managing electronic records

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Footnotes

1 Dr Doron Swade, formerly Assistant Director and Head of Collections at the National Museum of Science and Industry, London at 'Practical Experiences in Digital Preservation', The National Archives, Kew, 2–4 April 2003; www.nationalarchives.gov.uk/preservation/news/conference/media/06swade.wma.

2 Informal discussion with Dr David Thomas and colleagues, The National Archives, UK, 2003.

3 This chapter was prepared using Microsoft Word 97 - the word Google is underlined in red as I type - it does not exist in the Word dictionary.

Chapter 5

Research in electronic records management

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Introduction

By extending the range of usable knowledge and by applying analysis and theory to real problems, research also extends our ability to illuminate further problems and to generate solutions to them.

Information technology has a widening range of applications in organizations and in society. This has presented records managers with challenges and opportunities. To meet the challenges and to exploit the opportunities, research projects have played an increasingly important part in developing the discipline in the electronic and digital environment. As Hedstrom (2004) pointed out, unprecedented changes caused by new information technologies have changed the application of archival theory, and there are many new areas of professional practice that still lack a useful theoretical basis or standards of practice. Research into a wide range of issues must precede the development of a useful knowledge base for contemporary archival problems. Research is a necessary bridge between theory and practice, and it can supply consistently credible and useful tools for records managers (Pemberton, 1992, 46). What progress has been made in research and by research in electronic records management? What can we learn from current research projects? What are the future directions for research in electronic records management?

A review of the literature shows a great number of recent articles on electronic records management, but among these only a few deal with the

processes of developing research projects and how they can contribute to the international records community. Nothing is known about the relative successes of research projects and the implications of these for future research. This chapter tries to fill in gaps in the literature with a systematic examination of four main issues:

- significant roles and benefits of research in professional development
- stages of development of research processes and their research focuses
- general directions of research in electronic records management
- keys to the success of the internationally known InterPARES projects.

Significant roles and benefits of research in professional development

Research in the field of electronic records management has made significant contributions, bringing six notable benefits to the international records and archives community.

1 Research has provided a variety of methods to increase our knowledge of archival theory and our concepts of records, and broader ways of thinking (but with common understanding) about electronic records as evidence, information and memory. Typical cases are deductive methods in the diplomatic field in the UBC project (Duranti, 1995, 1998; MacNeil, 2000) as a basis for establishing the integrity and authenticity of records, and inductive methods for functional requirements in recordkeeping in the Pittsburgh project for the study of variables in legal, administrative and other organizational operations (Barata, 1997; Bearman, 2003; Duff, 1997, 1998; Cox, 1997, 2000).

2 Research has been used in all stages of the decision-making process to define problems and to identify opportunities, to diagnose causal factors and to clarify alternatives, to evaluate current programs and to forecast future conditions. A variety of management models have been developed for recordkeeping and archiving in a digital context. Two representative management models are the records continuum model at Monash University and the unified model by Hofman, deriving benefit from his partnerships in many international research projects.

The records continuum model provides a concept of service to users throughout the lifetime of records. Its standards-compliant metadata model, applied once in a specific environment, can then be used many times to meet a range of business purposes (Upward, 1996, 1997, 2000; Evans, McKemmish and Bhoday, 2004; McKemmish, 2001).

The unified model of records management offers a good basis for understanding the interrelationships between businesses, records and archives and sets a framework for standardization, interoperability and co-ordination of records management, not limited by time or space (Hofman, 2004).

3 Research has played a major role in developing industry-accepted standards for electronic document management systems (EDMS), electronic records management systems (ERMS) or electronic record-keeping systems (ERKMS), and electronic information management systems (EIS), for example, in the USA, DOD5015.2-STD at www.dtic.mil/; in the UK, Functional Requirements for Electronic Records Management Systems at www.nationalarchives.gov.uk/recordsmanagement/; in Canada, Request for Proposal: Records, Document, Information Management System: integrated document management system for the government of Canada at www.pwgsc.gc.ca/rdims/ and in Australia, Request for Tenders for VERS Compliant Recordkeeping System Part B: Specification for VERS Compliant Recordkeeping System at http://www.prov.vic.gov.au/vers/compliance/, the European Model Requirements for the Management of Electronic Records at www.cornwell.co.uk/moreq.html and Recommendations for the Effective Management of Government Information on the Internet and Other Electronic Records at http://whitepapers.zdnet.co.uk/0,39025945,60144483p-39000960q,00.htm.

4 Research has had a worldwide impact on establishing international standards for records management. The examples are ISO 15489-1:2001, *Records Management Standard*; ISO 23081:2003, *The Records Management Processes Metadata for Records* (draft); and ISO14721:2002, *The Open Archival Information System (OAIS) Reference Model.*

5 Research has promoted international guidelines for managing electronic records, e.g. *Guide for Managing Electronic Records from an Archival Perspective* (ICA, 1997) and *Electronic Records: workbook for archivists* (ICA, 2004). The latter draws on professional experience and contributions from international projects in the field of archives and records

management, in particular the work of ISO/TC46/SC11 and the InterPARES project (ICA, 2004).

6 Research has been an integral part of the exchanges of experience and knowledge about records and archives management; it has thus fostered education, training and further research. Research results can be seen at professional conferences, in professional journals and books, and in education and training manuals and programs (An, 2000; Gilliland-Swetland, 2004).

The above analysis indicates the role of research in electronic records management in terms of the development of resources and of contribution to the research process.

Stages of research development and its key features

An analysis of 71 research projects on electronic records awarded by the NHPRC from 1979 to 2002 at http://www.archives.gov/nhprc/projects/electronic-records/projects.html shows that since the first project, dealing with the management of machine-readable records, was awarded in 1979, numbers of research projects in electronic records management have increased, particularly after 1990 (six projects in the 1980s, 39 projects in the 1990s, 24 projects from 2000 to 2003). The first national research on electronic records was carried out in 1991 (Hedstrom, 1991) by the US National Historical Publications and Records Commission (NHPRC). This work was reviewed and revised in 1996 and in 2003 (www.mnhs.org/preserve/records/eragenda.html). Much other research has been done under the guidance of the NHPRC in North America. Its projects include those of Pittsburgh and Indiana Universities, the State Archives of Michigan and the San Diego electronic records project, the University of British Columbia and International Research on Permanent Authentic Records in Electronic Systems (InterPARES).

A study of the subjects of the above projects and of research papers published in professional journals shows the hot topics of research in electronic records management at different periods of time, which reflect the development of research in electronic records management. The development of these research projects falls into three stages according to their research focus.

1 The 1980s: research projects dealt with developing data-processing archives and records management programs for managing machine-readable records in computer-assisted management systems, such as the University of Wisconsin-Madison's project (1980), developing procedures to schedule, accession and retrieve information from machine-readable records of Wisconsin state agencies (www.archives.gov/nhprc/projects/electronic-records/projects.html.) The research focuses were managing electronic records as electronic data by means of computers.

2 The 1990s: research projects dealt with developing functional requirements for recordkeeping in electronic information systems and in office automation systems (Hedstrom, 1997; Marsden, 1997; Bantin, 1997). The research focuses were managing electronic records as electronic evidence facing the challenges of information technology (State Archives Bureau of China, 1999).

3 The 2000s: research projects concerned the development and promotion of integrated best-practice models, policies, programs, education and training for recordkeeping and archiving in web-based, interactive, dynamic information systems for e-government, e-business and e-commerce (An and Wang, 2004b; Gilliland-Swetland, 2004). There were also projects to develop interoperable recordkeeping metadata standards for complex integrated information systems (Evans, McKemmish and Bhoday, 2004; workshop at www.erpanet.org/, dissemination at www.interpares.org/ip2/ip2_dissemination.cfm?proj=ip2/). The research focuses are managing electronic records as digital information resources and assets with considerations of a variety of contextual factors (including cultural, political, economic, social, technological, legal, religious) at the given time and at the given place (An, 2004a; Wang, 2003).

General directions of the research agenda in electronic records management

The above development of research processes reflects the roles of research in the professional discipline in meeting the challenges of the wired global world. A study of the 71 research projects cited above (www.archives.gov/nhprc/projects/electronic-records/projects.html), the Electronic Records Agenda Project Final Report published by the NHPRC at www.mnhs.org/preserve/records/eragenda.html in 2003 and subjects discussed at

professional conferences in 2004 (An and Wang, 2004a, 2004b), as well as some of the individual and institutional websites, show some of the changes of the research agenda in electronic records management, and possibly the future direction of research in electronic records management as well. These include the following observations:

1 Types of research have tended to change from the simple to the complex, covering problem-solving, theory-building and test-bed research; descriptive, exploratory, analytical and predictive research; basic and applied research; theoretical and practical research, and so on.
2 The aims of projects have changed from those simply benefiting records and archives management services to those benefiting multiple services to internal and external customers of e-government, e-business, e-commerce, or customers of the digital city and society.

   One of the examples is the International Records Management Trust (IRMT) and the World Bank's collaborative project 'Evidence-based Governance in the Electronic Age' at www.irmt.org/evidence/index.html, which supports governance and service of democracy.

   Another example is the DIRKS manual developed by the National Archives of Australia in co-operation with the State Records Authority of New South Wales. Its 2000 version, *Designing and Implementing Recordkeeping Systems: manual for Commonwealth agencies* (National Archives of Australia, 2000), was primarily aimed at providing practical guidance on managing business information and records for government agency records management project teams and consultants. Its 2001 version, *A Strategic Approach to Managing Business Information* (National Archives of Australia, 2001), provides a flexible methodology that can be applied at different levels depending on the particular needs of an agency. It may be applied to the whole organization or confined to specific recordkeeping systems, business activities or business units, depending on the nature of the particular recordkeeping project. Its 2003 version, *Strategies for Documenting Government Business* (State Records NSW, 2003), is concerned with building more efficient and accountable business practices through the design and encouragement of good recordkeeping.
3 The objectives of research projects have changed not only just for long-term preservation of electronic records, but also for sustainable and consistent records and information management services throughout the life of a record and throughout the information continuum regime, particularly focused on adding value to business. There has been a change of emphasis from a focus on the medium to the integrated management of electronic records as evidence, information, historical sources, memory, culture, knowledge and information assets; from managing the physical entity to managing its content, context, structure and presentation; from the discrete management of electronic documents or electronic records systems to the integrated management of documents, records, information and knowledge; from managing data to managing the content of web-based resources; and from managing description to managing metadata schemes.

   The UK *e-Government Policy Framework for Electronic Records Management* (www.nationalarchives.gov.uk/electronicrecords/pdf/egov_framework.pdf) is a good example of employing electronic records management as a key technology underpinning electronic government, managing electronic records as valuable corporate information resources, encouraging the adoption of cross-government standards for metadata and interoperability to support greater commonality and inter-department working in electronic document and records management, and in the sharing and exchange of electronic records between government systems.

   Another example is the ANSI/AIIM/ARMA TR48-2004, *Framework for Integration of Electronic Document Management Systems and Electronic Records Management Systems* (Sprehe, 2004), which allows organizations to cut costs and improve customer service, enabling the vital links between people, processes and projects in a way that empowers organizations to more effectively realize the value in their information assets.
4 Interdisciplinary, multidisciplinary and cross-disciplinary approaches to research form an integral part of any research methodology if stakeholders are to be satisfied with the products of such research. They are no longer discrete approaches to specific problems, but have moved to study the integrated conceptual frameworks dealing with inter-disciplinary, cross-disciplinary and multidisciplinary approaches to broad topics. The Chinese project 'Research in integrated management and services of urban development records, archives and information'

is an example that employs customer-relationships methodology, postmodern archival thinking, the records continuum regime and a total quality management approach to build an integrated framework for the integrated control of services, processes and products of electronic records management services in the urban development field, with the aim of providing client-satisfactory records management, cost-effective and efficient records management processes and good quality of records throughout the lifespan of the records and throughout the lifespan of the built environment itself (An, 2004a, 2004b).

5 There are increasingly needs for pluralism of research methods in professional development. Many modern methods are now used in the development of research.

Taking the Australian Monash University's Clever Metadata Project as an example, methods of conceptual modelling, literary warrant analysis, mapping metadata, meta modelling and empirical instantiation have been used. Conceptual modelling of records in their business and socio-legal context is being undertaken to provide the conceptual framework for the project; analysis of literary warrant is being carried out to discover authoritative sources for the specification of recordkeeping metadata; an iterative process of conceptually mapping the elements of the Recordkeeping Metadata Schema against elements in existing 'best practice' generic sets and elements in recordkeeping-specific metadata sets is being undertaken; modelling of metadata elements is done using two formal modelling techniques: the Resource Description Framework (RDF) and Object Role Modelling (ORM); and empirical instantiation is used by populating metadata elements with examples to highlight inconsistencies or gaps in the metadata syntax and semantic expressions within the set and also to provide guidance to potential implementers on the application of the metadata syntax (www.sims. monash.edu.au/research/rcrg/research/crm/researchmethodology.html).

Another example is the InterPARES project where cross-disciplinary and multimethod approaches have been used, for instance literature analysis, comparative analysis, diplomatic analysis, statistical analysis, survey, field investigation, interview, case study, prototyping and modelling techniques.

6 Groups involved in research have been expanded from records and archives specialists to include new and broader partnerships and collaborations across disciplines, boundaries and cultures. In McKemmish's (2000, 353) analysis, the experience of a range of research and development projects in the Australian recordkeeping community, such as the Strategic Partnerships with Industry Research and Training (SPIRT) scheme and the Cooperative Research Centres (CRCs) project, she pointed out that the nurturing of collaborative research and development initiatives has been a key strategy of the recordkeeping community in its efforts to develop policies, standards, systems and tools for electronic recordkeeping. Increasingly, this collaborative research is becoming more international and multidisciplinary in nature.

7 Research outcomes have changed from single one-time products to sets of sustainable, coherent and consistent integrated products, adding value to common understandings, information sharing, co-ordination, collaboration and partnerships. These are directed towards the long-term preservation of authentic and reliable electronic records over the entire lifespan of data and information and their effective use by all types of stakeholders and potential clients.

A good example is the UCLA's 'Information Technology and Policy Curricula based upon Electronic Records Management and Preservation Project' at http://polaris.gseis.ucla. edu/swetland/nhprc.pdf, taking a range of stakeholders in aspects of electronic records management and preservation of digital materials into consideration for overall purposes. As Gilliland-Swetland wrote in her NHPRC's proposal (2001), the project concentrated on how undergraduate and graduate education in computer science, information science, information policy, archival science, preservation management, business and law can be used to prepare the next generation of professionals in a variety of fields who will be facing issues associated with electronic records management and information technology implementation in general.

8 The impact of research has broadened from purely local scope to national and international. It has added value to models, programs, technologies, policies and standards, both for specialists and in outside professions. It has spread through questions of communication and education as well as participating in research activities in other fields, to help creators, users, system designers and custodians to build their capacity to manage electronic records and to demonstrate their skills (An, 2003, 70-1).

To equip future records managers with problem-solving abilities for professional success and future leadership in this rapidly changing and volatile environment, research is a key instrument for experimenting, inventing, changing, and improving professional education (Ketelaar, 2000, 322). Integrating research requirements and opportunities at masters and doctoral levels in postgraduate archival education seems a new dimension for building capacity for research. The funding of PhD students seems a global trend to meet the high demand for faculty positions. They are increasingly sought also by industry and the policy development arena for research and development positions (Gilliland-Swetland, 2000, 258, 270).

To expect the unexpected in this networked global society, it is significant to accumulate, share and exchange research experiences in electronic records management across cultures.

Key elements in the success of the InterPARES projects

The above studies mentioned only a few research projects in electronic records management that have made particular contributions to the professional discipline. It is clear that there are some good research projects in electronic records management, but it is not possible, within this chapter, to cover a range of the major projects that highlight aspects of research practice in electronic records management.

The author has therefore concentrated on the InterPARES projects because of their representative range of elements and examples of good practice, being internationally recognized as successful and being transparent in their methodology and the entire research processes. So, what are the key elements in their success, and what can we learn from their experience? A comparison of research components of InterPARES I (findings of the InterPARES project at www.interpares.org/book/index.cfm) and InterPARES II (dissemination at www.interpares.org/ip2/ip2_dissemination.cfm?proj=ip2/) and their relationships indicates that there are five key elements in their success:

1 The aim of the research was to achieve sustainable and consistent development in electronic records management. The projects were closely related to previous and subsequent research and were built on prior work. InterPARES II (2001 to 2006) was based on InterPARES I (1999 to 2001) available at www.slais.ubc.ca/research/current-research/interpares.htm, and InterPARES I was based on the UBC project (1994 to 1997) available at www.interpares.org/UBCProject/ index.htm. The objectives were clear and relevant. The objectives of InterPARES I and II took forward the management of already existing electronic records to the management of electronic records yet to be created. There was a progression from static databases and document management systems to interactive, dynamic and experimental systems; from a narrow administrative environment to broader artistic, scientific and government environments; and from the processes of records preservation to the processes of creation, presentation and use.

The projects' coverage was inclusive, coherent and rigorous. InterPARES I included requirements for establishing the authenticity of records, appraisal criteria and methods, methods of preservation, a framework for the formulation of strategies, and policies and standards for long-term preservation. InterPARES II dealt with terminology, policy, description and modelling.

2 This research was conducted within a framework of multidisciplinary methodologies. The aim of InterPARES was to develop the theoretical and methodological knowledge essential to the permanent preservation of authentic records generated and/or maintained electronically, and, on the basis of this knowledge, to formulate model policies, strategies and standards capable of ensuring that preservation. Several methods were used, including diplomatic analysis, modelling, surveys, experimental testing, prototyping, and procedural testing. In addition to model policies, strategies and standards, many products resulted from these projects as spin-offs. The methodology consisted of a comparative examination of the relevant literature in the fields of textual criticism and art restoration (www.slais.ubc.ca/research/current-research/interpares.htm).

Four methodological principles were developed by the InterPARES II project (available at www.interpares.org/ip2/ip2_methodological_principles.cfm). These were interdisciplinarity (with a contribution from several disciplines); transferability (findings can be translated into the language and concepts of each discipline that need to make use of them); openness (InterPARES 2 works as a 'layered knowledge' environment); and multipurpose design (each case study was carried out using

the methodology and the tools that the dedicated investigating team considered most appropriate for it).

3 In these projects, the researchers had international, interdisciplinary and collaborative customer relationships. The projects were therefore eligible for support from multiple funding and institutional sources.

InterPARES II aimed to develop and articulate the concepts, principles, criteria and methods that can ensure the creation and maintenance of accurate and reliable records and the long-term preservation of authentic records, in the context of artistic, scientific and government activities that are conducted using experiential, interactive and dynamic computer technology.

Scholars in the arts and sciences, archivists, artists, scientists, industry specialists and government representatives from around the world have worked together to meet the challenge presented by the manipulability and incompatibility of digital systems, technological obsolescence and media fragility and to guarantee that society's digitally recorded memory will be accessible to future generations. Stakeholders have included individual records creators, organizations, governments, archivists and any other professionals, researchers in all scientific disciplines, the citizenry at large and the information technology sector (www.interpares. org/ip2/ip2_index.cfm).

4 The research results have added maximized value to theory and practice in electronic records management. Some of these are:

- methodology and principles for usable models, programs, technologies, policies, standards, common architectures, interoperability and partnerships in electronic records management
- collaboration with other research projects and standards committees
- contributions to a common core of knowledge for education and training
- better communication between participants, using travel, meetings, discussion and evaluation, websites, conference papers, workshops and publications
- a broader audience and cross-disciplinary readers
- invitations to multidisciplinary and international events
- a prestigious reputation worldwide.

5 The projects were planned with the ideal of integration in mind in relation to the following aspects :

- appreciation of the needs of the different stakeholders involved
- integration between research questions and activities
- consideration of all aspects of project management
- co-ordination between procedures and activities with a time schedule
- co-ordinated teamwork under the project committee, supported by full-time trained researchers
- co-ordination of components of the research with the design of research plans, for example objectives, questions (problems), hypothesis (conceptual framework), methods and methodologies, expected benefits, outcomes and output, findings, dissemination, delivery and publication, the impact of the research, and vocabulary.

Conclusion

This chapter has provided a brief overview of research in electronic records management conducted since 1979. The review has been organized to show the range of considerations that need to be addressed for the future direction of research into electronic records management. Four main issues confronting research projects were considered in turn: significant roles and benefits of research; stages of the research development process and their research focuses; the general direction of the research agenda; and key elements in the success of the InterPARES projects.

As the overview indicates, first, research projects have played important roles in the development of electronic records management and have brought six significant benefits to the international records and archives professional community. It is essential for the continued vitality of professional work that there should be further research projects. Research is a management tool needed for making the right decisions. Records and archives professionals have to work in a competitive environment. A dynamic and changeable digital society is constantly making demands on their competence.

Second, the development of research projects in electronic records management has fallen into three stages. The variation of focus from period to period has depended on the information technology available and the demand for research experienced at the time.

Third, the study indicates that the research agenda for electronic records management requires a methodology integrated with other services. This is the overall direction of all this work. An integrated methodology means collaborative ways of thinking, aimed at guaranteeing the long-term use of reliable, authentic and complete electronic records, and at maximizing the long-term preservation values of the various needs of many disciplines; in providing consistent and sustainable recordkeeping services to meet a variety of users; and in promoting professional commitments and value-added contributions for best practice. Collaborative methodologies focus on positive, rational, interactive, complementary, harmonious and cohesive ways of thinking, rather than passive, irrational, stagnant, incongruous, incompatible or disparate ones. They rely on similarities rather than on difference, on valuing the contribution of different professions and disciplines rather on excluding other potential representatives from a broader society, in government agendas (An 2004b, 129-30): 'Team-work is the great essential of the network society' (Cook, 2001, 278).

Finally, five key elements in the success of the InterPARES projects throw light on the mechanisms of their research practice. Integrated methodologies are important mechanisms in this. Considerations on integration include five components: research purposes, research process and methodology, the research team, research outcomes and research design.

In conclusion, research is a process of enquiry and investigation; it is an endeavour to discover new or collate old facts and reach new conclusions and increase knowledge; it is systematic, critical and methodical. There is an increasing demand for integration methodologies in electronic records management; there are increasing demands for better practice in research projects in electronic records management; and there are increasing demands for education and training in research skills for practitioners, researchers, educators and students. The experience gained from research projects provides directions and best practice about the research that should be incorporated into future projects to improve the quality of the results and to increase their impact on organizations and in the professional community.

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Chapter 6

Technologies for preservation

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Introduction

The InterPARES project (www.interpares.org/) has defined some of the essential requirements for a viable preservation environment. The two concepts of authenticity and integrity are used to express the differences between preservation and simple collection building. Authenticity is the assertion that information about the creation of a record can remain associated with the record throughout the preservation life cycle. Integrity is the assertion that a record can continue to be displayed and manipulated in the manner intended by the original creators. Integrity has associated connotations that the bits that represent the record have not been corrupted, that the management of the record can be audited and the custodians identified, and that the archival processes that have been applied to the record can be tracked.

Preservation can be applied to any digital entity, the string of bits that are generated by a computer program. In the diplomatics field, digital entities correspond to records on which actions are based. The records could be files from office products, images, diplomatic communiqués, or more complex products such as e-mail with attachments. Each of these types of digital entities requires a supporting software and hardware infrastructure for its display and manipulation. The supporting infrastructure may be a file system in which the output from a proprietary office product was stored. The challenge that the archivist faces is that the software and