



**ELECTRONIC RECORDS AGENDA PROJECT
FINAL REPORT**

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Executive summary

The challenges and opportunities that electronic records present are well known and eloquently described in a myriad of documents. For many years, the National Historical Publications and Records Commission (NHPRC) has encouraged and supported efforts to meet those challenges and realize the opportunities they represent. Its innovative work has greatly increased the potential to develop effective electronic records programs. To realize fully that potential, the NHPRC should encourage multiple, practical and collaborative engagements among the various communities and constituencies interested in electronic records and digital information resources, so they can work together and share what they learn.

This means a change in orientation from the 1991 agenda, which emphasized research. Analysis and evaluation of NHPRC-sponsored projects, feedback from the NHPRC's constituencies and review of the literature on electronic records indicate that there is now a foundation on which to build programs. As a result, a new electronic records agenda can build on the successful projects, while improving the chances for more and better work. The new emphasis should be on implementation and analysis, with particular encouragement of communication and education, so that all projects have an impact on the archival community.

First, the NHPRC can support the development of more electronic records programs by using targeted initiatives to create practical models for archivists. This will introduce more archivists to the issues and choices they face, giving them a starting point and the confidence with which to move forward. The targeted grants should focus on technological solutions that are practical and available. These need testing and further adaptation to ensure that they meet all archival needs and that they will support: a) further enhancement and improvement; and b) the development of collaborative and educational guidelines for archivists and their constituents. This will help archivists build their capacities to manage electronic records and to demonstrate their skills.

Second, the NHPRC can encourage applicants to build on the achievements of the targeted initiatives by supporting projects that echo four themes: a) new partners; b) education; c) technology as opportunity and; d) a common core of knowledge, skills and tools. These themes will encourage grant applicants to consider the factors that influence and determine the potential for the development of sustainable electronic records programs.

Success will not come as a matter of course. Any agenda for a topic as complex as the interaction of information technology with an established profession – complicated by an array of individuals and organizations of disparate skills and resources – will be problematic. In this framework, no single actor and no single approach will provide the answers. A new electronic records agenda will only provide a starting point. Moving forward, there will be challenges to the resources of the NHPRC and its abilities to fund the necessary work; challenges to the archival profession and its ability to assimilate new

concepts and technologies; and challenges to the abilities of individual archives and archivists to act on their opportunities and translate them into practical programs.

Further, information technology is dynamic: the challenges and the opportunities it presents to archives will change routinely and unexpectedly, so archivists have to learn and re-learn continually which options are available and practical. As well, bureaucracies and organizations are dynamic: as the current budget crises in state governments demonstrate, the missions and staffs of archives will change routinely and unexpectedly, so the archival responses to information technology have continually to be explored and examined. As a result, no single solution for electronic records management will exist, either for all places or all times.

As a result, this agenda aims to provide archivists with a significant amount of flexibility and latitude in determining the goals of their programs, while still ensuring that the investments of the NHPRC provide a return to the profession as a whole. Any agenda has to allow archivists to identify the factors that influence their individual environments and to develop the “local knowledge,” as anthropologists put it, that will enable them to negotiate through their surroundings. At the same time, the agenda has to ensure that these local projects have a larger, national impact.

Certain threads can tie these efforts together. While different environments will offer different opportunities, archivists should recognize that content and access are important drivers for investment in information technology projects. The appraisal of records will be an especially important skill and one of the critical functions of archivists will be identifying and collecting records of value, and particularly records that lend themselves to re-use or re-purposing and to online access.

Over the longer term, the critical role for the NHPRC is fostering the continuing development of social and intellectual capital. As technology becomes practical and affordable, the unresolved questions about electronic records programs will be on the human side of the equation, addressing issues such as education, organization, culture, project management and governance. Many of these will best be explored through practical, hands-on training, followed by analysis and evaluation.

The executive summary of the 1991 electronic records research agenda closed with these words: “The working meeting strongly urged the NHPRC to exert leadership in the electronic records field by establishing specific priorities for electronic records research supported with NHPRC funds, by serving as a facilitator for multidisciplinary research with allied professions, and by encouraging other Federal funding agencies and private foundations to sponsor or support electronic records research.”¹ After replacing “research” with “programs,” that sentence could summarize this report as well. But a different context assigns this statement a different meaning. Building on the experience and the successes of the past ten years, the NHPRC and archivists can much more effectively itemize and prioritize specific steps to take to further those goals. As a result, more should be expected. Information technology presents a critical opportunity for archivists. They should take that opportunity to realize practical and sustainable

NHPRC Electronic Records Agenda

electronic records programs at all levels of resources and among all types of organizations.

1. Background

The mission of the National Historical Publications and Records Commission (NHPRC) is “to ensure understanding of our nation's past by promoting, nationwide, the identification, preservation, and dissemination of essential historical documentation.” This includes the support of “a wide range of activities to preserve, publish, and encourage the use of documentary sources relating to the history of the United States.”² Relative to technology, the goal of the NHPRC is to “enable the nation's archivists, records managers, and documentary editors to overcome the obstacles and take advantage of the opportunities posed by electronic technologies by continuing to provide leadership in funding research and development on appraising, preserving, disseminating, and providing access to important documentary sources in electronic form.”

While these statements date from 1996 and 1997, respectively, the NHPRC has actively supported work with electronic records for more than two decades. The first electronic records grant awarded by the Commission was in 1979, to the University of Wisconsin and the State Historical Society of Wisconsin, to schedule, accession and retrieve information from machine-readable records of state agencies.³ Since 1991, the NHPRC has guided and evaluated electronic records projects using a formal research agenda, which was reviewed and revised in 1996. In that time, the NHPRC's work was path breaking; in its foresight, it supported work on electronic records well before the advances such as the World Wide Web and scandals such as Enron's brought the topic onto the public stage.

Since 1991, the NHPRC and archival programs have made great strides, particularly in terms of raising the levels of awareness and technological sophistication among archivists. The number of people who know about electronic records, who are concerned about electronic records and who are thinking about electronic records is much higher than it was in 1991.⁴ Success in these areas has largely been the result of educational, promotional and research projects that have effectively reached archivists and their constituencies across the United States and the world. International interest in the work of the Pittsburgh Project and InterPARES testifies to the impact of the NHPRC's sponsorship.

But the number of archivists who are actually managing electronic records is still too small. Despite the technological advances and the intellectual achievements of the past decade, despite all that the profession has done to apply new information technologies in other areas of its work (e.g., administration, collection management, arrangement and description⁵), it appears as if the majority of archival programs have done little with born-digital records.⁶

At the same time, there has been enormous growth in the rate of adoption of information technology by allied disciplines (e.g., librarians, records managers, information management professionals) and archival constituencies (e.g., lawyers, auditors, managers, researchers). This situation has greatly increased the potential for electronic records programs, by creating new possibilities for collaboration and by

extending the reach and application of information technology to many new aspects of business and life. The situation has, as well, heightened the expectations of archivists' patrons and constituents; the increase in the sheer number of electronic records is inevitably accompanied by more opportunities to manage them.⁷

In sum, while archivists can duly celebrate their progress, they must at the same time aspire to do more. Much of the substance articulated in the 1991 and 1996 agendas still needs to be systematically explored. Many of the projects sponsored by the NHPRC over the past decade have documented their work through either print publications or the Web, but many others have not. The dissemination and long-term availability of such documentation is also quite mixed. Further evaluation and dissemination of this previous work would undoubtedly benefit future efforts.

2. Recommendations

One fundamental question for the NHPRC's electronic records agenda is the extent to which funds should be directed towards specific products and results, as opposed to leaving it up to grant applicants to explore their options. This report recommends a combination of these two approaches. Targeted grants will raise the level of understanding among archivists and put more archivists in a position to work with information technology. They will provide a foundation on which the profession can build.

What archivists can actually build will differ from place to place and over time; because of that, individual applicants need a broad latitude and flexibility to act more freely and creatively in determining what projects they can explore. But applicants need some guidance: in order to ensure that individual projects provide more general benefits, the NHPRC can point to particular directions to explore. The four themes identified in this report - new partners, education, technology as opportunity and a common core of knowledge, skills and tools - will provide that direction, as well as serve as criteria to evaluate grant applications and determine if they will contribute to a greater and better implementation of information technology.

This is especially noteworthy as the NHPRC does not mandate a "one size fits all" approach. For the purpose of evaluating proposals, it only asks applicants to define their own projects and their own conceptions of records in the context of previous intellectual and theoretical work. It does not require any applicant to adopt a particular definition or concept. This report can serve the purpose of underscoring the fact that no theoretical project has the official blessing of the NHPRC. But the report goes even further, suggesting that the NHPRC should encourage applicants to explore their own definitions of archival roles in order to take advantage of the opportunities in their particular locales. In this way, different programs could look first for what they hold in common with their constituents and likely partners in any information technology project.

This approach emphasizes what has already been recognized: information technology projects increasingly have such broad impact and demand such diverse skills that

archivists have to form and work in teams that cross organizational and professional boundaries in order to have any success. Increasingly, the implementation of information technology is built on standards, common architectures, interoperability and partnerships. To enter into these collaborations, archivists have to add value. To make that possible, an electronic records agenda should identify and build upon commonalities held across professions. That suggests moving the focus from defining an overarching and all-encompassing framework of “archival requirements,” as suggested in the 1991 agenda, to supporting the proliferation of many archival engagements with information technology and ensuring that these productively inform the profession as a whole.

Along the same lines, there would be a certain hubris in defining any agenda solely in terms of beaten intellectual paths when there remains so much to explore. This is especially true in the area of information technology, where no one has accurately predicted its course over any significant length of time. It is an extraordinarily dynamic arena, remarkable in many ways for its continuing capacity to generate a seemingly endless parade of popular and scholarly monographs analyzing the mistakes and misconceptions of all the erstwhile leaders and thinkers. One such work, John Seely Brown’s and Paul Duguid’s *The Social Life of Information*, makes the important point that communication and education will mitigate the inevitability of mistakes. As some failures, in electronic records programs as in any other area of technology, are certain, it will be especially important to develop communities of learning that foster the sharing of knowledge, techniques and practices.⁸ That anticipates the themes of this agenda; it also defines a role for the NHPRC. The more that archivists actively engage with electronic records and the more that the NHPRC supports the analysis, evaluation and dissemination of the results of those engagements, then the more potential archivists have for progress.

Emphasizing the development of communities of learning would result in a grants program that focuses on infrastructure and particularly human capital or intellectual capital, the knowledge, experience and contacts that can build up the assets that will make electronic records projects and programs succeed. The principal form this would take is a renewed and strengthened concern for education, with ancillary support for the development of a body of knowledge and expertise, embodied in readily available, practical and scalable tools and techniques. This report defines that concept in terms of four themes: new partners, education, technology as opportunity, and a common core set of knowledge, skills and tools. These define general orientations that could guide the NHPRC and individual projects towards the development of sustainable electronic records programs.

3. Targeted grants and focused initiatives

Some initial catalyst will be necessary if the NHPRC wants to encourage, facilitate and nurture the development of electronic records initiatives widely among the profession. In order to prepare the ground for future work, preliminary efforts could generate and distribute tangible products focused on particular needs, issues or groups. This work could take the form of collaborations that are of lower cost and shorter duration than the usual year or multi-year projects entertained by the NHPRC. While

these activities would take on relatively small, well-defined problems, the scope of applicability for their results could be broad, in that their express purpose would be to inform multiple organizations. These results would not be the final answers to any issue, but would instead provide the basis for further, incremental development and analysis. Perhaps even more importantly, they could serve as identifiable “wins” that both the NHPRC and its constituencies could use to justify increased funding in the future.

This work could address the following objectives:

- establish and/or promote standards
- test available technologies
- test collaborative funding and governance models
- establish educational standards for basic archival functions
- study and evaluate projects and model partnerships
- promote partnerships and collaboration across disciplines and boundaries
- develop business cases and economic models
- provide hands-on training opportunities
- foster the development of professional consensus

Some initiatives could be designed to focus primarily on just one of these objectives, while others might explicitly tackle two or three, though to varying degrees.

A key step would be to demonstrate that archivists do not have to do it all themselves. In fact, it is unlikely that the vast majority of archives will ever be in a position to install and manage the technology architectures they will need in order to preserve and provide access to electronic records. The more economical and more promising approach is for archives to organize around service providers, along the lines of models represented, for example, by the OCLC Digital Archive.⁹ Archives can also explore the use of technology emerging from a number of other collaborations, including MIT’s DSpace, the University of Virginia’s and Cornell University’s FEDORA and the San Diego Supercomputer Center’s Storage Resource Broker (SRB).¹⁰

The focus should be on technologies that are practical and available. These will, in many cases, require testing and further adaptation to ensure that they meet all archival needs, so they should be the immediate focus of targeted grants that will lead to: a) further enhancement and improvement; and b) the development of collaborative and educational guidelines for archivists and their constituents. The applications noted are not the only potential solutions and obviously the NHPRC cannot anoint one or any of them as “the” technology to adopt, but they are the optimal possibilities to explore now, particularly as they are not mutually exclusive and do not rely on proprietary systems or formats. Instead, they are based on standards, could well be integrated and promise to be interoperable. Other technologies with similar promise can be explored as they develop.

In these collaborations, content and access will be important drivers for investment and partnerships. The appraisal of records will remain an important skill, as one of the critical functions of archivists will be to identify and collect records of value, particularly

records that lend themselves to re-use or re-purposing and to online access. There are a number of model projects integrating the collections of several institutions (e.g., the Colorado Digitization Program or the California Digital Library) that are worthy of study.

¹¹ Archivists will also need to develop skills to enable appraisal of the technical aspects of electronic records. This includes ability to understand basic information technology (IT) concepts (networks, hardware and software platforms, storage, requirements analysis, systems development, etc.), as well as to understand the linkage between technological dependencies and long term sustainability.

In this context, most archivists will play a primary role as the connection between records creators and users, but they most likely will not have to develop the “back office” systems that store and preserve records. As a result, archivists will have to articulate business rules, not design, finance, build and run complex information management systems. Even so, that prospect still encompasses a substantive body of knowledge that is both technological and social, with an emphasis on the latter. It is especially critical to understand that, as the technology becomes practical and affordable, the unresolved questions about electronic records programs will often be on the human side of the equation, addressing issues such as education, organization, culture, project management and governance.

That point underscores the absolute importance of collaboration in all aspects of the agenda and its implementation. Collaboration encompasses more than the economic and organizational infrastructure of the consortium model. It assumes that the essential catalyst of collaboration is continuing communication and that everyone should share his or her knowledge and expertise. To facilitate that communication, the NHPRC should foster travel, meetings, discussion and evaluation as components of every project. If, as the consortium model portends, and there will be a few archives with far more technological capacity than most others, then the NHPRC should also extensively encourage the sharing of information and expertise in order to be sure that most archivists have the opportunity to gain from the progress made. The NHPRC could routinely make smaller grants to professional organizations (as, for example, the Midwest Archives Conference, etc.) or to state historic records advisory boards, which can reach smaller archives and lone arrangers on a regular basis and address their educational needs.

4. Themes

At its initial meeting, the project’s advisory board decided to structure the new agenda around four themes: new partners, education, technology as opportunity and a common core set of skills. Overall, these define general orientations that build on successful models to guide individual projects towards better productivity. In that context, the themes could well serve as criteria to evaluate proposals; they point to directions individual applications should explore.

As such, the themes reflect an emphasis on programs. So there is a mix here both of topics to research and of the criteria that will differentiate grants, or the factors that will make them more likely to succeed and more likely to contribute to the national

conversation on electronic records. As noted, there is perhaps some hubris in precisely identifying topics in an area as complex and dynamic as electronic recordkeeping. But it is certainly possible to generalize from experience and point to what will foster better, sustainable collaborations and guide grant projects that will contribute to the profession as a whole.

To help applicants understand and apply these themes, each is broken down into several standard categories. These are: a definition; examples of possible proposals; references to what will help meet these goals; and references to what will present challenges to meeting these goals.

While each theme is defined separately, it is clear that they are conceptually and programmatically linked, so that any proposals or applications they inspire will touch on elements they share. To an extent, this situation also characterized the 1991 agenda, where many questions overlapped, usually because the terminology, despite its variations, led back to the same basic connotations and concepts.¹² Here the overlap lies in that these themes connote factors and issues that are inevitably part of an electronic records program. A comprehensive plan has to address them all in some fashion.

In section describing a theme, the first items listed are priorities identified by the participants in the review and approval meeting held in St. Paul in December 2002.

5. New partners

5.1 Definition

This is a very broad and inclusive concept. “New partners” could potentially include a number of different groups, such as:

- New grant applicants: members of the NHPRC’s constituencies who have not applied for electronic records grants in the past. It is important to move beyond government archives and major universities to address college and university archivists, smaller shops and manuscript archivists.
- New collaborators: three of the usual suspects are lawyers, auditors and information technology (IT) administrators. As always, opportunities for partnerships will vary from one locale to another. Because technology increasingly demands a sophisticated infrastructure, IT expertise is necessary. One logical choice, especially in university settings and for smaller historical societies, is a partnership with libraries. Another, strongly recommended in discussions with ARMA members, is vendors, who are often best placed to implement records management functions in applications.¹³
- New users of electronic records: traditional records management and, consequently, many initial electronic records management efforts, stress the value of records as evidence. As a result, the primary partner of most such projects is

necessarily the records creator. Their perspective on the use value of records cannot be neglected, but other audiences of users should be explored for a whole variety of reasons.

- New records creators: the majority of research on electronic records has focused on those created within organizational contexts. In recent years, several authors have emphasized the importance of records created by individuals and loosely defined groups.¹⁴ This consideration is closely connected with new users, since many communities have a potential interest in the documentation of activities that take place outside formal institutions.
- New professional groups: there is a plethora of organizations with whom archivists should work collectively. ARMA, with its emphasis on records management, is the most obvious; but also consider, for example, AACRAO, AAM, AAMD, AASLH, ABA, ACLS, ACM, AHA, AIIM, ALA, AMIA, APDU, ARL, ARSC, ASIST, BFMA, CENSA, CIC-UAG, CNI, CompTIA, CPSR, FGS, IASSIST, IEEE, ISKO, NASCIO, NECCC, NGS, NIRMA, OAH, SLA, TAWPIOAH, and all the standard-setting bodies.¹⁵
- New funding sources: given the limited resources of the NHPRC and the continuing, high costs of technology, archivists have to look for additional sources of funds and to partnerships that can generate financial support.

At the first advisory board meeting of this project, this theme was defined as “new audiences,” but the participants in the meeting held in December 2002 felt that the emphasis should be on developing active collaborations, so the title was changed to “new partners.” There was a profound consensus that archivists needed to reach new partners and that the NHPRC could undertake certain specific tasks to foster partnerships.

These are outlined below, but two general points are worth noting here. First, virtually everyone dealing with a significant investment in digital resources and wanting to realize some return on that investment has eventually to be concerned with preservation and access. If archivists can offer useful information on those topics, they could become welcome collaborators on almost any project. Second, as noted above, this is an area where successfully seeking and exploiting the commonalities between professions might well depend on a broader definition of records.

5.2 Examples of topics and areas of research

Preservation: everyone investing in information technology has to think about preservation. Given the increasing scale of investment and the ubiquity, through e-government, e-commerce and the like, of attention to the potential of the Internet, it will be especially important for archivists to explore how to preserve web sites and web-based resources.

Standards: the emergence of enterprise architectures, interoperability and infrastructure-independent digital resources all point to the importance of standards. Two options to pursue are XML and metadata, which currently offer the best potential to support long-term access to and use of electronic records.¹⁶ One example would be learning how to manage and foster federations of records, where different collections are aggregated in common systems and technologies.

Standards are needed for the execution of archival processes that facilitate appraisal, accessioning, description, arrangement, preservation, and access. A range of processes is needed, from the minimally adequate process in each area, to the most sophisticated implementation that might be used by a very large repository.

Scalable and practical models: archivists have developed a variety of tools and techniques to manage electronic records more effectively. They need to evaluate these and present them as models that can be implemented at different institutions with different levels of resources and types of missions. For the archives that specialize in manuscript collections, working with individual donors and small organizations, guidelines and applications for preservation, description and access might be welcome.

New organizational roles: archivists working in collaborative relationships need to learn new tricks. These may demand new definitions of archival roles and organizational niches. Archivists have to understand the models and tools for distributed responsibilities. How will archivists manage partnerships? The more funds that are at stake, the harder it may be for an archives to play a significant part in decision making.

5.3 What will help?

Cost-benefit analyses: attracting partners, especially when those partners are expected or obliged to make significant investments to support archival needs, is contingent on demonstrating compelling need. Archivists need persuasive studies of costs and benefits that will justify expenditures on electronic records management.

Advocacy: building new partnerships will depend on defining what these new partners want and what archivists can offer them. To achieve that, archivists should study and meet with targeted audiences to identify the topics they want solved and what archivists can do to help. There has to be a quid for the quo: what products and expertise are archivists going to offer new partners? Such partnerships will be easier to build and sustain if there is some established track record of success and collaboration. This can include research on incentives and even marketing, whatever will help archivists make their case.

Broadening the definition of record: as noted, above, there is an ongoing debate among archivists over the definition of record and, consequently, the point of focus for archivists. This has contributed to the perception that the NHPRC leans towards the definition of electronic records as evidence of transactions.¹⁷ Continuing to encourage the development of a more flexible definition, and particularly one that fosters exploring the

common concerns pertinent to managing digital collections would expand the possibilities of partnerships available to archivists. The management of records, whether born digital or digitized, is a legitimate concern of the NHPRC.

Addressing contemporary social and political concerns: even in times of scarcity, resources are available for social and political priorities. Currently, such disparate issues as privacy, homeland security and genealogy are opportunities for archivists to connect their program to broader trends.

5.4 What will be a challenge?

A one-size-fits-all process: the current review and approval process for grant applications can be time consuming. It can take up to a year or more to move from conception to implementation of a project. Certain opportunities demand faster responses. Some partnerships are contingent on a much smaller window of opportunity.

Indirect costs: many universities insist upon charging indirect costs to grant projects. The NHPRC's general policy of not supporting such funding may serve to limit the participation of some archivists, particularly in academic settings.¹⁸

Competition: changing an agenda could come at someone's cost. If the NHPRC decides to re-allocate its limited funds, that could have an impact on some established constituency. Certain projects might not be funded or funded at a lower level.

Sustainability: grant funding can initiate a partnership, but it cannot sustain it. Long-term collaboration will require archivists to devote more time and resources of their regular budgets to electronic records.

6. Education

6.1 Definition

Education will always be a concern. While many recognize that technological obsolescence is an issue, they should also recognize it is not just hardware and software at stake – the knowledge of technology and its implementation has a shelf date too. What people learned yesterday may have no relevance to what they have to do tomorrow.

Moreover, what archivists learn has to be interpreted and communicated to their partners and constituents. Given all the costs of technology and the absolute need for collaboration, archivists have to teach their potential partners why and how to assume responsibility for archival goals and functions. In the consequent division of labor in these partnerships, providing education is an important, manageable and sustainable role for archivists to undertake.

As a result, education should be a component of all programs. In order to ensure that NHPRC-sponsored projects have the maximum impact on a diverse profession, each

project should consider how to disseminate what it learns in the form of multiple products appropriate for multiple audiences.

6.2 Examples of topics and areas of research

Understanding the electronic recordkeeping ecosystem: archivists should understand electronic information systems and systems design. The basic techniques are systems design, business analysis, project management and modeling. Archivists need to understand how to apply these using existing functional tools.

Appropriate practices: especially on the technological side, there will be needs for different levels of knowledge and, consequently, different types of educational tools. At a minimum, there will be a distinction between basic and more intensive levels of technological expertise, that is, between archivists serving primarily as the collectors of information and archivists involved in the support and implementation of consortia which are providing services.

Educating partners and constituents: the key goals are to explain to others why they should collaborate, to identify what is in it for them and to persuade them that archives are important. Archivists need compelling ways to explain archival and electronic records concepts across disciplines. They need to acquire the necessary skills to collaborate with partners and to influence and work with information technology staff.

Training the trainers: there is more to training archivists about electronic records than identifying subjects and content. Archivists need to know how to deliver, and how to receive, education and training about electronic records. A principal component is learning how to manage change, which can involve learning how to retrofit archives and re-train archivists.

Using different tools for education: there are all sorts of media and approaches to education, including workshops, web delivery, publications and conferences. Archivists need to understand the costs and benefits of different tools. Since different groups learn differently, archivists need to identify their audiences and the technologies appropriate to them.

6.3 What will help?

An electronic records institute: there are a number of models for providing a standard introduction to electronic records that archivists can emulate: Camp Pitt, the NHPRC's own documentary editing workshops, and the University of Virginia's Rare Books School, to name a few.¹⁹ One goal of an institute would be to inspire and improve leadership within the archival profession. To be effective, an institute would need a coherent and complete curriculum for the course of study. The NHPRC could support such proposals and provide scholarships to attend such an institute, but such a program should become self-sustaining as quickly as possible.

Integrating theory and practice: the NHPRC could provide incentives to bridge research projects to the actual implementation of programs and encourage the translation of research products into comprehensible and applicable terms. While the NHPRC could require an education module as part of every electronic records project, it is possible that the researchers are not the optimum choice to cross the gap to implementation. Some intermediary may be better placed to make the connections. Whatever the means, archivists can do a more consistently effective job of translating research projects into usable form and to make sure that what they learn in practice in turn refines research.

An intermediate form is the use of externships within NHPRC-funded projects to involve archival science students in the application and development of archival processes. As well, the NHPRC could encourage graduate student participation, where feasible, as a component of each project it funds.

Case studies: case studies and models for developing sustainable and practical educational programs will provide maps for others to follow. These efforts could expand upon existing instructional packets/modules on specific topics as well as build from future projects.

Learning from the past: the NHPRC can encourage efforts to review, categorize, synthesize and harmonize information from completed electronic records projects. It can support the development of repositories of available and authoritative information so that there is a reliable way to learn about the mistakes and successes of other electronic records projects. This might demand separating the institution/archivist/ego from the project through the use of external evaluators and more standardized procedures for outcome and performance measurement.

Sustained education programs: continuing education for those already in the profession will probably involve collaboration with professional groups. ARMA and SAA have established educational programs; NAGARA is developing one.²⁰ One option to take is to build on and refine already existing education curricula and modules so that they can be readily adapted and re-used.

6.4 What will be a challenge?

Making education a priority: this is not a new idea. The earlier agendas spoke eloquently of the need to use education to promote programs and the NHPRC has supported a special initiative to educate archivists about electronic records. Because of its importance, though, education has to be a continuing point of concern. Archivists must do more of it and do it better, especially by targeting specific audiences.

Costs: everything comes at a price, in money, staff and time. Many archives do not have budgets that support the costs of attending training. Collaborative educational products take a long time to create. Some altruistic individuals and organizations have to support the development of projects and products that are outside of their immediate missions.

7. Technology as opportunity

7.1 Definition

Archivists and their partners have often considered records management, and particularly electronic records management, to be a burden. Some electronic records programs have reinforced this attitude by imposing more costs than benefits on those directly involved. Future success depends on reframing the perception of new technologies both internally and externally.

First, it is important for archivists to recognize how new technologies can help them in their own work. Their mastery of new tools can not only contribute directly to the everyday operations of archival institutions, but also signal to their partners that archivists have unique skills and resources to offer.

Second, archivists must monitor (or ally themselves with others who do such monitoring) the external environment for technological innovations that archivists can exploit for their own purposes.²¹ If a new industry or research area emerges that tackles issues related to electronic records (e.g., data mining, data warehousing, knowledge management, grid computing, software reengineering, content management, web portals), archivists can draw from and contribute to this work, rather than attempting to invent solutions entirely on their own.

Finally, archivists must convey to their partners how the adoption of certain new recordkeeping technologies can directly serve their business needs. This is especially important as most of the approaches that archivists advocate (e.g., implementation of records management applications (RMAs), building recordkeeping considerations into the design of new systems, application of retention schedules, exporting records to less software-dependent formats) require their partners to assume some or all of the costs of the technologies.

7.2 Examples of topics and areas of research

Development of web-based records management and archival services: such work could maximize a return on the large investments in web-based resources, address a problem where technical resources are most available (rather than within each separate archival institution), and potentially integrate with other web-based services. Some areas to explore are: digital libraries (information discovery); integration of the Metadata Encoding and Transmission Standard (METS)²² and the Open Archival Information System's (OAIS) Archive Information Package (AIP)²³; representation of the semantic web²⁴; and grid technology.²⁵

Build on existing efforts in business to develop ontologies, schemas and specifications: companies in a variety of industries have developed standards to facilitate their work across the enterprise and between enterprises. Rather than starting with a blank slate,

archivists can use this work as a foundation for advancing their own efforts to develop appropriate, sustainable systems for the long-term management of electronic records.²⁶

Cost analyses for preservation: in planning for digital preservation, archivists could benefit from a tool that lays out the cost factors associated with various components of media migration and data transformation and then allows them to apply these costs factors in their own organizational contexts. Such a tool would need to be modular and revised over time. The OAIS model could be used for gap analysis.

Digital information as an asset: access and use are explicitly addressed in the current agenda, but the level of investment in information technology and the varied applications now being developed to exploit it, make this concept all the more important to stress.²⁷ Audience research would play an important role in determining value. To repurpose data, data structures, and collections, the technological needs would include building an ontology²⁸ into digital entities to describe internal relationships, defining operations that can be applied to digital entity ontologies and characterizing transformative migrations as operations on digital entity ontologies.

Emerging technologies and issues: technology is a moving target. Periodic studies of emerging possibilities can facilitate strategic planning within archival intuitions and the NHPRC. Where are the computer industry and electronic recordkeeping practices moving? By identifying current trends, archivists can better anticipate the electronic records issues that they will need to confront in the near future. Some current examples of emerging technologies might be XML²⁹, resource description framework (RDF)³⁰, grid computing, a standard for an archival version of PDF (PDF-A)³¹, wireless networking, and a variety of devices made possible through the continuously decreasing costs of processing power and storage capacity. Currently emerging issues might include online collaborative work environments, privacy, surveillance, e-commerce, security and electronic discovery.

7.3 What will help?

Bring together experts to define requirements through workshops and working meetings: in order to guide investment in research and development, it is important for the NHPRC to have a clear understanding of the requirements of its constituencies. These workshops and working meetings could serve as meta-level initiatives, informing the priorities for funding future projects. They could also help to form professional partnerships and collaborative relationships.

Identify existing funding sources and projects upon which to build: as discussed in Section 4, the NHPRC could benefit from a continuing collaboration with other players supporting information technology research and development. If the NHPRC can foster work on promising technologies, that would be an opportunity to increase considerably the return on investment.

Monitoring the information technology environment: archivists are not likely on their own to keep up with all the innovations and developments in information technology, nor are they likely to understand all their potential ramifications. Monitoring can help the NHPRC manage some of the risks associated with leading-edge research and development. The NHPRC can learn from the technological leaps of others who have an incentive to take such risks, in order to invest its own limited resources most prudently.

Demonstration of repeatable successes, or re-use of technology: projects could include a second phase, in which the tools developed in the first phase are applied elsewhere. Some projects could specifically target the problem of technology transfer. The NHPRC could also encourage the demonstration of widely applicable solutions through presentations at conferences.

7.4 What will be a challenge?

Business case for electronic recordkeeping: business cases would ideally be in modular form, so different organizations could repackage them in different ways. Cost models are currently lacking, not only for the digital preservation concerns described above³², but also for responsible management of records in live systems.³³ Benefits of electronic recordkeeping could also use much more detailed analysis, emphasizing such things as the repurposing of intellectual capital.

Bridge to the communities developing the technology: these social ties are difficult to form and sustain. Archivists must monitor the environment to identify the most appropriate allies and then convince them of the value that collaboration offers. Simply attending conferences would be a step in the right direction.

Development of literacy in information technology among archivists: this is thoroughly addressed in the theme on education. Without a basic level of understanding and vocabulary, it is unlikely that many archivists can serve as viable partners with those engaged in technological development. The ultimate expression of this would be developing the curriculum for and then actually training personnel with the expertise of “archival engineers.”

Intellectual property: the legal aspects of this are still unfolding. Archivists collaborating with the myriad of groups interested in the repurposing of data must consider the liabilities attached to embedded objects, digital rights management in preservation environments, and policy enforcement.

Identification of demand: what exactly do archivists’ partners and constituents want to support? Costs and benefits were a critical concern in the 1991 and 1996 research agendas. Few studies subsequently addressed these in hard terms. It is possible that those archival institutions that do not have electronic records programs identified many perceived costs, but few perceived benefits to developing such a program. By better understanding the business cases, the needs of these audiences and the technological

opportunities at hand, archivists may be able to reverse this perception and facilitate the development of more viable electronic records programs.

8. Common core of knowledge, skills and tools

8.1 Definition

The past decade has witnessed a revolution in the application of information technology to everyday life. Virtually every organization is on the Web, is using technology to do their work, is creating and using digital objects (including electronic records). As the use of technology continues to grow and as information and technology architectures continue to standardize, everyone can benefit from a common core of knowledge, skills and tools to meet the basic challenges of their work and to realize fully their investments.

In that framework, and at the most basic level, all digital objects are the same – information stored on a medium, in some particular format, requiring hardware and software to be intelligible. The management of digital objects demands a common core of functions such as description, location, evaluation, access and preservation. Archivists can best partner with and learn from other communities by exploring this shared context.³⁴

8.2 Examples of topics and areas of research

Standards: there are specific areas where more work has to be done to understand and implement standards. These include: metadata, file formats, classification schemes, XML, naming conventions, media, etc. But archivists also have to understand which standards are appropriate for any given environment. With respect to organizations, both internal and external standards need to be considered and established.

Tools for analysis: every information technology project begins with certain analytical steps that frame the effort and the investment. These include developing business cases, understanding business requirements and mission for any given environment, usage analysis, cost-benefit analysis, risk analysis, and business process analysis.

Archives 101: to find common ground, archivists first have to map out the fundamental knowledge and skills for electronic records management. These should include defining record and electronic record as appropriate within their own programs, locating records in a system, making electronic records an accessible and comfortable topic for non-specialists, understanding the electronic records lifecycle, understanding legal and records management requirements, and knowing how to appraise records.

Systems: virtually everything that archivists know and want to achieve in a technological implementation has to be translated into some representation in a data model and the documentation of systems. All that knowledge has to be applied to the information

systems lifecycle and the information architecture. Overall, archivists need to learn IT's language and become comfortable in the IT environment.

Investing in the Internet: an extraordinary number of technology projects have some web base or aspect. Archivists can contribute to many of these efforts if they have the tools and expertise to preserve and provide access to web sites. They will need to understand subjects like web applications, web architecture, security, digital signature and encryption technologies, and XML.

Understanding the options: what are the differences and where are the overlaps among records management, content management, and document management systems and technologies? Some of the aspects to consider are return on investment, legal mandates, user needs and interoperability with other applications.

Access and preservation: access and preservation are the two basic functions of any investment in information technology, as well as the two keys to any long-term return on investment. Access encompasses metadata and description, with examples such as finding aids, standards and the documentation of systems. Preservation demands more information on media, media longevity, and format dependency on software and hardware.

8.3 What will help?

Documented models: these will include best practices and case studies for all pertinent topics. White papers targeted to the various audiences with whom archivists work would be valuable. These would document and demonstrate what archivists can offer.

A common language: the various professions do not all speak the same language. While a single, common and comprehensive vocabulary will never be a realistic possibility, archivists can learn how to speak to other professions, with special emphasis on learning how to speak to IT professionals. Archivists might then also serve in the role of translator, the intermediary between different groups. To achieve this, archivists have also to understand the cultural needs of both their organizations and their partners.

Collaborations: archivists need to work with the various professional organizations, such as AIIM, ARMA, etc., as well as other groups involved in the creation of standards, such as ANSI and ISO.³⁵ The goal is to provide the support for the continuing participation of archivists in development of standards and models.

8.4 What will be a challenge?

Keeping up: information technology is always changing and the amount of information to learn is overwhelming. There have to be some priorities. It is important to know what has been done and what has worked; it is also important to know how to keep theory and practice mutually informed.

A seat at the table: archivists have complained about being excluded from discussions and projects. But these affairs are potluck suppers: more often, the problem is that archivists need to bring along something useful. Archivists have to offer some benefit, not just increased costs, to a technology project or to attract the support of management. To be welcomed as a partner and invited to the table, archivists have to make a compelling case for their presence.

Costs: everything, of course, has a price, but joining professional societies and industry-related organizations is an additional expense. There are barriers for individuals and institutions – not all archives can provide the human resources and funds to play roles in standard-setting bodies.

Digital and digitized objects: there are differences which need to be explored in the management of born-digital and digitized objects. Archivists need to know how these are created, presented, preserved, described and federated. Hybrids of paper and electronic recordkeeping systems have similarly to be explored.

Rights: intellectual property rights issues are a complication. Licensing continues to be a challenge. The frontiers of the use and re-use of information are still being explored intellectually and in court.

9. Conclusion

Overall, this report has been designed to give voice to, as well as to address, multiple audiences: all the individuals, communities and organizations who contributed to its development and who must participate in the development of sustainable electronic records programs. The direct and immediate audience is the NHPRC, which has the opportunity to reflect on what response it will make. On the assumption that the report accurately reflects the considerable expertise and interests of the people who took part in the project, the report also seeks to inform archivists of the steps they can take to manage electronic records effectively. Further, it advises archivists on what they can do to help engage the collaboration of all those whom they need to support their programs.

These additional efforts are critically important. While the NHPRC has done much and has notably supported innovative and impressive work, much more remains for archivists to do. Building on its successes, the NHPRC can support that work and facilitate the successful implementation of electronic records programs by archivists in two ways. First, through targeted grants and focused initiatives, it can help prepare more archivists to make the leap from paper to electronic recordkeeping. That leap remains somewhat daunting; it is clear that many archivists are not positioned to work effectively with information technology. Yet models and tools, many developed with the NHPRC's support, are already available from a variety of sources, perhaps not in a perfect state, but useful enough for adaptation. To encourage the use of the resources at hand, this report recommends that the NHPRC act as a catalyst and support the immediate development and enhancement of more electronic records programs through targeted initiatives to create a model toolkit and knowledge base for archivists.

NHPRC Electronic Records Agenda

Second, by emphasizing these four themes - new partners, education, technology as opportunity, and a common core of knowledge, skills and tools, - the NHPRC can help ensure that what archivists explore on their own provides a return to the profession and its constituents as a whole. Over the longer term, the critical role for the NHPRC is to foster the continuing development of social and intellectual capital. As technology becomes practical and affordable, the unresolved questions about electronic records programs will be on the human side of the equation, addressing issues such as education, organization, culture, project management and governance.

With these two components, the new agenda would orient the NHPRC to invest in building assets that will help all its constituencies to use information technology more effectively. It would especially help the NHPRC to take an active role as a catalyst in the construction of an infrastructure for the continuing evolution of the archival profession.

Notes

¹ "NHPRC: Research Issues in Electronic Records," http://www.archives.gov/grants/electronic_records/research_issues_summary.html#exec

² NHPRC, "Strategic Plan," 19 June 1997, http://www.archives.gov/grants/about_nhprc/strategic_plan.html. The mission statement is quoted in this document.

³ The \$34,595 grant was awarded in June 1979 (NHPRC Project Grant 80-008).

⁴ One indication of this interest is the considerable media coverage of issues ranging from the legal discovery of e-mail to concerns about long-term digital preservation. An excellent source for such coverage is "Records/Archives in the News (RAIN)" compiled by Peter Kurilecz, particularly the section called "Technology." RAIN is distributed through the following two mailing lists: ARCHIVES (<http://listserv.muohio.edu/archives/archives.html>) and RECMGMT-L (<http://www.lists.ufl.edu/archives/recmgmt-l.html>).

⁵ Members of the archival profession have been using and writing about computers for several decades. According to Anne J. Gilliland-Swetland, "Archivy and the Computer: A Citation Analysis of North American Archival Periodical Literature," *Archival Issues* 17, no. 2 (1992): 95-112, "the first article relating to computers published in archival periodical literature" was Murray G. Lawson, "The Machine Age in Historical Research," *American Archivist* 11 (1948): 141-49. By the late 1970s and early 1980s, the archival literature included many reports on the actual and potential use of computers to support the internal operations of archives. See Thomas H. Hickerson, et al., *SPINDEX II at Cornell University and a Review of Archival Automation in the United States* (Ithaca, NY: Dept. of Manuscripts and University Archives, Cornell University Libraries, 1976); Thomas H. Hickerson, *Archives and Manuscripts: An Introduction to Automated Access, Basic Manual Series* (Chicago: Society of American Archivists, 1981); A. Arad and M.E. Olsen, "An Introduction to Archival Automation" (Koblenz, Germany: International Council on Archives Committee on Automation, 1981); Lawrence J. McCrank, ed., *Automating the Archives: Issues and Problems in Computer Applications* (White Plains, NY: Knowledge Industry Publications, 1981). Since the 1991 NHPRC agenda meeting, the archival profession has made many advances in the development and adoption of new information technologies, particularly in the area of standards for description.

⁶ This is a general impression shared by many of the participants in this study. The project staff was not aware of any studies that have attempted to systematically identify the current state of electronic records activity within the profession as a whole. The NHPRC may wish to support such a baseline research effort, in order to inform future strategies and programs. For related studies, see Margaret Hedstrom and Sheon Montgomery, "Digital Preservation Needs and Requirements in RLG Member Institutions" (Research Libraries Group, 1998), <http://www.rlg.org/preserv/digpres.html>; Catherine Bailey, "Canadian Archivists Speak Out: Results of the Surveys Conducted by the ACA Select Committee on Electronic Records." *Archivaria* 36 (1993): 136-65.

⁷ Peter Lyman and Hal R. Varian, "How Much Information?" 2000, <http://www.sims.berkeley.edu/research/projects/how-much-info/>; Gretel Johnston, "You've Got Mail: 60 Billion a Day by 2006," *InfoWorld*, 26 September 2002; Michael K. Bergman, "The Deep Web: Surfacing Hidden Value," *Journal of Electronic Publishing* 7, no. 1 (2001), <http://www.press.umich.edu/jep/07-01/bergman.html>; *Web Characterization*, Online Computer Library Center, <http://wcp.oclc.org/>; Inktomi Webmap, <http://web.archive.org/web/20020124184249/http://www.inktomi.com/webmap>. Consulting companies such as IDC, Jupiter Research (previously Jupiter Communications) and Gartner Group have also conducted studies of increasing e-mail volume.

⁸ John Seely Brown and Paul Duguid, *The Social Life of Information* (Boston: Harvard Business School Press, 2000).

⁹ For more information, see <http://www.oclc.org/digitalpreservation/about/archive/>.

¹⁰ For DSpace, see <http://www.dspace.org>; for FEDORA, <http://www.fedora.org>; and for the SRB, <http://www.npaci.edu/DICE/SRB>.

¹¹ Information on the Colorado Digitization Program is available online at <http://www.cdpheritage.org>. For the California Digital Library and the Online Archive of California, see <http://www.cdlib.org>.

¹² This is most evident in the ten research questions listed in the section entitled: "Research Issues in Electronic Records," at http://www.archives.gov/grants/electronic_records/research_issues_report.html#research.

¹³ ARMA International is "the association for information management professionals." Its focus is on records management. <http://www.arma.org/index.cfm>

¹⁴ Peter Botticelli, "Records Appraisal in Network Organizations," *Archivaria* 49 (2000): 161-91; Adrian Cunningham, "The Archival Management of Personal Records in Electronic Form: Some Suggestions," *Archives and Manuscripts* 22, no. 1 (1994): 94-105 and "Waiting for the Ghost Train: Strategies for Managing Personal Electronic Records Before it is Too Late," *Archival Issues* 24, no. 1 (1999): 55-64; Mark A. Greene, "The Power of Meaning: The Archival Mission in the Postmodern Age," *American Archivist* 65, no. 1 (2002): 42-55; Margaret Hedstrom and David A. Wallace, "Expanding the Options: Strategies for Preserving Electronic Records of Collaborative Processes," Paper presented at the Conference for Research on Electronic Work (CREW) Lab Seminar, Ann Arbor, MI, 14 March 2002; Charles K. Humphrey, "Research for Building a Better Data Community," *IASSIST Quarterly* 25, no. 1 (2001): 21-24; Tom Hyry and Rachel Onuf, "The Personality of Electronic Records: The Impact of New Information Technology on Personal Papers," *Archival Issues* 22, no. 1 (1997): 37-44; Susan S. Lukesh, "E-Mail and Potential Loss to Future Archives and Scholarship or the Dog That Didn't Bark," *First Monday* 4, no. 9 (1999), http://www.firstmonday.org/issues/issue4_9/lukesh/index.html (In her recommendations for addressing the problem of preserving personal electronic correspondence, Lukesh specifically calls for the NHPRC to "continue and increase funding for research in the preservation of electronic records, including e-mail correspondence."); Sue McKemmish, "Evidence of Me," *Archives and Manuscripts* 24, no. 1 (1996); Lucie Paquet, "Appraisal, Acquisition and Control of Personal Electronic Records: From Myth to Reality," *Archives and Manuscripts* 28, no. 2 (2000): 71-91; Weston Thompson and Caryn Stein, "Using Electronic Manuscripts to Document Student Life," *Open Entry* 23, no. 1 (1995): 4-7.

¹⁵ AACRAO (American Association of Collegiate Registrars and Admissions Officers), AAM (American Association of Museums), AAMD (Association of Art Museum Directors), AASLH (American Association for State and Local History), ABA (American Bar Association), ACLS (American Council of Learned Societies), ACM (Association for Computing Machinery), AHA (American Historical Association), AIIM International (formerly the Association for Image and Information Management), ALA (American Library Association), AMIA (Association of Moving Image Archivists), APDU (Association of Public Data Users), ARL (Association of Research Libraries), ARSC (Association for Recorded Sound Collections), ASIST (American Society for Information Science and Technology), BFMA (Business Forms Management Association), CENSA (Collaborative Electronic Notebook Systems Association), CIC-UAG (Committee on Institutional Cooperation - University Archivists Group), CNI (Coalition for Networked Information), CompTIA (Computing Technology Industry Association), CPSR (Computer Professionals for Social Responsibility), FGS (Federation of Genealogical Societies), IASSIST (International Association for Social Science Information Service and Technology), IEEE (Institute of Electrical and Electronics Engineers), ISKO (International Society for Knowledge Organization), NASCIO (National Association of State Chief Information Officers), NECCC (National Electronic Commerce Coordinating Committee), NGS (National Genealogical Society), NIRMA (Nuclear Information and Records Management Association), OAH (Organization of American Historians), SLA (Special Library Association), TAWPI (The Association for Work Process Improvement). Among standards-setting bodies, ANSI (American National Standards Institute), IETF (Internet Engineering Task Force), ISO (International Organization for Standardization), NISO (National Information Standards Organization), and W3C (World Wide Web Consortium) are the most widely known.

¹⁶ Metadata is descriptive information (e.g., creator, date created, keywords, format) that facilitates the description, location, evaluation, and management of digital objects. XML is an international standard which allows the creation of customized syntaxes for describing and structuring information in an infrastructure-independent format. For a discussion of metadata in library-like environments, see Gail Hodge, *Metadata Made Simpler* (Bethesda, MD: NISO Press, 2001), available online at http://www.niso.org/news/Metadata_simpler.pdf. For more information about the XML, see <http://www.w3.org/XML/>

¹⁷ In its published suggestions for electronic records grant applications, the NHPRC states, “Electronic Records’ means records originally created in electronic form. NHPRC uses the phrase to mean information originally created in electronic form during the course of business or conduct which documents the functions and activities institutions and individuals.”

http://www.archives.gov/grants/electronic_records/suggestions.html

¹⁸ “Indirect costs are costs incurred for common or joint objectives and therefore not attributable to a specific project or activity. Typically, indirect costs include such items as overhead for facilities maintenance and accounting services. The Commission prefers not to provide grant funds for indirect costs.” NHPRC, *Grant Guidelines: How to Apply for NHPRC Grants, How to Administer NHPRC Grants* (Washington, D.C.: NHPRC, January 2000), p. 7.

¹⁹ For a discussion of the Camp Pitt institutes, see David J. Olson, “‘Camp Pitt’ and the Continuing Education of Government Archivists: 1989-1996,” *American Archivist* 60, no. 2 (Spring 1997): 202-214. The Institute for the Editing of Historical Documents, now in its 32nd year, is jointly sponsored by the NHPRC and the University of Wisconsin (http://www.archives.gov/grants/education_programs/education_programs.html#ins). The Rare Book School, hosted by the University of Virginia, is “an independent, non-profit educational institute supporting the study of the history of books and printing and related subjects.” <http://www.virginia.edu/oldbooks/>

²⁰ The ARMA International Learning Center (<http://www.arma.org/learning/welcome.cfm>) centers around online and home-study courses, while the SAA Continuing Professional Education Program (<http://www.archivists.org/prof-education/index.asp>) focuses on workshops and seminars held around the country.

²¹ “Archivists should strive to stay in the technological mainstream of information handling by monitoring developments in information technology innovation.” Charles M. Dollar, *Archival Theory and Information Technologies: The Impact of Information Technologies on Archival Principles and Methods* (Macerata, Italy: Università degli studi di Macerata, 1992), 72.

²² Metadata Encoding and Transmission Standard (METS), <http://www.loc.gov/standards/mets/>

²³ User Technology Associates, “Archival Information Package (AIP) Design Study,” (Washington, D.C.: Library of Congress, 2001), http://lcweb.loc.gov/rr/mopic/avprot/AIP-Study_v19.pdf. For general information on the OAIS, see RLG, “Open Archival Information System (OAIS) Resources”, <http://www.rlg.org/longterm/oais.html>.

²⁴ Tim Berners-Lee, et al., “The Semantic Web,” *Scientific American* 284, no. 5 (2001): 35-43; Semantic Web, World Wide Web Consortium, <http://www.w3.org/2001/sw/>

²⁵ IEEE Mass Storage Systems Technical Committee, <http://www.msstc.org/>; International Symposium on High Performance Distributed Computing, <http://www.hpdc.org/>

²⁶ Several authors in the archival literature have argued for the importance of exploiting metadata from active recordkeeping systems. See the comments of Thomas Mills in Carolyn L. Geda, et al., *Archivists and Machine-Readable Records* (Chicago: Society of American Archivists, 1980); Charles M. Dollar, *Archival Theory and Information Technologies* and “Archivists and Records Managers in the Information Age,” *Archivaria* 36 (1993): 37-52; David A. Wallace, “Managing the Present: Metadata as Archival Description,” *Archivaria* 39 (1995): 22-32 and “Metadata and the Archival Management of Electronic Records: A Review,” *Archivaria* 36 (1993): 87-110; Bearman, “Record-Keeping Systems”; Margaret Hedstrom, “Descriptive Practices for Electronic Records: Deciding What Is Essential and Imagining What Is Possible,” *Archivaria* 36 (1993): 53-63.

²⁷ For one example, see <http://www.lib.uconn.edu/DoddCenter/ASC/pages/records/StrategicPlan.htm> (NHPRC Project Grant 2000-55).

²⁸ “An ontology defines the terms used to describe and represent an area of knowledge. Ontologies are used by people, databases, and applications that need to share domain information (a domain is just a specific subject area or area of knowledge, like medicine, tool manufacturing, real estate, automobile repair, financial management, etc.). Ontologies include computer-usable definitions of basic concepts in the domain and the relationships among them (note that here and throughout this document, definition is not used in the technical sense understood by logicians). They encode knowledge in a domain and also knowledge that spans domains. In this way, they make that knowledge reusable.” Jeff Heflin, ed., “Web

Ontology Language (OWL) Use Cases and Requirements," World Wide Web Consortium, Working Draft, 3 February 2003, <http://www.w3.org/TR/webont-req/>

²⁹ eXtensible Markup Language (XML), <http://www.w3.org/XML/>

³⁰ Resource Description Framework (RDF), <http://www.w3.org/RDF/>

³¹ PDF-Archive, AIIM International, <http://www.aiim.org/standards.asp?ID=25013>

³² Many institutions find it difficult to factor digital preservation into their economic decisions, since there currently no well-defined model for identifying costs. See Simon Tanner and Marilyn Deegan, "Exploring Charging Models for Digital Cultural Heritage," Higher Education Digitisation Service, 2002, http://heds.herts.ac.uk/mellon/charging_models.html; Michael Day and Maggie Jones, "A Report on the Cedars Final Workshop," 2002, <http://www.leeds.ac.uk/cedars/pubconf/umist/finalWorkshopRep.html>. Some recent work has begun to address these issues. See Tony Hendley, "Comparison of Methods and Costs of Digital Preservation," London: Joint Information Systems Committee, The British Library, 1998, <http://www.ukoln.ac.uk/services/elib/papers/tavistock/hendley/hendley.html>; Claes Gränström, "Reformatting: Preservation of New Media and Data Migration," *Comma. International Journal on Archives* 2 (1998): 77-86; John C. Bennett, "A Framework of Data Types and Formats, and Issues Affecting the Long Term Preservation of Digital Material," British Library Research and Innovation Centre, 23 June 1999, <http://www.ukoln.ac.uk/services/papers/bl/jisc-npo50/bennet.html>; Kelly Russell and Ellis Weinberger, "Cost Elements of Digital Preservation," 2000, <http://www.leeds.ac.uk/cedars/documents/CIW01r.html>; Anne R. Kenney, et al., "Preservation Risk Management for Web Resources: Virtual Remote Control in Cornell's Project Prism," *D-Lib Magazine* 8, no. 1 (2002), <http://www.dlib.org/dlib/january02/kenney/01kenney.html>; Shelby Sanett, "Toward Developing a Framework of Cost Elements for Preserving Authentic Electronic Records into Perpetuity," *College and Research Libraries* 63, no. 5 (2002): 388-404; CAMILEON, <http://www.si.umich.edu/CAMILEON/>.

³³ Several guidance documents and articles on electronic records present eloquent arguments for why electronic recordkeeping is important and some even fairly detailed lists of considerations. But sources are generally not presented in a way that can serve directly as a business case. There are a number of promising places to look outside of the archival literature for guidance in developing such models. See William Saffady, *Costs Analysis Concepts and Methods for Records Management Projects* (Prairie Village, KS: ARMA International, 1998); David O. Stephens and Roderick C. Wallace, *Electronic Records Retention: New Strategies for Data Life Cycle Management* (Prairie Village, KS: ARMA International, 2003); John S. Chandler, "A Multiple Criteria Approach for Evaluating Information Systems," *MIS Quarterly* 6, no. 1 (1982): 61-74; Martin, Kingsley, "Show Me the Money: Measuring the Return on Knowledge Management," *Law Library Resource Xchange: LLRX.com*, 15 October 2002, <http://www.llrx.com/features/kmroi.htm>; Richard T. Dué, "The Value of Information," *Information Strategy* 13 (1997): 36-41; "The Value of Information," *Information Systems Management* 13 (1996): 68-72; *Electronic Journal of Information Systems Evaluation*, <http://www.iteva.rug.nl/ejise/>; "Determining Economic Feasibility: Four Cost/Benefit Analysis Methods," *Journal of Information Systems Management* 4 (1989): 14-19; Tridas Mukhopadhyay, et al., "Business Value of Information Technology: A Study of Electronic Data Interchange," *MIS Quarterly* 19, no. 2 (1995): 137-56; George P. Schell, "Establishing the Value of Information Systems," *Interfaces* 16, no. 3 (1986): 82-89; Gordon V. Smith and Russell L. Parr, *Valuation of Intellectual Property and Intangible Assets*, 3rd ed (New York: J. Wiley & Sons, 2000); Matthias Schumann, "Methods of Quantifying the Value of Office Automation," *Journal of Information Systems Management* 6, no. 4 (1989): 20-29.

³⁴ For a comprehensive analysis of an analogous concept, see Mary Feeney (ed.), *Digital Culture: Maximizing the Nation's Investment* (London, 1999).

³⁵ Many organizations like the ISO and the W3C create standards through a work group process involving dues-paying members, although often there is a period of public comment. Unlike the W3C which accepts individual members, the ISO limits membership to one organization per country, ANSI/NISO in the case of the United States. Both AIIM and ARMA are members of ANSI.