digital preservation, much of which concerns the enumeration and quantification of costs, as well as the development of cost-recovery or profit-making mechanisms to support the provision of digital preservation services.

Keywords
Digital preservation costs are analysed. The author points out that the notion of preserving digital materials is relatively new. It is not surprising, then, that the bulk of the actual cost data available is confined to the earliest stages of the digital preservation process, such as selection, reformatting or conversion, and storage technologies. The greater part of the costs, however, are distributed over an indeterminate time horizon, hidden in the processes that ensure the long-term recoverability of the object's bit stream, as well as the ability to render the bit stream into useable information.

Authors: Oltmans, Erik and Kol, Nanda
Title: "A Comparison Between Migration and Emulation in Terms of Costs"
Journal or Book: *RLG DigiNews*
Publication Details: Vol. 9, no. 2 (April 2005)
Web Address: http://worldcat.org/arcviewer/1/OCC/2007/07/10/0000068902/viewer/file1.html

Abstract
An important issue in digital archiving is long-term access: how can we guarantee permanent access to digital publications while software and hardware are constantly changing? This issue strongly relates to the object's life cycle management. In this paper, the life cycle management issues are discussed as they relate to two prominent digital preservation techniques and associated costs: migration and emulation. Authors argue that applying the emulation strategy may be more efficient in terms of life cycle management (and thus costs) than the migration strategy.

Annotation
The main topic of the paper – advantages of one digital archiving technique compared to another, in terms of associated costs, makes it relevant to this list. The example of e-Depot, a fully operational digital archives within the National library of the Netherlands, used in the paper, could also be valuable for a researcher in the subject.

Keywords
Digital preservation, or permanent availability of digital information is described in the paper as one of the processes dramatically affected by the evolution towards an all-digital world.

Long-term costs of a digital archive may determine (or limit) the choice for certain preservation strategies, the paper argues. Unlike most business models and cost-estimates available in the literature, which only address the general preservation issues, the comparison done by the authors estimates the costs of specific strategies.

Authors: Palm, Jonas
Title: "The Digital Black Hole"
Publication Details: This article was published as part of the Training for Audiovisual Preservation in Europe (TAPE) program.
Publication Date: April 2005
Web Address: http://www.tape-online.net/docs/Palm_Black_Hole.pdf

Abstract
The article presents an analysis of costs for digitizing and long-term storage at the Riksarkivet (National Archives) in Stockholm, Sweden.

Annotation
The model for the estimation of costs presented in the paper can be used to make similar calculations in other situations.

Keywords
The **costs of long-term storage** and the **costs of digitization** are detailed in the presentation.

Author: Russell, Kelly, and Ellis Weinberger
Title: "Cost Elements of Digital Preservation"
Publication Details: Archived by the UK Web Archive
Publication Date: May 2003
Web Address:
http://www.webarchive.org.uk/wayback/archive/20050410120000/http://www.leeds.ac.uk/cedars/colman/CIW01r.html

Abstract
The costs of preservation of digital materials will be different than for other materials and will require resource commitments of a different nature on an ongoing basis. The ongoing costs of digital preservation are also likely to span a more extended timeframe than traditional preservation and it may be the case that different technical strategies will prescribe quite different costing timeframes and schedules. This document attempts to identify some of the main costs elements that libraries can expect to encounter when considering digital preservation as part of their ongoing collection management function. It is divided into two parts: part one provides an introduction and overview of some of the general issues associated with the costs of digital preservation and part two provides a detailed breakdown of specific cost elements.

Annotation
This draft article discusses various factors that affect the cost of preserving digital information and has subsequently been incorporated into the various CEDARS (CURL Exemplars in Digital ARchiveS) Guides.

Keywords
Digital Preservation Strategy: a particular technical approach to the preservation of digital

materials. Broadly speaking there are three main technical approaches to preserving digital materials: technology preservation, technology emulation and data migration. The first two focus on the technology itself. Data migration strategies focus on the need to maintain the digital files in a format which is accessible using "current technology" and require regular migration from one technical environment to a newer one.

Cost Elements for Digital Preservation: The cost of preserving an object will depend on many factors. There will be a multitude of other considerations which will impact on how these costs are made manifest and it may be that any decision-making based on the following elements is best expressed as a matrix.

Author: Saffady, William
Title: "Cost Analysis Concepts and Methods for Records Management Projects"
Publisher: ARMA International
Publication Date: 1998

Abstract
Cost analysis is an essential part of business decision making. Performing cost analysis has become more complicated since the RIM opportunities had expanded. The author shows how to identify, categorize, and evaluate the cost of records management activities.

Annotation
The book is written for records and information management professionals using records management applications. It will be especially helpful for those who have planning and budgeting responsibilities requiring them to project future requirements for personnel, technology, and other resources and to evaluate alternative methods and costs of achieving specific objectives.

Keywords
Cost analysis is the staple of the book. The author focuses on two aspects of cost analysis: categorizing costs and justifying costs. Categorization gives RIM professionals understanding of costs, which, in turn, makes them better skilled in analyzing, managing and controlling them. Justification of costs is applied as the economic evaluation of a proposed action to determine if it will result in economic benefits.

Author: Sanett, Shelby
Title: "Toward Developing a Framework of Cost Elements for Preserving Authentic Electronic Records into Perpetuity"
Journal or Book: *College and Research Libraries*
Publication Details: Vol. 63, no 5 (September 2002)
Web Address: http://crl.acrl.org/content/63/5/388.full.pdf

Abstract
The financial challenges of the processes involved in preserving electronic records into

perpetuity are significant. Financial management tools will support the decision-making processes in which archives and libraries engage when preserving electronic records. Applying business concepts, in combination with archival precepts and collection management principles, to the challenge of preserving electronic records will assist institutions such as archives and libraries in making decisions that will support their mission statements and act in the best interests of their users. This article proposes that a cost model specific to preserving authentic electronic records be developed.

Annotation
This article argues that applying business concepts such as cost-benefit analysis, risk-benefit analysis, decision-making models, and cost models, in combination with archival precepts and collection management principles, to the challenge of preserving electronic records will assist large institutions such as archives and special collections in making decisions that will support their mission statements and act in the best interests of their users, both present and future.

Keywords
The author discusses **financial planning tools** that help making the best possible decisions for the institution and the electronic records, in conjunction with the organization's mission statement.

The first is **decision tree analysis**, which combines decision points with probabilities and costs to produce better information. **Cost-benefit analysis** is the second financial planning tool, which will supply information to support decision making.

Author: Strodl, Stephan, et al.
Title: "How to Choose a Digital Preservation Strategy: Evaluating a Preservation Planning Procedure"
Publication Details: Proceedings of the ACM IEEE Joint Conference on Digital Libraries (JCDL'07), Vancouver, British Columbia, Canada, June 18-23, 2007
Web Address: http://www.ifs.tuwien.ac.at/~strodl/paper/FP060-strodl.pdf

Abstract
The paper presents the *PLANETS Preservation Planning approach*. It provides an approved way to make informed and accountable decisions on which solution to implement in order to optimally preserve digital objects for a given purpose. The viability of this approach is shown in several case studies for different settings.

Annotation
The paper describes in detail the workflow for evaluating and selecting digital preservation solutions. The authors describe a framework to support the acquisition and documentation of various requirements arising in the context of preservation planning. Besides, guidance is provided for institutions having less expertise in the area of digital preservation and its challenges to identify core requirements that any solution should fulfil in a given setting.

Keywords
Digital Preservation is defined as the process of keeping electronic material accessible and

usable for a certain period of time. The authors note that it has turned into one of the most pressing challenges within the digital library community. Not only because of the rapid changes and ongoing developments in file formats, long-term archiving of digital material is a highly complex and diverse matter. The ever-growing amount of material being available digitally not only drives the need for feasible access and delivery, but also for preserving digital objects in the medium and long run.

Costs have a significant influence on the choice of a preservation solution. Usually, they may be divided into technical and personnel costs, as well as start-up and operational expenditures.

Author: Wheatley, Paul
Title: "Costing the Digital Preservation Lifecycle More Effectively"
Publication Details: Proceedings of the iPRES 2008 (The Fifth International Conference on Preservation of Digital Objects)
Publication Date: September 2008
Web Address: http://www.bl.uk/ipres2008/presentations_day1/19_Wheatley.pdf

Abstract
This paper reviews the work of the LIFE (Lifecycle Information For E-Literature) and LIFE2 projects, the LIFE models, case studies and methodology for costing the digital preservation lifecycle. It concludes that there is further work required in refining the costing models and costing tools and encourages organisations to record costs and where possible make them available to the wider community.

Annotation
The LIFE and LIFE2 Projects have advanced understanding of the short and long-term costs in this complex area, facilitating better planning, comparison and evaluation of digital lifecycles. Case studies presented in the paper provide useful practical experience of the application of costing tools.

Keywords
The concept of **lifecycle costing**, which is used within many industries as a cost management or product development tool is concerned with all stages of a product's or process's lifecycle from inception to retirement.

Author: Wright, Richard, Ant Miller, and Matthew Addis
Title: "The Significance of Storage in the "Cost of Risk" of Digital Preservation"
Book/Journal: *The International Journal of Digital Curation*
Publication Details: Issue 3, Vol. 4 (December 2009)
Web Address: http://www.ijdc.net/index.php/ijdc/article/viewFile/138/173

Abstract
As storage costs drop, storage is becoming the lowest cost in a digital repository – and the biggest risk. The authors examine current modelling of costs and risks in digital preservation,

concentrating on the Total Cost of Risk when using digital storage systems for preserving audiovisual material. They review the vital role of storage and show how planning for long-term preservation of data should consider the risks involved in using digital storage technology. Gaps in information necessary for accurate modelling – and planning – are presented. The paper calls for new functionality to support recovery of files with errors, to eliminate the all-or-nothing approach of current IT systems, which in turn reduces the impact of failures of digital storage technology and mitigates against loss of digital data.

Annotation
This article (based on a paper given at IPRES 2008, British Library Conference Centre 29-30 September 2008), discusses the role and significance of storage contributing to the reducing costs and increasing risks of digital preservation. The concept of the "cost of risk" is applied to the discussion of storage and the benefits of using uncompressed storage are considered.

Keywords
Cost Modeling: The authors present an approach to risk that combines the dimensions of cost, risk (uncertainty) and value (benefits). Their model builds upon and extends work on cost modelling by both the digital library and audio-visual communities.

Cost-of-Risk Modeling: Estimation of cost involves uncertainties. Some uncertainties can be represented as variances in cost estimates (uncertainty about how much costs may vary from the predicted value), but a whole range of uncertainties are related to things that may or may not happen, and should be formally identified as risks.