LOOKING UNDER THE HOOD:

UNRAVELING THE CONTENT, STRUCTURE, AND CONTEXT OF FUNCTIONAL REQUIREMENTS FOR ELECTRONIC RECORDKEEPING SYSTEMS

by

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A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba
in partial fulfilment of the requirements of the degree of

MASTER OF ARTS

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Abstract

Functional requirements for electronic recordkeeping systems have emerged as a principal tool for archival and records management professionals to communicate electronic recordkeeping standards to both records creators and computer systems designers. Various functional or model requirements have been developed by government and international organizations around the world to serve as tools for the design, evaluation, and implementation of recordkeeping systems that will satisfy these recordkeeping requirements. Through their evolution, functional requirements have become complex guiding documents covering an array of recordkeeping systems and preservation interests. Often misunderstood or simply ignored, the recordkeeping requirements at the heart of these specifications are crucial for ensuring the creation, maintenance, and preservation of electronic or digital records over time, for operational, accountability, archival, and historical purposes.

This thesis examines the origins and evolution of these functional requirements, particularly through the contributions of the Pittsburgh project's study of electronic records as evidence and the University of British Columbia project's study of the preservation of trustworthy electronic records, which together articulated key foundational assumptions about electronic or digital recordkeeping and the structure of many of the functional requirements circulating today. By looking at their conception, development, and evolution, this thesis sheds light on the content, structure, and context of the most widely-used available functional requirements. It evaluates the merits of their often competing assumptions and deliveries, and suggests that none represent a "silver bullet" that addresses the issues associated with electronic records, as each has limitations resting both with the ability of users to implement the requirements and with the rapid and ever-changing landscape of electronic communication.

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Acknowledgements

This thesis would not have been possible without assistance and support from those I proudly call family, friends, colleagues, and mentors. I would like to express a special note of thanks to Dr. Terry Cook, my thesis advisor, who has devoted his time and thoughtful guidance throughout the writing of this work. Thanks also go out to Dr. Tom Nesmith, who together with Dr. Cook, devoted tireless efforts to the benefit of me, the students of the Archival Studies program, and to archives in general.

The idea for this thesis, as well as the room to explore the available functional requirements, stems from an internship I undertook at the Archives of Manitoba in 2007. While there, I was fortunate to work with, and learn from, some very kind and talented people. Special thanks go out to managers, mentors, and friends, Jackie Nicholls and Paula Warsaba, both of whom took me under their wings, sharing freely their knowledge and guidance, giving me a rich and varied apprenticeship. They have set the standard for mentorship, which I will forever endeavour to reach.

I also wish to thank my family and friends for their understanding and backing as this work was being pieced together, for both hearing my complaints and sharing in my successes; to Amanda, for your support and understanding; to my parents, Gerhard and Neta, and the rest of my family, for their encouragement; to my archival colleagues, who have been both sounding board and critic as needed; and, finally, to my University of Manitoba family, Karen Meelker, Robyn Wellman, Greg Juliano, Shelley Sweeney, among many others who have supported my work in these last few months. I am truly grateful for all of you.

Introduction

In 2011, the International Organisation for Standardisation unveiled ISO 16175-2:2011 as the international standard for electronic recordkeeping systems, which was just the latest in a growing list of standards, guidelines, and functional requirements for electronic recordkeeping systems.[1] The ISO standard took its place among predecessors and competitors such as the International Council of Archives' *Principles and Functional Requirements for Records in Electronic Environments*, (2008),[2] the United Kingdom's *Functional Requirements for Electronic Records Management Systems* (1999, with revisions in 2002),[3] the European Commission's *Model Requirements for Electronic Records* (2001, with revisions in 2008)[4], The National Archives of Australia's *Functional Specifications for Electronic Records Management Systems Software* (2008),[5] the well-known United States Department of Defense's *DoD 5015.2-STD, Design Criteria Standard for Electronic Records Management Applications* (1997, with revisions in 2000, 2002, and 2007), and numerous other smaller, local, regional, professional, and less ambitious national standards, all attempting to

[1] ISO 16175-2:2011, *Information and Documentation – Principles and Functional Requirements for Records in Electronic Environments – Part 2: Guidelines and Functional Requirements for Digital Records Management Systems* (Geneva: International Organisation for Standardization, 2011).
[2] International Council on Archives, *Principles and Functional Requirements in Electronic Office Environments* (2008) http://www.ica.org/4127/strategic-objective-2/icareq-principles-and-functional-requirements-for-records-in-electronic-office-environments-guidelines-and-training-material.html, accessed 1 April 2012.
[3] Public Record Office, United Kingdom, *Requirements for Electronic Records Management Systems, 1-4: Functional Requirements, 2002, Revision – Final Version,* (Surrey: 2002).
[4] Cornwell Management Consultants plc., (for the European Commission Interchange of Documentation between Administrations Programme), *MoReq: Model Requirements for the Management of Electronic Records* (Bruxelles-Luxembourg: 2001); Serco Consulting (for the European Commission interchange of Documentation between Administrations Programme), *MoReq2: Model Requirements for the Management of Electronic Records, Update and Extension* (Bruxelles- Luxembourg: 2008).
[5] National Archives of Australia. *Specifications for Electronic Records Management Systems Software and Guidelines for Implementing the Specifications for Electronic Records Management Systems Software (ERMS)*, (Canberra, Australia: 2008).

establish the functional requirements necessary for the creation, maintenance, use, and long-term preservation of reliable and trustworthy electronic records.[6]

Like many of those standards and models it joined, the ISO standard consisted of nearly two hundred pages of complex optional, mandatory, and preferable system specification statements concerning the "functions" involved in creation, capture, classification, storage, access, security, disposition, and preservation of electronic records. While these statements represent the distillation and refinement of years of multi-disciplinary research and development by archivists and others seeking to ensure the creation of trustworthy records for current business use and for long-term accessibility of historical records in electronic or digital form,[7] their competing formats, their size, and their complexity make them inaccessible to most personal, business, and archival end-users of the resulting digital media. Indeed there is little hope of evaluating, selecting, testing, and implementing these models or standards without a clearer picture of what they actually do and how they do what they do.

Archivists have for years contributed to the creation, development, testing, and implementation of functional requirements for recordkeeping, yet widespread use of the standards to ensure the preservation of electronic records of historical value has remained elusive, even more than

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[6] Archives New Zealand, *Electronic Recordkeeping Systems Standard* (Wellington, New Zealand: June 2005); Department of Defense, United States, *DoD 5015.2-STD, Design Criteria Standard for Electronic Records Management Software Applications* (Washington: Assistant Secretary of Defense for Command, Control, Communications, and Intelligence, 2007); Public Record Office Victoria, *Standard for the Management of Electronic Records PROV 99/007 (Version 2)* (July 2003), available at http://prov.vic.gov.au/government/vers/standard-2, accessed 1 April 2012; Riksarkivet, National Archives of Norway, *NOARK 4 Part 1 – Norwegian Recordkeeping System: Functional Description and Specification of Requirements* (1999), available at http://www.arkivverket.no/eng/Public-Sector/Noark/Noark-4, accessed 1 April 2012; State Records of South Australia, *South Australian Government EDRMS Functional Compliance Requirements 2002, Version 1.0* (August 2002), available at http://www.archives.sa.gov.au/files/management_EDRMS_functionalcompliance.pdf, accessed 1 April 2012.

[7] The distinctions between electronic and digital records will be made more clear later in this thesis, but for the purposes of this introduction, the terms will be interchangeable, referring generally to records created and maintained virtually by computer systems.

two decades after the need for such functional requirements and related system specifications first emerged. For many archivists and information management professionals, understanding, evaluating, implementing, and reaping the benefits of the adoption of these functional standards have remained just out of reach. I first arrived at the topic of functional requirements in 2007, as part of a student internship at the Government Records Office of the Archives of Manitoba, which was evaluating available sets of functional requirements for adoption by the Province of Manitoba. Like most public sector organizations, the Government Records Office was searching for tools, standards, design criteria, and guidelines which could be used by information technology staff to ensure the creation, capture, storage, disposition, accessibility, and preservation of electronic records over time. With the certification of Microsoft's SharePoint add-on module against the DoD 5015.2 standard in 2010, there was great hope that a technological solution to the problems associated with electronic records was drawing near. Yet there was uncertainty about what the standard ensured, about how it would be implemented, and about the quality of the records that would emerge from a system that met the standard. The Government Records Office thus began an in-depth study of the standards, models, and guidelines available at the time. Five years later, in 2012, implementation of a standard for archival electronic records created across the Government of Manitoba is still in the future.

Functional requirements for electronic recordkeeping systems were established to address the creation, capture, preservation, and accessibility of trustworthy electronic records over time. Recorded information that can be trusted as reliable evidence is essential to shaping and maintaining our collective memory for legal, administrative, national, historical, social justice, and personal purposes. Creating and preserving the recorded information that forms the basis of our collective and personal memory is thus critical for all members of society, yet for the last three decades this vital resource has faced a crisis that threatens our ability to transmit collective or societal memory from one generation to the next. Vast amounts of recorded information in electronic or digital form has

been lost to deterioration, obsolescence, ignorance, and neglect. Across the globe, governments, businesses, organizations, and individuals create and use crucial data that will not be available to future generations unless action is taken to ensure these data are preserved in reliable contexts and made available over time as trustworthy evidence of the past. In response to the challenges posed by digital information systems, the archival and records management communities have worked together to develop guidelines for electronic recordkeeping systems, designed to ensure the long-term availability of electronic records. These guidelines have many dimensions, but overall they attempt to provide information to put the digital object – the email message, the word-processing document, or the digital photograph – in context so that it may be understood. Because this added contextual data is data about the original data, it is usually called metadata. The key issue, then, is what is required to make this metadata, and related policies and procedures, function in such a way that the resulting "record" (the original data object and its linked essential metadata) may be judged as authentic and reliable evidence, across centuries. Discerning, articulating, and implementing these functional requirements for producing trustworthy and lasting digital documents has been an intense and sometimes divisive professional debate among archivists and records managers for over two decades.

The widespread use of personal computers by governments, businesses, schools and universities, non-government community organizations, and individual homes has changed not only the way the modern world conducts its business and human communications take place, but also the ways in which even the most basic activities on up to complex ideas and programs are documented. Traditional business forms, files, and documents have largely been replaced by electronic equivalents. For example, in place of a letter, complete with envelope, addressee, identifying letterhead, file number, and signature, is an email, in the form of bits and bytes on a hard drive. Stores of physical records held by governments about their citizens in paper case files have been replaced by huge databases and distributed storage networks. Photographs or maps once "fixed" on

paper are now in their digital formats endlessly manipulable, ever changing, and, like email or databases, subject to frequent hardware and software transience and obsolescence. This new reality has ushered in profound challenges for archivists, who are responsible for appraising and acquiring, preserving, and making available documentary records for historians and all other users of these records decades and centuries from now, when a part of these digital records winds up in archives as heritage or historical source material for research.

As electronic records began to make their way into archival institutions, or even before as archivists interacted with records managers to appraise and schedule records for future transfer to archives, archivists gradually became aware of the unique issues associated with the growing use of digital information systems. The most immediate challenge they encountered was the many technological obstacles associated with the acquisition, processing, reliable display (or renderability as it is termed), and long-term preservation of electronic records. Unlike physical letters, photographs, and maps, digital records require supporting software and hardware in order to make them available over time. Similarly, the physical media used for the storage of digital records (tapes, diskettes, optical platters, hard drives, etc.) remain fragile and particularly vulnerable to degradation or obsolescence in a tiny fraction of the time of their physical counterparts, whether paper, parchment, photograph plates, or even film negatives. This necessitates archival maintenance of obsolete and often proprietary technologies, or else the continual migration of records across software platforms and storage technologies in order to make them accessible to current and future users. Both strategies are costly, time-consuming, and alter the original form, context, and possibly the meaning, of the record itself, thus making it highly problematic for long-term administrative use, protection of rights, or as historical sources. Not migrating records, developing emulation tools, or preserving the technology required to store and access them, dooms them to technological obsolescence and thus de facto destruction. There will be no history of our era unless the “functional

requirements" for digital record-making and recordkeeping are accepted and implemented, from the biggest government agency or large corporation down to the writer in her office or photographer in his studio.

Equally important as the technical challenges presented by electronic information systems, are those associated with the nature of the records they generate. The same qualities that make electronic information systems so appealing to users -- the ease with which records can be created, manipulated, altered, copied, shared, and destroyed -- are the same qualities that make them difficult to process following the conventional methods and procedures in the records management and archival toolkit. The proliferation of electronic information systems has led to an exponential increase in the amount of information available to archivists for appraisal, acquisition, processing, description, and preservation. While this flood of information may be seen as a great boon to archival institutions typically accustomed to limited documentary sources, the incredible volume of records produced and used have also placed an impossible burden on their resources. Archival institutions of all sizes and budgets now face the daunting task of separating the wheat from the chaff in an environment where creation has long surpassed their ability to process digital records and the need to do so up front, and not several decades after the records were created as in the paper world, all while maintaining resources and services for the accumulated legacy of paper records that fall to their institutions and still attract many researchers.

Further complicating the work of processing electronic records is the lack of crucial contextual information required to appraise, acquire, process, describe, preserve, and make available archival records. As most electronic information systems were designed for ease of use rather than their ability to effectively create a lasting documentary record, the resulting "records" lack much of the characteristics of trustworthy records. Vital indicators embedded in paper documents that help

archivists identify authentic and reliable records simply do not exist for most electronic records created over the past thirty years. In an ever changing environment where time and much needed contextual information are in short supply, archives, no matter how well supported, cannot hope to identify, appraise, acquire, process, describe, and preserve the torrent of electronic information coming their way without a good deal of supplemental information, or metadata, about the records themselves.

While archivists have in the past adroitly navigated changing media (film, video, television, and various audio formats), the tell-tale signs they depended on with such media to identify physical records simply cannot be relied on in the new digital realm. To some archival thinkers, this represented larger shifts in the ways in which we view records themselves, rather than simply the adoption of a new recording medium. Canadian archivist Hugh Taylor remarked that electronic records represented a paradigm shift, one that marked a move from the industrial age to the electronic age. This new electronic age, according to Taylor, required a new conceptualization of what records are and the purpose they serve.[8] A key aspect of this shift was the re-definition of an archival record, the essential characteristics that marked authentic records, as contrasted to mere transient data without context, and thus re-defining of the role archivists should play in the shaping of the documentary record before it crossed the archival threshold. It quickly became apparent that, unlike the physical realm, archivists could not wait the customary twenty to thirty years before records were scheduled (and ever appraised) to arrive at their institutions to identify and make appropriate preservation preparations. Indeed, if archivists were to have any chance of preserving and making available electronic records, they would need to actively engage records creators in order to ensure that records contain, as they are created and then used, certain essential elements to place them in

[8] Hugh Taylor, "Transformation in the Archives: Technological Adjustment or Paradigm Shift?," *Archivaria* 25 (Winter 1987), 12-28.

context and thus render their contents meaningful, usable, and trustworthy, both now and especially, as systems and software changes, over time.

Two large, well-funded research projects were established to systematically explore and articulate the recordkeeping requirements arising from the challenges of this new electronic age. As the first of their kind, the David Bearman-led University of Pittsburgh School of Library and Information Science *Variables in the Satisfaction of Archival Requirements for Electronic Records Management* (Pittsburgh project), and the Luciana Duranti-led University of British Columbia Masters of Archival Studies project, entitled *The Preservation of the Integrity of Electronic Records* (UBC project), became the foundations of many subsequent archival efforts to communicate recordkeeping requirements to senior managers, system developers, IT professionals, records managers, records creators, senior managers, and auditors, and not least to the archival community itself. The projects identified and defined the functional requirements necessary to produce trustworthy electronic records and provided creators with design criteria for systems that would or could create such authentic and reliable records. Out of the Pittsburgh and UBC projects emerged some common understandings of the issues at hand, as well as the recordkeeping tools required to address them. These two projects led to a new body of work that sought to establish and communicate, to both the developers and users of electronic information systems, the basic requirements in terms of policy and technology for creating reliable and trustworthy digital recordkeeping systems.

Though archivists have been central contributors to the various sets of functional requirements for electronic recordkeeping systems developed to date, very little work has been done to synthesize the progress made in following these models and the impact their adoption will have on archival functions and thus on future use of archives by researchers. This thesis will outline the

development of functional requirements since the mid-1990s, explore the nature of their origins and their evolution, analyse the differences and similarities of these various sets of articulated requirements, and assess the current state of these efforts. It will seek to verify that the core functional requirements of each research project adequately address the basic recordkeeping issues first outlined by David Bearman. Finally, this thesis will assess the implications for archival functions that are contained within the available functional requirements, including questions surrounding the ways in which archivists appraise, acquire, process, describe, preserve, and provide access to records created with various levels of adherence to the available functional requirements.

The thesis has four chapters, plus a short conclusion. Chapter One will review the archival professional dialogue that grew out of the increasing dependence on electronic means of communication for government, business, education, and community and personal activities. This opening chapter will survey the early debates within archival literature concerning fundamental aspects of recordkeeping in the electronic realm. These debates, drawing from traditional archival practices as well as from other disciplines, helped to frame the issues presented by records in the electronic environment, and which provided the framework from which to address them. Out of these early debates formed the two distinct frameworks, methodologies, and set of tools designed to address the issues of creation, capture, storage, access, and preservation. These two distinct paths form the basis of Chapter Two, which unravels the complex and ground-breaking work of the electronic records projects coming out of the University of Pittsburgh and University of British Columbia during the 1990s. These projects, which sought to establish the criteria necessary to the creation and preservation of electronic records, provided the foundation on which modern functional requirements were based. Chapter Three will then trace the work of these two projects carried forward into other projects to articulate or refine further more modern functional requirements. Chapter Four will look at the implementation of functional requirements and will investigate how

they address the issues uncovered by the UBC and Pittsburgh projects, and how well they do this. Finally, this thesis will conclude with an analysis of the state of functional requirements, their strengths, their weaknesses, and their potential impact on the electronic documentary heritage that will be left for the future.

Chapter One

Framing the Discussion:

Archival Ideas About Early Electronic Records

Standards for electronic recordkeeping systems are the culmination of nearly three decades of debate among archivists, records managers, and records creators. They reflect the early struggles to identify electronic records, to capture them in a fixed form, to appraise them, to organize them, to preserve them, and to make them available to users over the longterm. They are the result of examination and articulation of each step in the archival process, and beyond, in an effort to establish the criteria for recordkeeping systems that will enable them to create, maintain, and preserve records with sufficient context to make them meaningful, usable, and reliable over time.

This chapter looks at the development of archival responses to the rising tidal wave of electronic records brought about by the computer revolution. It surveys the early struggles to identify the issues concerning technology, appraisal, reliability, authenticity, and preservation associated with electronic recordkeeping systems. As awareness and understanding of the issues grew, so did the focus of the archival responses, from established conceptualizations of records preservation to records creation as the site of preservation efforts, and from insulated, specialized, and fragmented responses towards multidisciplinary and collective efforts.

As computer use began to grow exponentially in the late 1970s and early 1980s, archivists quickly realized that their institutions (and their profession) would need to adapt to accommodate the records that computers produced.[1] Though records in non-paper or non-textual forms had presented challenges to the profession before, electronic records represented an additional set of technical and theoretical challenges to archival practice. Electronic records, being so closely tied to the technological environments in which they were created and used, required new skills and new tools for archivists. More than simply a new medium, such as television or photography, the digital records produced by modern information technology represented a new form of communication that required a new set of technical, conceptual, and legal tools to capture and maintain as reliable evidence crucial elements of documentary heritage.

Archivist and archival educator Terry Cook has argued that archival thinking on electronic records can be separated into three distinct generations.[2] The first-generation, he asserted, is characterized by and confined to the large mainframe databases that dominated in government, large business, and educational institutions from the 1950s onwards. It is marked by a focus on content over context, and challenges presented by the demands of new technology to archival tradition. The second-generation is characterized by a return to many traditional archival principles in order to deal with issues of accountability, reliability, and authenticity; and finally, the third generation built on the work of the second, by widening its scope and complexity to deal with exponential growth of computerized records and changing focus of computer uses. Some, like Thomas Elton Brown, have challenged this generational framework for not accurately representing the complexity and overlap in

[1] For examples of early efforts to respond to the archival challenges posed by electronic records, see Charles M. Dollar, "Appraising Machine-Readable Records," *American Archivist* 41 (October 1978), 423-30; Harold Naugler, *The Archival Appraisal of Machine-Readable Records: A RAMP Study With Guidelines* (Paris: General Information Programme and UNISIST United Nations Educational, Scientific and Cultural Organization, 1984); and Margaret L. Hedstrom, *Archives & Manuscripts: Machine-Readable Records* (Chicago: Society of American Archivists, 1984).
[2] Terry Cook, "Easy to Byte, Harder to Chew: The Second Generation of Electronic Records Archives," *Archivaria* 33 (Winter 1992), 202-216.

thought and action within generations, yet Cook's divisions offer useful markers of larger shifts in archival trends.[3]

Though these shifts are clearer with the benefit of hindsight, it should be noted that many of the ideas and concepts developed by electronic records preservation pioneers have evolved with familiarity and practice. Prominent archival thinker David Bearman, for example, recognized the many changes even within his own work as a response to changes in the archival field, in computer technology, and in societal use.[4] And though many of the subtleties of these evolutions are lost in the three generational framework, a point Cook himself readily acknowledged, this is not to deny the existence of three broad phases in the professional archival response. The terminology used for computer-generated records in the literature also reflects, subconsciously perhaps, the three phases Cook noted: machine-readable records, electronic records, and now digital records.[5] For this reason, therefore, the three-generation framework provides a useful division of the three more general shifts in the focus of archival responses to the challenges presented by electronic records.

This first-generation of responses emerged out of efforts to appraise, arrange and describe the machine-readable records created by computer systems in the 1960s and 1970s. While accessing and making available outputs from proprietary systems loomed large in these early years, the need for common archival concepts surrounding machine-readable records was also clear. Early computers

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[3] Thomas Elton Brown, "Myth or Reality: Is there a Generation Gap among Electronic Records Archivists?" *Archivaria* 41 (Spring 1996), 234-243.

[4] David Bearman, *Electronic Evidence: Strategies for Managing Records in Contemporary Organizations* (Pittsburgh: Archives & Museum Informatics, 1994), 2.

[5] The three-generational framework is also useful for informing the usage of the terms: machine-readable records, electronic records, and digital records. The archival literature of the first-generation used the term machine-readable records to refer to the records produced by large databases and mainframe computers; the second-generation primarily used the term electronic records to denote the products of early personal computers and terminal information systems in the automated office environment; and subsequently, there has been a shift towards the term digital records to describe both born-digital and digitized records produced in the past ten to fifteen years, including a third-generation of networked and web-based computer applications and communication technologies, though electronic records is still commonly used. As such, this thesis will use machine-readable records to discuss the first-generation discussions and electronic records thereafter.

had limited applications, generally taking the form of large mainframe computers used to process questionnaires, survey files and other text-based inputs, using database software to process and tabulate information that was used in the production of paper reports. Since the records produced by early computers were often used as the basis of more substantive paper reports, the status of the machine-readable portions of these records was unclear in terms of their appraisal as having archival value for acquisition and long-term retention by archives.

It is not surprising then, that much of the early writing on machine-readable records focused on the appraisal of records. Producing primarily sociological and statistical data in machine-readable form, the first-generation of mainframe computers created records that usually formed part of a greater physical documentary record. These machine-readable records were generally comprised of a fixed output resulting from a single input and a series of computational processes. The fixed output typically took the form of punch cards, print-out reports, statistical tables, or visual display which was used as source or supporting information in a traditional documentary record (physical or paper). This supportive role led archivists in this first-generation to focus on questions surrounding the archival value, or appraisal, of machine-readable records.[6] Questions surrounding the archival value of these "feeder" machine-readable records combined with the technical challenges involved in the interpretation and preservation, limited general archival interest beyond a few specialists and pioneers.

The early efforts to appraise machine-readable records offer valuable insight into the distinction between information or data and records. As a result, data can be generally considered to be information content that is devoid of the structure and context required to generate a meaningful record of activity. Records, imbued with the context of creation and use (information about who

[6] Naugler, "Archival Appraisal of Machine-Readable Records," 14.

created it, for what purpose, and how it was used); and with corresponding structural information relating to the organization, arrangement and display of the record, provide the essential evidential value necessary for the existence of authentic, reliable records.[7] Documents without the requisite context and structure remain information or data, rather than records. However, because these early machine-readable records formed part of a larger record, archivists tended to focus on their informational value, as reflected by the content of the document, rather than on the full integrated spectrum of context, content, and structure, which, in most instances, forms a complete, authentic, and reliable archival record. This distinction of data versus record became fundamental to the later responses – intellectual, strategic, technical, and legal – of the archival profession to computer-generated information.

When records were appraised to have long-term significance, or archival value, the primacy of content over context, however, dictated much of the response to early electronic records. This focus on content led some archivists to look to technological solutions to the challenges electronic records presented. As the bulk of early information systems produced fixed outputs in relatively simple forms, the records they produced could be removed from the original context within which they was created and still be used by skilled professionals.[8] As long as the archivist or data librarian had the necessary knowledge of computer technology, and the necessary resources, the records could be migrated and made available without much difficulty.[9] Furthermore, the relative stability of the records in these fixed forms allowed for one-time archival "dumps" or "snapshots" where the whole of the record could be copied from, or removed from, the mainframe computer and transferred to archival custody, while not significantly degrading or altering its meaning.

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[7] Definition derived from the Society of American Archivists, "Glossary of Archival and Records Terminology," entry by Richard Pearce-Moses, (Chicago: Society of American Archivists, 2005), available at http://www.archivists.org/glossary/term_details.asp?DefinitionKey=54, accessed 1 April 2012.
[8] Cook, "Easy to Byte, Harder to Chew," 204.
[9] Ibid.

The content-driven machine-readable records of the 1960s to early 1980s made mastering technological issues a high priority for archivists. This was, however, a considerable challenge in this first-generation of machine-readable records, since it required expertise that exceeded the grasp of most archivists. The operation of early computers required the user to have knowledge and understanding of the complex computer languages on which they operated, as there were no Windows or Apple "point and click" user-friendly interfaces. Archivists, assuming that they had the necessary equipment, and could discern through appraisal what an archival record was, were forced to become familiar with both the technology and the use of computers in order to make machine-readable data available to archive users. Thus, as Terry Cook has argued, the first-generation of archivists dealing with electronic records were "isolated" and therefore "turned to others using computerized records for advice and inspiration."[10] Using the examples set by social scientists and data librarians, archivists began to integrate information technology within their own institutions in the 1970s (the National Archives and Records Administration, the then Public Archives of Canada, and the New York State Archives being the three pioneers), which allowed for technical access to machine-readable records, but resulted in library-based cataloguing systems that were missing much of the context-based description present in non-electronic archival records.

As these early systems required a trained hand to access, maintain, and migrate the records they produced, the natural response of some in the field was to push for a reorientation of the archival profession. Indeed, early archival responses to electronic records, such as by Richard M. Kesner, were mainly aimed at encouraging archivists to move away from their historical roots to become information managers.[11] Kesner argued for a fundamental change in the "purpose and nature" of archivists in order to avoid being "relegated to the antiquarian curatorial role that [archivists] have

[10] Ibid., 203.
[11] Richard M. Kesner, "Automated Information Management: Is There a Role for the Archivist in the Office of the Future?" *Archivaria* 19 (Winter 1984-85), 162-172.

heretofore rejected as a misplaced 'popular' notion of what an archivist does for society."[12] Though offering more concessions to the historical aspects of archival work than Kesner, Canadian archivist and scholar Hugh Taylor also urged archivists to play a more active role in managing the records of the emerging personal computer age of the 1980s.[13] Others, like Tom Nesmith and George Bolotenko, argued that history and its contextual framework should remain central to archivy, regardless of the medium of these records.[14] Along similar lines, Terry Cook recognized that archivists would need to "sharpen their tools," and indeed become more computer savvy, but that they should not forgo their traditional role as knowledge brokers in exchange for "efficient retrieval of names, dates, subjects, or whatever, all devoid of context."[15]

While the first-generation of archival responses addressed the then relevant key issues surrounding appraisal and accessibility of the electronic records they encountered, dramatic changes to computer usage during the 1980s and 1990s would require different solutions. Some, like Hugh Taylor and American archivist and educator Margaret Hedstrom, recognized early on that this transformation would lead to significant changes for the archival profession, for system developers, and for records creators.[16] Databases continued to be run in centralized IT areas, but were increasingly relational, continuing, and subject to daily additions, changes, and deletions, as opposed to "one off" producers of paper printouts. Desktop computing also underwent dramatic changes, initially from the hobbyists of the late 1970s to the widespread proliferation of "personal" computers within offices by the late 1980s, initially as "smart typewriters," but increasingly as engines of

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[12] Ibid., 162.
[13] Hugh Taylor, "Information Ecology and the Archives of the 1980s," *Archivaria* 18 (Summer 1984), 25-37.
[14] Tom Nesmith, "Archives from the Bottom Up: Social History and Archival Scholarship," *Archivaria* 14 (Summer 1982): 5-26; and George Bolotenko, "Archivists and Historians: Keepers of the Well," *Archivaria* 16 (Summer 1983), 286-290.
[15] Terry Cook, "From Information to Knowledge: An Intellectual Paradigm for Archives," *Archivaria* 19 (Winter 1984), 49.
[16] Hedstrom, *Machine-Readable Records*; and Hugh Taylor, "Transformation in the Archives: Technological Adjustment or Paradigm Shift?" *Archivaria* 25 (Winter 1987), 12-28.

paperless processes with the "records" stored only on the thousands and millions of individual hard drives in existence at the time. As the use of personal computers spread, these individual terminals were linked gradually in local area networks (LANs), paving the way for the larger World Wide Web, producing evervaried multi-media "records" that had no discernable paper equivalent. Extensive use of personal and business computer networks, combined with increasingly diverse applications, to create an abundance of volume and types of records. These changes amounted to what Hugh Taylor argued was a paradigm shift for archivy, where established practices would need to be fundamentally altered.[17] Taylor predicted a future where archivists would get bogged down in the information overload of this new era, unable to appraise, acquire, process, and describe the tidal wave of information, unless they re-conceptualized records, as well as their profession's role in documenting society. Archivists, Taylor contended, would need to understand how and why electronic records were created, and to understand what this new way of remembering could reveal about the society that creates them.

The transition referred to by Taylor was marked by diversity and uncertainty bordering on chaos. Summing up developments by the early 1990s, pioneering National Archives of Canada digital archivist, John McDonald, famously dubbed this period of electronic records as "the wild frontier."[18] This wild frontier was characterized by few regulations, and almost no centralized management of records, "where creation, transmission, use, and retention of electronic records is under the control of the individual user."[19] This freedom was a great boon to end-users, who were able to create and control all manner of systems, but has also presented enormous problems for archivists and records managers, to say nothing of auditors, senior managers, freedom of information

[17] Taylor, "Transformation in the Archives," 13-14.
[18] John McDonald, "Managing Records in the Modern Office: Taming the Wild Frontier," *Archivaria* 39 (Spring 1995), 70-79.
[19] Ibid., 73.

and privacy commissioners, and of course citizens and researchers, needing access to the collective records of thousands of such individual end-users, and over time.

Without regulation and standardization, new and vastly different software applications were implemented, creating records that required proprietary hardware and software to operate, let alone later retrieve as archival and historical sources. This wild frontier was suddenly flooded with software and hardware upstarts, with little to indicate which technology would survive the year, let alone the decade, and with them, which data so created using these transient technologies would also survive. To tame this wild frontier, McDonald advocated implementing both standards and systems where business processes, rather than subject content or form, would be the determinants of archival value and arrangement under corporate-wide central control and management of records and technology. Others too, like Charles Dollar, argued that archivists and records managers shared similar goals, and that they should work together to put in place measures that ensured both their needs were met.[20] What the necessary measures were, what form they would take, and how they would be implemented, and by whom, would be the central focus of the professional discourse of second-generation electronic records archivists.

The untamed nature of second-generation records required much more contextual support to make them useful. In addition to the widely varying software developments of the 1980s and 90s, advances in computer networking made electronic records far more dynamic and relational than their predecessors. Terry Cook has argued that the second-generation response can be characterized by the emergence of "large hierarchical networked, and especially relational databases…in business, universities and government,"[21] as well as by the desktop personal computer becoming pervasive in

[20] Charles Dollar, "Archivists and Records Managers in the Information Age," *Archivaria* 36 (Winter 1993), 37-52.
[21] Cook, "Easy to Byte, Harder to Chew," 205.

the modern workplace. Indeed, it became clear to archivists that meaning was tied closely to communication processes and workplace relationships in this second-generation of records, where evidential properties surrounding the context of creation, structure, and contemporary use are critical to understanding actual informational content.

This change in use and output of computer systems required a re-conceptualization of archival practices and for some an affirmation of traditional archival principles. In this electronic world, archivists would first need to structure, then identify, and then capture records in a contextualized environment, where now they were unstructured, virtual, fleeting, devoid of context, and where they were often comprised of different textual, audio, and graphic components, and where record outputs could be found stored on countless digital media types, from tapes to disks, magnetic or optical, all with different designs of tracks, sectors, and data location codes. These new computer systems were dependent on relational contexts that were difficult or impossible to trace; and where diversity of form meant that not only was content not tied to its relational context, but that records could not be removed from the technological context of creation and use without losing their meaning. To some, like Terry Cook, the only way to deal with the multi-relational and dynamic new uses of computers was to document this complex "world of relationships, of interconnections, of context,"[22] rather than merely the output records thereby created. This re-focus on the contextual framework of records re-enforced the importance of provenance, the longstanding foundation of archival theory articulated early in published form in the influential Dutch *Manual for the Arrangement and Description of Archives*, originally published in 1898.[23]

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[22] Ibid.

[23] S. Muller, J. A. Feith, and R. Fruin, *Handleiding voor het Ordenen en Beschrijven vanArchieven* (Groningen:Erven B. Van der Kamp, 2d ed., 1920, originally 1898). Translation of the second Dutch edition by Arthur H. Leavitt published as *Manual for the Arrangement and Description of Archives* (New York: H. W. Wilson, 1940; 2d ed., 1968).

Structuring records to capture appropriate context, amidst a sea of transient data, thus became very important aspects of this second generation of electronic records. Records in this new electronic environment were fluid, transitory, and dynamic. Indeed, electronic records were accessed, added to, subtracted from, altered, and deleted, every day, even every second, often without a trace. This real-world dynamism in records creation and use prompted much scholarly effort to consider what actually constituted a record and what information technology systems were needed to create and then maintain and preserve records as opposed to merely data. In response to this fundamental question, freelance archival and museum consultant David Bearman first identified digital information that represents or engages in significant business "transactions" as the context that archivists should attempt to capture as evidential "records" as contrasted to mere data or information.[24] These transactions required the transmission of data from one point of origin to another, fixing the data at the point of that intersection as the record or "evidence" of that activity or use – in short, of its context. This initial conceptualization – though imprecise, open to interpretation and yet limiting at the same time – was a critical step in moving the second generation of archival responses forward during the early 1990s.

Through his early exploration of "record-ness," David Bearman emerged as the leading figure in the archival discourse of the late 1980s and early to mid-1990s. During this period, Bearman laid much of the foundation of the archival theory on electronic records that would come to dominate the discussion well into the twenty-first century. Alarmed at the lack of recordkeeping capability of computer systems in use by government, business, academics and individuals, Bearman recognized the "crisis of accountability brought on by the use of electronic information systems"

[24] Bearman, *Electronic Evidence*, 17.; and David Bearman and Ken Sochats, "Metadata Requirements for Evidence," in *Automating 21st Century Science – The Legal, Regulatory, Technical and Social Aspects of Electronic Laboratory Notebooks and Collective Computing in R & D*, Rich Lysakowski and Steve Schmidt, eds., (Sudbury, Mass: Team Science Publishing, 1996), 2.

producing de-contextualized data instead of evidence-centred records.[25] In order to create and capture the essential contextual data necessary for the creation of records over data, Bearman encouraged the collaboration of records managers, working with active records, and archivists, working with their end-products. Furthermore, Bearman argued that the complex interrelated nature of virtual records required archivists and information managers to view these records conceptually, rather than physically, as a focus on the physicality of computer-generated records was neither helpful nor possible to achieve in electronic-based systems.

Although Bearman claimed no adherence to a particular archival tradition, he looked to existing thought and practice for understanding and means of preserving electronic records. Borrowing from the European tradition of provenance, which employed organizational structure and creator biographies to add meaning to archival records, Bearman argued that a functional context-based approach to archiving electronic records offered the best hope of dealing with this new media, rather than the first-generation focus on content or physical medium.[26] Applying the principle of provenance beyond traditional organizational structure or personal biographies to descriptive functional data about the records themselves, about what they did and communicated, to whom, when, where, and why, Bearman argued, ensured that the necessary contextual information required to create and capture records, as opposed to data, would be available to archivists once the record was no longer required for business use.[27] By capturing and attaching crucial information (metadata) about how an organization creates, uses, and discards its digital information, records could be more easily, accurately, and contextually described and retrieved. Like the European tradition Bearman drew from, this description and retrieval was based on the functional mandate and administrative

[25] Bearman, *Electronic Evidence*, 3.
[26] David Bearman and Richald Lytle, "The Power of the Principle of Provenance," *Archivaria* 21 (Winter 1984), 162-172.
[27] Ibid.

histories/biographies of the creators, but then also added metadata about how the records themselves functioned as part of work processes.[28] The creation and linkage of data about the records, or metadata, at the time of creation and use was not unfamiliar to European archival traditions, in which little distinction was made between current and historical records. Indeed, the European tradition understood "archives" to mean both current and historical records, those in ministries of government and the sub-set of these in historical archives, even if managed separately by records managers, registry officials, or archivists. This re-purposing or blending of current and historical recordkeeping practices became a key component of Bearman's contributions during this period.

Recognizing that this essential metadata could best be captured in collaboration with records and information managers working with records in a current, active business environment, Bearman became a forceful proponent of greater ties between the records management and archival professions, more specifically with archivists playing a more active role in the up-front creation of essential metadata. Although the European archival tradition did not maintain significant divisions between archives and records management professions, by the 1930s North American practices had begun to split current from archival recordkeeping. Under the leadership of the then National Archives and Records Service in Washington and the then Public Archives in Ottawa, records management emerged as a distinct function apart from the need to ensure the long-term preservation of historically significant records.[29] This split was due in large part to the rapid growth and development of both government bureaucracies and the records they created. Voluminous records, fluid administration and the continuous nature of modern record groups, which could not be treated as discrete, self-contained collections, encouraged the split between the methodology and professions

[28] Ibid., 16.
[29] Jay Atherton, "From Life-Cycle to Continuum: Some Thoughts on the Records Management-Archives Relationship," *Archivaria* 21 (Winter 1986), 43-51.

dedicated to creating and maintaining records for short-term business use, from those dedicated to the long-term preservation of the much smaller portion as historical records.

By the late 1980s and early 1990s, collaborative links between North American records management and archival professions had suffered as a result of shifting concepts of current and archival records over the preceding half-century.[30] Archivists were generally considered to have differing methods, and distinct goals, to say nothing of different education and professional status, from records managers, the two separated by records crossing the archival threshold. Summing up this divide in 1986, Jay Atherton wrote:

> Traditionally, the archivist has viewed himself as a scholar, interested in research and certainly the intellectual equal of the professional historian and researcher .... Records managers, conversely, have viewed themselves as administrators, managers, interested in the development of systems and the increase of efficiency, with little interest in history or understanding of sophisticated historical research techniques.[31]

Although historians and archivists have benefitted greatly from the work of records managers -- who design, create, and maintain the filing systems, original (or contemporary) finding aids, and supporting documents of records, a portion of which end up in archives -- the threshold that divided active business records from archival records was maintained. The divide between these two professions was in large part due to the predominance of the concept of the records life-cycle, a two-phased conceptualization separating current administrative use of records from the historical sources found in archives. This conceptualization holds that the first, or records management phase of the life-cycle, consists of:

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[30] For more on the archivist as information or records manager, see Taylor, "Information Ecology and the Archives of the 1980s;" and Terry Cook, "From Information to Knowledge: An Intellectual Paradigm for Archives," *Archivaria* 19 (Winter 1985), 28-49.

[31] Atherton, "From Life-Cycle to Continuum."

- creation or receipt of information in the form of records,
- classification of the records or their information in some logical system,
- maintenance and ongoing administrative use of the records,
- long-term storage of "dormant" records still having occasional administrative use, and
- their disposition through destruction or transfer to an archives. [32]

The second, or archival, phase of this records life-cycle, consists of:

- appraisal and selection/acquisition of a small portion of the total records by an archives, having permanent value as historical or heritage sources,
- description of the records in inventories, finding aids, and the like,
- preservation of the records or, perhaps, the information in the records, and
- reference, use, and promotion of the information in these records for researchers, scholars, and the general public.[33]

For some, the purpose of this division was to ensure archival institutions did not disturb the natural or original order, as established by the records creators. These traditions hold that maintaining this original order , alongside the other records of the creator (*respect des fonds*) provide vital contextual information which gives records meaning. Interference by archivists before the record crosses that threshold would distort the meaning of the record. By challenging archivists to work more closely with records managers to ensure that records contained adequate contextual data for the long-term accessibility of electronic records, Bearman both re-enforced traditional values about the importance of provenance and context, and challenged the extent to which archivists should influence the ways in which records are created and maintained.

The bridging of the archival threshold suggested by Bearman was not, however, without precedence or practical examples. In challenging traditional obstacles that prevented the integration

[32] Ibid., 44.
[33] Ibid.

of records management and archival interests, Bearman also drew on the Australian tradition of Peter Scott's records continuum, which held that records move within a continuum, rather than typical sequential life-cycles of creation and active use, followed by a period of occasional use and dormant inactivity, and then ending by transfer to historical archives if the record has enduring value or by its destruction.[34] The Australian tradition emphasized the fluid nature of records operating in a continuum, where they are constantly moving through the stages of functions, creation, uses, alterations, communications, and preservation.

Vital in this type of conceptualization are the complex relationships within which records operate, including the relationship of creating, sharing, using, changing, and preserving recorded information. [35] Bearman built on this tradition by urging archivists to shift their focus away from the record itself to the record-creating and record-use processes. By looking at where records are situated, or the roles that records play within a particular recordkeeping system, or how they are queried, shared, altered, and erased, this functional context makes it possible to manage large amounts of data quickly and effectively. This is possible by managing consistent metadata containing these contextual connections in reasonable and searchable volumes, rather than in billions of discombobulated "floating" data streams that are created daily.

Bearman's conceptualization of records and re-affirmation of provenance also aligned with significant changes taking place in archival theory and practice at the same time, particularly with

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[34] For more on the Australian series-system see: Peter J. Scott, 'The record group concept : a case for abandonment', *American Archivist* Vol.29, No.4, (October 1966), 495-496; Clive Smith, "The Australian Series System," *Archivaria* 40 (Fall 1995), 86-93; and several chapters in *The Records Continuum: Ian Maclean and Australian Archives First Fifty Years*, Sue McKemmish and Michael Piggott eds., (Clayton: Ancora Press in association with Australian Archives, 1994), most notably Chris Hurley's "The Australian ('Series') System: An Exposition," 150-172.

[35] Unlike North American and European archival practice, the Australian archival tradition has long embraced this active link between archives and creator. For more on the archival continuum, or the Australian archival tradition, see Smith, "Australian Series System," and Piggott and McKemmish, *Records Continuum*.

regards to the appraisal of institutional records. In response to pressures at the then National Archives of Canada for appraisal of the rapidly increasing volumes of records created by the postwar Canadian government, as well as in response to pressures to codify and justify appraisal decisions, NAC archivist Terry Cook developed from 1989 to 1991 a radically different appraisal methodology designed to meet both challenges.[36] Cook, citing Bearman's work on provenance as having inspired his own re-evaluation of provenance, blended a top-down approach for researching and organizing the structures, functions, and workplace cultures of institutions with a bottom-up approach that looked to citizen-state interactions to assess the significance and archival value of records of the government of Canada. Instead of appraising record content for value according to perceived future research needs, and doing so at the end of their life-cycle once no longer required for active business use, Cook's appraisal methodology calls for appraisal of the functional, structural, and work-place cultures of an institution in relation to "points of special intersection" between citizens and the state (which he also called transactions), all of which takes place at the time of creation, while the records are still actively used.[37]

Dubbed "macroappraisal" for its initial high-level assessment and ordering of the functions and structures of the entire creating organization, Cook's methodology calls for the extensive research of the functions and structures of creators, the processes which generate records (regardless of media), and citizen-state transactions prior to, or at the same time, as records creation is taking place. This forms the basis of the appraisal of the functions and processes, and the targeting of specific transactions as sites where records documenting significant activities are likely to be found. Adopted as the official appraisal methodology of NAC in 1991, macroappraisal involves the conceptual organization of records according to functions, structures, and transactions. This fit

[36] For a comprehensive history and explanation of macroappraisal, see Terry Cook, "Macroappraisal in Theory and Practice: Origins, Characteristics, and Implementation in Canada 1950-2000," *Archival Science* 5 (2005), 101-161.
[37] Ibid., 128.

beautifully with Bearman's conceptual nature of records, free from the traditional bounds of physical arrangement and description, and was well-suited for the electronic environment of virtual or conceptual provenance. Macroappraisal's use of functional context and transactional records thus re-enforced Bearman's views on the importance of provenance (in its expanded form) and contributed significantly to his later efforts to develop the requirements for capturing electronic records at the site of these transactions.

Coming to similar conclusions as David Bearman, though by different means, was Luciana Duranti of the University of British Columbia. Duranti looked to diplomatics, a traditional methodology for identifying, evaluating and authenticating medieval manuscripts, to address the challenges presented by electronic records.[38] Diplomatics treats records as part of a logical system of memory, which may best be understood by investigating and establishing the laws, regulations, and administrative rules which created them. In this conceptualization, each record is comprised, internally, of essential elements or structures, which together provide the necessary information to provide context and meaning. These elements include the medium of the record, the content, the form (both the physical and intellectual format of the record), the persons acting or acted upon by the record, and the acts (the movements or transactions which are intended to create, maintain, or alter situations).[39] By examining the essential elements of the system that a record participates in, diplomatics can be used as a tool to determine what the record is, who created it where and when, what the activity that generated the record was and is, and therefore, using these factors, assess whether the record itself is authentic and reliable.

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[38] For more on diplomatic analysis, see Luciana Duranti, "New Uses for an Old Science (Part I)," *Archivaria* 28 (Summer 1989), 7-27.

[39] Luciana Duranti and Heather MacNeil, "The Protection of the Integrity of Electronic Records: An Overview of the UBC-MAS Research Project," *Archivaria* 42 (Fall 1996), 47; the project's documents and publications may also be found at: http://www.interpares.org/UBCProject/tem1.htm, accessed 1 April 2012.

Stemming from the traditional archival practice of understanding the meaning of isolated medieval manuscripts, diplomatic analysis stresses the importance of establishing the reliability and authenticity of records. According to Duranti, "reliability refers to the authority and trustworthiness of the records as evidence, the ability to stand for the facts they are about,"[40] which is essential in establishing the evidential value of records. Reliable records are therefore records which provide trustworthy evidence of activities. In establishing the reliability of records, diplomatic analysis looks at the form of the record and the procedure that created it. The form establishes the persons, places, or subjects of which the record is about, most significantly by the date (of the subject, activity, or record) and the signature assigning responsibility for the record content. The form is considered to be complete when the socio-juridical system in which the record exists recognizes it as containing the necessary elements for legitimacy. This acceptance of a record by the body that relies on similar records as evidence of activity is therefore a key element of determining reliability.

The second aspect of reliability comes from the procedure of creation, which refers to the body of rules which make up the documentary context of the record. Rules regarding authority, work processes, routines, and supplementary recording further establish the reliability of a record by situating it within the context of creation and use.[41] These rules may be applied to all manner of records, such as a memo, which may have a company name and logo, the name and contact information of both the sender and recipient, as well as the date on which it was sent. These pieces of contextual information indicate that the document contains the basic elements of a memo as conceived by a twentieth-century office environment. As such, the record may be considered to possess, at least to some extent, the requirements necessary to be a reliable record of activity.

[40] Luciana Duranti, "Reliability and Authenticity: The Concepts and their Implications," *Archivaria* 39 (Winter 1994-95), 5-10.
[41] Ibid.

While diplomatics arose in the late seventeenth century out of the need to authenticate records in a time where forgeries were commonplace and the original context lost centuries earlier, Duranti saw an analogous need to separate authentic records from often indistinguishable inauthentic records in the electronic environment. With countless pieces of data forming drafts, competing versions, and feeder documents, teasing out the document of "record" within an electronic environment was the key insight of diplomatic principles for the preservation of electronic records. While a reliable record has all the trappings of a trustworthy record (complete, controlled creation procedure, and reliable author), its authenticity is determined by extent to which the record is what it claims to be. According to Duranti, authenticity "warrants that the record does not result from any manipulation, substitution, or falsification occurring after the completion of its procedure of creation, and that it is therefore what it purports to be."[42] Authenticity is therefore derived from evidence of the reliability of a record after its creation by knowing about its subsequent transmission, storage, and preservation.

In the physical realm, this trustworthiness sought by diplomatics may be achieved by evidence of a seal, stamp, secure repository, or detailed chain of custody and control, among others. Duranti argued that authentication of electronic records could be achieved using electronic equivalents which fixed records, protected them throughout their lifetimes, and applied digital equivalents of seals or stamps to attest to its having remained as the author(s) intended. It is important to note that authenticity and reliability remain distinct and complementary aspects of trustworthy archival records. While a given record may be reliable, that is to say that the form and procedure of creation is understood and consistent with the administrative context in which it exists, it may not be authentic if, for example, the record cannot be proven to have been created by the

[42] Ibid., 7-8.

stated author, or not to have been subsequently tampered with or altered. Similarly, records which may be considered authentic may not necessarily be reliable, though this is less likely to occur as authenticity derives largely from reliability. Thus, Duranti posited that only records which are proven reliable and authentic may then be considered genuine or trustworthy records of activity.

When applied to electronic records therefore, diplomatic analysis relies on the affixing of signs, seals, and supporting information about creation and storage of the record (metadata) to demonstrate authenticity and reliability. This authenticity and reliability provides the warrant of trustworthiness of the record and therefore requires the use of clues found in the content, context and structure of the document to establish the ability of the record to provide evidence of activity. [43] Important in this method of study is the need to understand the context within which a document is created, accessed, and executed, as well as the relationships it represents. Duranti sought to apply these concepts to electronic records systems, arguing that "an understanding of procedures is the key to the understanding of information systems,"[44] and therefore the records they create.

The approaches represented by Bearman and Duranti, both recognizing the importance of defining and capturing recordkeeping context, though in different ways and from different intellectual and methodological frameworks, led to the two major research projects that would fundamentally shape archival responses to the crisis presented by electronic records. David Bearman went on to play a lead role in a research project conducted at the University of Pittsburgh School of Library and Information Sciences with co-investigator, Richard J. Cox, a professor there. Together, they sought to define archival recordkeeping functionality and related metadata requirements, to explore the challenges to the long-term retention of electronic records, and to develop practical tools

[43] Duranti, "New Uses for an Old Science (Part I)," and her "Reliability and Authenticity."
[44] Duranti, "New Uses for an Old Science (Part I)," 23.

to address them. And as the Pittsburgh project reached its midway point, Luciana Duranti began to make her own impact on this framework with the University of British Columbia Master's of Archival Studies Program project to investigate the preservation of the integrity of electronic records through the application of diplomatics.

These two projects relied heavily on the theoretical foundations and professional discourses discussed earlier in this chapter, which informed their approaches and shaped their conclusions. The projects Bearman and Duranti undertook in the 1990s went on to play the deciding role in the approaches, content, and structure of the later functional requirements and standards used to ensure the creation, use, maintenance, and preservation of electronic records. These two projects, their differences and their influence on the models that followed, are the subject of the following chapter.

Chapter Two

Diverging Streams Embodied by the Pittsburgh and UBC Projects

Modern functional requirements for the management of electronic recordkeeping systems are rooted in the theoretical traditions in which they were conceived. The explosion of data being created by information systems during the 1980s, and the resulting problems associated with the appraisal, arrangement, description, access, and preservation of electronically-produced records forced the archival profession to re-evaluate its core assumptions about records and the systems that create them. Some, like Luciana Duranti, saw "new uses for an old science," applying the long-standing tradition of diplomatics to the modern problems associated with electronic information systems. Others, like David Bearman, borrowed and adapted traditional notions of provenance to fundamentally change the ways in which the archival community conceived of itself and the recordkeeping systems it works with. From these two prominent figures in archival theory emerged two distinct approaches to the preservation of electronic records in the decades that followed. The different approaches represented by Duranti and Bearman were developed and articulated by the two major research projects into the preservation of electronic records they led during the 1990s.

Following up on the research he had conducted in 1980s and early 1990s, David Bearman joined a team of researchers at the University of Pittsburgh School of Library and Information

Science looking into electronic recordkeeping. The project was headed by faculty members Richard J. Cox and James Williams, and included a team of doctoral students (Wendy Duff, Ingjerd Skogseid, David Thomas, and David Wallace), with David Bearman serving as Project Consultant. While Bearman brought to the project years of experience writing about electronic records issues, working for a time with all the electronic information systems of the Smithsonian Institution, Richard Cox was himself an accomplished academic, active participant in the Society of American Archivists, Editor of the *American Archivist* from 1991 to 1995, and a former working archivist.

The three-year project (1993 to 1996) entitled *Variables in the Satisfaction of Archival Requirements for Electronic Records Management* was funded by the U.S. National Historical Publications and Records Commission (NHPRC) in response to growing concerns about the archival preservation of electronic records.[1] The Pittsburgh project, as it became known, considered the ways in which archival interests could align with those of records creators and records managers to ensure that sufficient metadata was added to records at the time of creation and subsequent use to enable them to stand as evidence. The multidisciplinary project brought together library, information, and archival science expertise to address the following issues:

1. Recordkeeping (including archival) functional requirements for electronic information systems;
2. Variables in organizations that affect the way in which both software and hardware are utilized and that may affect the degree to which recordkeeping functional requirements can be adopted;
3. Technical capabilities of organizational software products to satisfy recordkeeping requirements;
4. Other means, such as policy and standards, to satisfy recordkeeping functional requirements; and

[1] University of Pittsburgh Electronic Records Project, "Functional Requirements for Evidence in Recordkeeping," *Variables in the Satisfaction of Archival Requirements for Electronic Records Management* (Pittsburgh, PA: University of Pittsburgh, School of Information Sciences, 1997), available at http://www.sis.pitt.edu/~bcallery/pgh/MainPage.htm, accessed on 1 April 2012.

5. Effectiveness of technology and policy strategies to ensure that archival interests can be met.[2]

The project focused on defining the problems associated with records produced in the electronic office environment on second-generation computing, and with the development of core system requirements that would address these issues.[3] Its principal research methodology was to look at many examples in a dozen sectors of society to see how those who faced huge risks without reliable records actually operated, and then to generalize from those real-world examples the functional requirements for good digital recordkeeping. A further key assumption was based on Bearman's conceptualization of records as opposed to data or information. As discussed in Chapter One, Bearman identified records in the electronic environment as being the result of a business transaction, which must contain sufficient and integrated content, context, and structure to make them stand apart from the myriad decontextualized bits of data found in all recordkeeping systems. The evidence of the nature of these transactions thus became the target of the functional requirements designed to capture the content, context, and structure required to create, manage, use, and preserve electronic records as evidence.

The foundational assumptions of the Pittsburgh project held that the basic requirements needed to satisfy the archival management of traditional physical records could be applied to electronic systems. Thus, the project sought to establish the functional requirements essential for creating, maintaining, using, and preserving records if they are to serve as reliable evidence, as records which adhere to legal, financial, and professional standards for authentic documentation of human or organizational activity. Once these functional requirements were established, the project

[2] Richard J. Cox, University of Pittsburgh Electronic Records Project, "Proposal," available at http://www.sis.pitt.edu/~bcallery/pgh/Proposal.htm, accessed 1 April 2012.
[3] For more on the generational responses, see Terry Cook, "Easy to Byte, Harder to Chew: The Second Generation of Electronic Records Archives," *Archivaria* 33 (Winter 1991-92), 202-216.

set out to produce the means by which to satisfy the requirements through four distinct or tactics: "Policy," which was conceived as procedural rules for the creation and use of recordkeeping systems; "Design," which was the integration of requirements into building new recordkeeping systems; "Implementation," which was the application of functional requirements to existing electronic systems; and "Standards," which consist of generalized information technology standards and guidelines which supported the recordkeeping requirements, issued by national and international standards organizations, or major institutions.[4]

In order to establish the functional requirements for evidence in recordkeeping, the Pittsburgh project methodology called for collection and analysis of recordkeeping practices in public- and private-sector environments where sound recordkeeping was an area of concern, and current best practices were in place. The gathered data was compiled into a compendium of statements or requirements according to broad professional areas (lawyers, auditors, records managers, information technologists, senior managers, medical, and pharmaceutical professionals, financial and banking, nuclear industry, etc.), which described their records systems and justifications of their particular requirements. These policy statements established the basic requirements for records as evidence, or the literary or social warrant, for each area, which were then distilled into core functional requirements needed for the preservation of electronic records. The resulting functional requirements, if met, would ensure the creation, capture, maintenance, use, accessibility, and preservation of electronic records which could be relied on as evidence, both in the present and long into the future.

[4] Cox, University of Pittsburgh Electronic Records Project, "Variables in the Satisfaction of Recordkeeping Requirements."

The functional requirements were separated into five main areas and thirteen sub-categories, some of which received further breakdowns. In total, the Pittsburgh project established a total of nineteen requirements:

CONSCIENTIOUS ORGANIZATION

1. Compliant

ACCOUNTABLE RECORDKEEPING SYSTEM

2. Responsible
3. Implemented
4. Consistent

CAPTURED RECORDS

5. Comprehensive
6. Identifiable
7. Complete
    a). Accurate
    b). Understandable
    c). Meaningful Authorized
8. Authorized

MAINTAINED RECORDS

9. Preserved
    a. Inviolate
    b. Coherent
    c. Auditable
    Removable

USABLE RECORDS

    Exportable
    Accessible
    a. Available
    b. Renderable
    c. Evidential
13. Redactable[5]

[5] University of Pittsburgh Electronic Records Project, "Functional Requirements for Evidence in Recordkeeping."

Conscientious Organization included requirements related to the internal and external legal and administrative responsibilities particular to the creating organization. Within Conscientious Organization were the requirements for knowing, describing, and adhering to the legal, regulatory, and best practices of the creating business, as well as a requirement to track and make changes to recordkeeping instructions as the environment changed. Within this section was the requirement for compliance with the socio-juridical environment in which the system exists:

1. Compliant: Organizations must comply with the legal and administrative requirements for recordkeeping within the jurisdictions in which they operate, and they must demonstrate awareness of best practices for the industry or business sector to which they belong and the business functions in which they are engaged.

    a. External recordkeeping requirements are known.

        i. Laws of jurisdiction with authority over the record creating organizations are known.
        ii. Regulatory issuances of entities with administrative authority over the record creating organizations are known.
        iii. Best practices of recordkeeping established by professional and business organizations within the industry and business functions of the organization are known.

    b. Records created by organizational business transactions which are governed by external recordkeeping requirements are linked to an internal retention rule referencing the documented law, regulation, or statement of best practice.

    c. Laws, regulations, and statements of best practice with requirements for recordkeeping are tracked so that changes to them are reflected in updated internal recordkeeping instructions.

Accountable Recordkeeping System concerned the establishment and adherence to recordkeeping policies, responsibilities, and methodologies. This section consisted of requirements relating to responsible recordkeeping practices supported by policies, procedures, defined roles and responsibilities, and backup procedures in case the system fails, as well as requirements for the

recordkeeping systems to be regularly and routinely employed, and for their consistent application, so that their results may be logical and repeated outside the system:

2. Responsible: Recordkeeping systems must have accurately documented policies, assigned responsibilities, and formal methodologies for their management.

    a. System policies and procedures are written and changes to them are maintained and current.
    b. A person or office is designated in writing as responsible for satisfying recordkeeping requirements in each system.
    c. System management methods are defined for all routine tasks.
    d. System management methods are defined for events in which the primary system fails.

3. Implemented: Recordkeeping systems must be employed at all times in the normal course of business.
    a. Business transactions are conducted only through the documented recordkeeping system and its documented exception procedures.
    b. No records can be created in the recordkeeping systems except through execution of a business transaction.
    c. Recordkeeping systems and/or documented exception procedures can be demonstrated to have been operating at all times.

4. Consistent: Recordkeeping systems must process information in a fashion that assures that the records they create are credible.

    a. Identical data processes permitted by the system must produce identical outcomes regardless of the conditions under which they are executed.
    b. Results of executing systems logic are demonstrable outside the system.
    c. All operational failures to execute instructions are reported by the system.
    d. In the event of system failures, processes under way are recovered and re-executed.

Captured Records concerned the creation of authoritative records, which included separate requirements for: Comprehensive records, which specify that all transactions between humans and between humans and machines must generate a record; Identifiable records, that specify that records are to be linked to a particular transaction through unique identifiers; Complete records, that specify that records must contain the content, context and structure of the linked transaction through quality

control measures for accurate content, for the display and access (rendering) of the record as intended by the creator, and for the inclusion of information describing the nature of the record so as to make it meaningful (source, time, transaction, and linkage to other transactions or to other related records); and Authorized records, which specify requirements for documented and authorized creators of records:

5. Comprehensive: Records must be created for all business transactions.

    a. Communications in the conduct of business between two people, between a person and a store of information available to others, and between a source of information and a person, all generate a record.
    b. Data interchanged within and between computers under the control of software employed in the conduct of business creates a record when the consequence of the data processing function is to modify records subsequently employed by people in the conduct of business.

6. Identifiable: Records must be bounded by linkage to a transaction which used all the data in the record and only that data.

    a. There exists a discrete record, representing the sum of all data associated with a business transaction.
    b. All data in the record belongs to the same transaction.
    c. Each record is uniquely identified.

7. Complete: Records must contain the content, structure, and context generated by the transaction they document.

    a. Accurate: The content of records must be quality controlled at input to ensure that information in the system correctly reflects what was communicated in the transaction.
        i. Data capture practices and system functions ensure that source data is exactly replicated by system or corrected to reflect values established in system authority files.
    b. Understandable: The relationship between elements of information content must be represented in a way that supports their intended meaning.
        i. Meaning conveyed by presentation of data are retained or represented.
        ii. System defined views or permissions are retained and the effects are reflected in the record represented.
        iii. Logical relations defined across physical records are retained or represented.

iv. Software functionality invoked by data values in the content of the record are supported or represented.

c. Meaningful: The contextual linkages of records must carry information necessary to understand correctly the transactions that created and used them. Meaning conveyed by presentation of data are retained or represented.
    i. The business rules for transactions, which minimally locate the transaction within a business function, are captured.
    ii. A representation of the source and time of the transaction which generated a record is captured.
    iii. Links between transactions which comprised a single logical business activity are captured.

8. Authorized: An authorized records creator must have originated all records.

a. All records have creators which are documented.
b. Records creators must have been authorized to engage in the business that generated the record.

Maintained Records covered the storage and preservation of records, including requirements for the preservation of content, context and structure over time and across software and hardware environments, as well as requirements for auditable systems to guarantee protection against unauthorized deletion, alteration or loss, while still allowing for authorized changes to the record:

9. Preserved: Records must continue to reflect content, structure and context within any systems by which the records are retained over time.

a. Inviolate: Records are protected from accidental or intended damage or destruction and from any modification.
    i. No data within a record may be deleted, altered, or lost once the transaction which generated it has occurred.

b. Coherent: The information content and structure of records must be retained in reconstructible relations.
    i. If records are migrated to new software environments, content, structure, and context information must be linked to software functionality that preserves their executable connections or representations of their relations must enable humans to reconstruct the relations that pertained in the original software environment.

ii. Logical record boundaries must be preserved regardless of physical representations.

c. Auditable: Record context represents all processes in which records participated
   i. All uses of records are transactions.
   ii. Transactions which index, classify, schedule, file, view, copy, distribute, or move a record without altering it are documented by audit trails attached to the original record.

10. Removable: Records content and structure supporting the meaning of content must be deletable.

   a. Authority for deletion of record content and structure exists.
   b. Deletion transactions are documented as audit trails.
   c. Deletion transactions remove the content and structural information of records without removing audit trails reflecting context.

Useable Records, which ensured the accessibility of records, including requirements for exporting records to other systems and back without changes to the record, for accessibility, availability, and renderability in either print or electronic output as it was originally intended, and for the ability to retain a record of redacting a portion or the whole of the record:[6]

11. Exportable: It must be possible to transmit records to other systems without loss of information.

   a. Exporting protocols should be reversible.
   b. Functionality should be represented in a fashion that produces the same result in the target system as in the originating environment.

12. Accessible: It must be possible to output record content, structure, and context.

   a. Available: Records must be retrievable.
   b. Renderable: Records must display, print, or be abstractly represented as they originally appeared at the time of creation and initial receipt.

[6] Ibid.

i. The structure of data in a record must appear to subsequent users as it appeared to the recipient of the record in the original transaction or a human meaningful representation of that original rendering should accompany the presentation of the original context.

c. Evidential: Record's representations must reflect the context of the creation and use of the records.

13. Redactable: Records must be masked when it is necessary to deliver censored copies and the version as released must be documented in a linked transaction.

a. The release of redacted versions of a record is a discrete business transaction.
b. The fact of the release of a redacted version of a record is an auditable use of the original record and therefore results in creation of an audit trail with a link to the transaction which released the redaction.[7]

In each of these areas, detailed statements established the essential components found in trustworthy records which could be relied on as evidence. The development and articulation of the nineteen functional requirements marked a significant accomplishment for the project. With these core requirements, a baseline set of necessary elements was established which, if implemented, would ensure the creation, maintenance, ready and accurate use, and preservation of electronic records as evidence for both records management and archival systems. While the functional requirements did provide statements of essential recordkeeping elements which could be used to design recordkeeping systems, they were in this form imprecise and therefore difficult to implement in a real world environment. Most challenging was the fact that they did not offer specific or testable system requirements, which meant they could not be easily applied to either existing systems or used for systems design. Additional products would be needed and further refinement of the functional requirements necessary in order to ensure real-world application of their findings.

To this end, in addition to developing and articulating the functional requirements, the Pittsburgh project also released a number of complementary reports and publications designed to

[7] Ibid.

support the practical application of the functional requirements and to expand on the initial findings of the project. Forming a "Framework for Acceptable Business Communications" alongside the functional requirements were production rules (a string of code used for the design and testing of software systems), and metadata specifications which were designed to satisfy the functional requirements articulated by the project.[8] The production rules were developed by David Bearman and Ken Sochats using artificial intelligence language to express the functional requirements as unambiguous, consistent, specific, and therefore observable and testable requirements which could be used to design and evaluate software systems.[9]

The metadata specifications marked a significant contribution to the goals of the project by establishing clearly defined contextual information necessary to create, maintain, preserve, and make accessible trustworthy records over time. Use of these metadata specifications would ensure a given record would be encapsulated along with necessary information about how to locate and make sense of the record; about the structure necessary to render or migrate it; about its provenance and context; about the content of the record; and about the ways in which it has been used.[10]

While these metadata specifications were essential to demonstrating the authenticity and reliability of records, they did not however address other essential non-records related requirements that are necessary for business communication, including access rights management, search and retrieval, retention and disposition, and security capabilities. To address the need for such additional functionality, the Pittsburgh project also produced a "Reference Model for Business Acceptable

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[8] University of Pittsburgh Electronic Records Project, "Metadata Specifications," http://www.sis.pitt.edu/~bcallery/pgh/MetadataSpecifications.htm, accessed 1 April 2012.
[9] David Bearman and Ken Sochats, "Formalizing Functional Requirements," (unpublished draft paper included in University of Pittsburgh Recordkeeping Functional Requirements Project: Reports and Working Papers, LIS055/LS94001, September 1994), available at http://www.archimuse.com/papers/nhprc/BACartic.html, accessed 1 April 2012.
[10] University of Pittsburgh Electronic Records Project, "Metadata Specifications."

Communications," which included both essential, or mandatory, recordkeeping requirements along with desirable additional or optional business requirements in a six-module, or layered, structure:

1. Registration: concerning the capture, ingestion, declaration, classification or identification of a record within a recordkeeping system
2. Terms & Conditions: concerning the management of access, use and retention rights and responsibilities
3. Structure: concerning the description of a record which makes it renderable and accessible as intended by the creator
4. Context: concerning the description of the factors contributing to authorship, including the originator and recipient of the record, the nature of the business transaction and function that created it, and any linkages to other records or specific users
5. Content: concerning the description of the record content
6. History of Use: concerning the description of how the record was used, altered, redacted, disposed, etc. [11]

These layers represented the first integration of requirements for authenticity and reliability with the additional requirements necessary for acceptable business communication in an electronic environment. It marked an important evolution in the archival response to the challenges presented by electronic records by recognizing and incorporating recordkeeping needs (both active and inactive) with the business needs of users in a set of specific and testable requirements. Implementation of the reference model, the project concluded, could be achieved in one of two ways: either by organizations developing and implementing their own methods to meet the model's criteria, or more likely, they would need to adopt a set of standards which software and hardware vendors would have to meet.[12] Other contributions of the Pittsburgh project included various working papers, progress reports, bibliographies, and project committee meeting minutes. However, in a painful and

[11] David Bearman, University of Pittsburgh Electronic Records Project, "Towards a Reference Model for Business Acceptable Communications," (December 6, 1994), available at http://www.sis.pitt.edu/~bcallery/pgh/Bearman_TowardaReferenceModel.html, accessed 1 April 2012.
[12] Ibid.

ironic twist, much of the original content of the Pittsburgh project was lost during a University-wide server migration in the mid 1990s. What remains of the original website (the primary repository for the project itself) has been partially recovered by the Internet Archive's "Wayback Machine" and the University of Pittsburgh's Miranda Nixon in 2008, though not without highlighting the precarious position of electronic records.[13]

Despite the loss of the Pittsburgh project's original website and repository, the project made several important contributions to future efforts to create and maintain records over time. Most notably, the project established the literary and social warrant for functional requirements for the preservation of electronic records as evidence. The project confirmed that the fundamental properties of a system that creates and maintains records with integrity could be defined, and that the requirements for such a system could be satisfied through a combination of policy, design, implementation, and standards.[14] In these ways, the project also reaffirmed traditional archival concepts that stressed the importance of creating and maintaining informational content, context and structure in an integrated fashion in order to add meaning to data or information.[15] The project also developed metadata standards and production rules which could be used to test and design systems that would meet the functional requirements set out by the project, which would be particularly useful models for the projects that followed, and indeed for the evolution of international functional requirements themselves by other researchers over the next two decades.

The impact of the foundations established by David Bearman, Richard Cox, and the rest of the Pittsburgh project team cannot be overstated. This work, however, was not accepted without

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[13] University of Pittsburgh School of Information Sciences, "Pittsburgh Project Group," compiled by Miranda Nixon, April 2008, http://www.sis.pitt.edu/~bcallery/pgh/index.htm, accessed 1 April 2012.
[14] David Bearman, *Electronic Evidence: Strategies for Managing Records in Contemporary Organizations*, (Pittsburgh, PA: Archives & Museum Informatics, 1994).
[15] Ibid., 13.

criticism by archivists and scholars. While strongly supporting and himself building on the contributions of Bearman and Pittsburgh project, Terry Cook noted seven points of critique for developing these contributions.[16] Cook argues that the Bearman and Pittsburgh project definition of a record (as the documentary evidence of business transactions) privileged institutional and organizational creators to the exclusion of individual creators, whose activities often do not conform to the business transaction model and therefore do not create "records" as Bearman had defined them.[17] This critique was also made by Paul Marsden, a digital-information archivist at the National Archives of Canada, who noted that this definition is an "over-simplification of the concept of a record," because it "potentially excludes from the status of records documents with long term legal and evidential value," such as dynamic databases relied on to make policy decisions, yet where no true "transaction" takes place.[18] Cook also argued that under the Pittsburgh project model, the valuable contributions of archivists, both as links between end-users and the records, and their research into context over time and space, as well as the custodians of many archival electronic records, was underplayed, even if as Bearman's "last bastion." Metadata, Cook argued, while providing essential contextual and structural information about a record, cannot replace the rich archival description needed to make sense of records long removed from original creation and use, as implied by Bearman and the Pittsburgh project. Similarly, archives have proven over centuries to be judicious and responsible custodians of archival records, whereas Cook points out, for the long-term, "no non-archival agency or operating line department of government has ever shown itself willing to look after archival records."[19]

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[16] Terry Cook, "The Impact of David Bearman on Modern Archival Thinking: An Essay of Personal Reflection and Critique," *Archives and Museum Informatics* 11 (1997), 15-37.
[17] Ibid., 29.
[18] Paul Marsden, "When is the Future? Comparative Notes on the Electronic Record-Keeping Projects of the University of Pittsburgh and University of British Columbia," *Archivaria* 43 (Spring, 1997), 163.
[19] Cook, "Impact of David Bearman," 32.

Also lacking in the Pittsburgh project's functional requirements, Cook argued, was a plan to address legacy systems that did not, and never would, create records embedded with the necessary metadata specified by the functional requirements. This would be, at least in part, addressed by the second major electronic-records research project during 1990s by the University of British Columbia project, entitled-*The Preservation of the Integrity of Electronic Records*.[20] Funded by a three-year grant from the Social Sciences and Humanities Research Council of Canada (SSHRCC) between 1994 and 1997, the project was headed by professors Luciana Duranti and Terry Eastwood at the University of British Columbia School of Library, Archives and Information Studies (UBC-SLAIS). While Duranti's specialization in diplomatic analysis served to underpin the project's theoretical orientation, Eastwood also brought his extensive experience as a working archivist and long-time academic to the project. Eastwood chaired the UBC Masters of Archival Studies program from 1981 to 2000, during which time he played an active role in archivy, producing numerous publications on arrangement, description, appraisal, information technology and archival science.[21] Also contributing to the project with both research and publications was then doctoral student Heather MacNeil, who later taught at UBC and is now Associate Dean at the University of Toronto's Faculty of Information.

The aim of the three-year UBC project was to establish the functional requirements necessary to create, handle, and preserve authentic and reliable electronic records.[22] The driving principles of

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[20] For an overview of the findings of the UBC project, see Luciana Duranti and Heather MacNeil, "The Protection of the Integrity of Electronic Records: An Overview of the UBC-MAS Research Project," *Archivaria* 42 (Fall 1996), 46–67; the complete products and findings of the UBC project may also be accessed at http://www.interpares.org/UBCProject/index.htm, accessed 1 April 2012.

[21] For a select sample of his work, see his, "The Origins and Aims of the Master of Archival Studies Programme at the University of British Columbia," *Archivaria* 16 (Summer, 1983), 35-52; "From Practice to Theory: Fundamentals US Style," *Archivaria* 39 (Spring 1995), 137-150; and "Towards a Social Theory of Appraisal," in *The Archival Imagination: Essays in Honour of Hugh A. Taylor*, Barbara L. Craig, ed. (Ottawa: Association of Canadian Archivists, 1992).

[22] Duranti and MacNeil, "Protection of the Integrity of Electronic Records."

the project, including concepts of authenticity and reliability, stemmed from Duranti's extensive work on the long-standing practices of diplomatics. As noted earlier, diplomatics is an auxiliary "science" of historical analysis at the level of the individual document, to assess its internal characteristics as a means to discover its context. As such, the project used the methods and concepts traditionally employed in the authentication and verification of medieval manuscripts to identify and then define, in an analogous way, the core requirements for the production of authentic and reliable electronic records. This meant that a key piece of the conceptual framework was the diplomatics' understanding of a record, which must consist of content, or facts the record speaks of; form, or the physical and intellectual manifestations of the content; persons involved, including the author, the writer, the addressee, the witness, and the person validating the record; as well as acts, or transactions to which the record attests.[23] Although the language used to label these key elements of a record differed somewhat from those established by the Pittsburgh project, corresponding elements of the core concepts are easily found between the two. While diplomatic analysis was able to provide much of the conceptual foundation of the research project, the project also drew from concepts of archival science to conduct analysis on bodies of aggregated records, rather than at the level of the individual document, a necessity because of the volume and interdependence of records in the electronic environment. With these foundations, the research objectives of the UBC project were:

- to establish what a record is in principle and how it can be recognized in an electronic environment;
- to determine what kind of electronic systems generate records;
- to formulate criteria that allow for the appropriate segregation of records from all other types of information in electronic systems generating and/or storing a variety of data aggregations;

[23] UBC project, "Template 1: What is a record in the traditional environment," available at http://www.interpares.org/UBCProject/tem1.htm, accessed 1 April 2012.

- to define the conceptual requirements for guaranteeing the reliability and authenticity of records in electronic systems;

- to articulate the administrative, procedural, and technical methods for the implementation of those requirements; and

- to assess those methods against different administrative, juridical, cultural, and disciplinary points of view.[24]

The project began by establishing the theoretical constructs of records that constitute evidence of activity. As noted earlier, the diplomatics conceptualization of trustworthy records is determined by authenticity (records deemed to be genuine by the degree to which they conform to known modes or forms, and by the integrity of the collection, delivery, reception, storage, and preservation procedures) and reliability (records deemed to be trustworthy by the degree to which they are complete, the degree to which their creation was part of a controlled procedure, and the degree to which the author may be relied upon).[25] As with the key elements of a record, corresponding concepts of comprehensive, identifiable, complete and authentic records are also found in the findings of the Pittsburgh project, though arrived at by different means. Using these concepts, the UBC project developed eight templates that set out the parameters of each of the following terms, as defined by diplomatics, and archival science:

1. A traditional record: according to diplomatics as a record consisting of medium (material form), content, form (the socio-juridical procedural rules governing the record), persons (the agents of a record), and acts (the intended actions of the record), along with concepts derived from archival science of creator (the person or entity who makes or receives the record) and the archival bond (the relationship between records and their creator, the actions in which they participate, and other records).

2. A traditional record that is complete: defined as a record that has all of the necessary elements of form required by the juridical context in which it is created. Although there are many other elements, the minimum required elements include date, superscription or

[24] Duranti and MacNeil, "Protection of the Integrity of Electronic Records."
[25] Luciana Duranti, "Reliability and Authenticity: The Concepts and their Implications," *Archivaria* 39 (Winter 1994-95), 5-9.

attestation (identification of the author), inscription (identification of the addressee), and disposition (identification of the action).

3. A traditional record that is reliable: as noted, a reliable record is deemed to be trustworthy by the degree to which it is complete (see above), by the procedural controls which govern its creation, and by the extent to which the author is reliable. The minimum required elements include name of the recipient, date of receipt, and classification code (registration number which provides information about the nature of the relationship of a record to the larger body of records to which it belongs).

4. A traditional record that is authentic: as noted, an authentic record is deemed to be genuine by the method by which it is communicated over time, which requires security to ensure the record remains reliable over space and time.

5. An electronic record: an electronic record must consist of medium (e.g. hard drive), content, form (must be readable and intelligible), persons (authors, addressee, etc.), acts (actions), archival bond (the relationship that links the record to others within a group of related records), and transmission (there must be intent and capacity to communicate).

6. An electronic record that is complete: complete electronic records must have the elements required for traditional records (date, superscription or attestation, inscription, and disposition), but with additional information, including chronological date, topical date, entitling (originating address), receivers, and title or subject.

7. An electronic record that is reliable: as traditional reliable records, an electronic record's reliability stems from its completeness, the degree to which its creation procedure is controlled, and/or its author's reliability. The minimum required elements for electronic records which are reliable include date, time, author, addressee, subject, name of the recipient, date of receipt, and classification code, and registration number, if applicable.

8. An electronic record that is authentic: as with a traditional record that is authentic, the authenticity of an electronic record is derived from its mode, form, and/or state of transmission, and/or manner of preservation and custody. This requires controlled administrative procedures and strenuous security systems which ensure the integrity of the transmission over time and space.[26]

The definitions arrived at constituted the research team's functional requirements for ensuring authentic and reliable electronic records. Though the methodology used to establish them,

[26] For detailed definitions, see UBC project, templates 1-8.

as well as their form (deductive definitions from theory), and language differed from those of the Pittsburgh project, both sets of requirements articulated the same core essential elements required to create, maintain, use, and preserve electronic records that would be trustworthy evidence. A principal difference, however, was that while the UBC project reinforced traditional archival concepts that focused on the individual record or record group as the object of appraisal, arrangement, description, and preservation efforts, the functional requirements developed by the Pittsburgh project were designed to appraise, evaluate, and model recordkeeping systems. This marked a key difference in their approaches, which then determined the tools they inspired. The UBC project, rooted in Canadian and European archival traditions, concluded that, as with physical records, there can only be one creating entity, whether individual, group or organization, and that information about the context of creation derived from the arrangement (original order) of records contributes significantly to the meaning of a record. These traditions held that records preservers must receive a body of records from the creator (acquisition) in order to appraise them (authenticate), arrange them (situate them within other records of the creator), affix metadata to enable search and retrieval (description), and to ensure their accessibility over time (preservation). The intention was for the preserver of electronic records to use provenancial information to carry out traditional archival functions in a familiar way.

Bearman, however, envisioned electronic recordkeeping systems that applied metadata directly to individual records at the site of the business transaction, which allowed for representation of the complex and multi-faceted relationships at play in actual business processes. This virtual arrangement and re-arrangement of records during all phases of the recordkeeping processes enhanced the Australian series and records continuum models, opening up new possibilities for documenting multiple relationships between records, their creators, and other records. Rather than having preservers pool records once they were no longer active, appraising them, acquiring them,

then arranging, describing and making them available, Bearman argued that the metadata should be applied at the transaction level, based on the functional context of creation and use within a system where they can move freely through the records continuum. Bearman held that provenance is best understood within the origins of a creating system or activity, where the system or activity (with multiple authors and contributors) functions as the creator. This different type of provenance was one in which the recordkeeping systems themselves, and the functions they represent, become the provenance, rather than the individual or corporate authors, and the sites of activity (transactions) become the sites where electronic records are created, captured, and registered.[27] Recordkeeping systems have "concrete boundaries and definable properties," Bearman argued, which "solve the problems identified with the concepts of fonds, record groups, and series…[and] give archivists new tools with which to play an active role in the electronic age."[28] The active role envisioned by Bearman and the Pittsburgh project was one where archivists collaborate with records creators to identify the site at which records are created (appraisal of transaction) and to ensure the necessary metadata is affixed in order to capture, arrange, describe, and preserve records over time. Unlike the Pittsburgh project, which sought to define the system that creates and maintains recordness, the UBC initiative sought "to formulate criteria that allow for the appropriate segregation of records from all other types of information in electronic systems,"[29] specifically in non-current or archival circumstances.

This conceptual difference meant that the functional requirements generated by the Pittsburgh project were ready-made to design and test recordkeeping systems, while those generated by the UBC research team (which provided the tools necessary to identify and separate authentic and reliable records as opposed to recordkeeping systems) required further refinement before being

[27] Bearman, *Electronic Evidence*, 30.
[28] Ibid., 34.
[29] Duranti and MacNeil, "Protection of the Integrity of Electronic Records," 47.

applied to systems design or tools for the application of metadata. In order to do so, the UBC research team used the functional requirements generated from their analysis to form models from which procedural rules for creating, handling, and preserving electronic records could be formed. The project did this with help from the U.S. Department of Defense Records Management Task Force (DoDRMTF), which was at the time of the UBC project seeking ways to communicate recordkeeping needs to its systems developers. Thus, from January 1995 to October 1996, the UBC researchers collaborated with the DoDRMTF to develop the means to articulate the functional requirements established by the team in a way that could be used by systems developers to design and test recordkeeping systems. Rather than using metadata standards or production rules, as the Pittsburgh project had done, the UBC project relied on the DoDRMTF's own internal Integration Definition for Function modelling technique (IDEF) to graphically express the requirements.[30]

The result was a series of thirteen activity models and a complementary entity relationship model which defined all the entities involved in recordkeeping activities, as well as the scope, nature, and context of potential activities, and the relationships between them. These templates could then be used to develop detailed procedural rules for creating, handling, and preserving records, though this was not within the scope of the UBC-MAS research project.[31] The additional step of using the models developed by the UBC research team to articulate textual, testable, specific functional requirements was done in collaboration with the U.S. Department of Defense under a successor project, which in 1997 released the first and most well-known of the functional requirements for recordkeeping systems: *DoD 5015.2-STD, Design Criteria Standard for Electronic Records*

[30] Ibid., 48.
[31] Ibid.

Management Software Applications (known simply as DoD 5015.2 or the DoD standard)[32]. While the DoD standard was based almost exclusively on the UBC project findings and within the timeframe of both the Pittsburgh project and the UBC project, it marked a significant departure from the content and form of either of the two seminal projects. As such, the DoD standard will be looked at in more detail in Chapter Three, along with other similar functional requirements.

In addition to the functional requirements and the activity models developed by the UBC research team, the project also produced a number of important findings for future research and development. The team divided these findings into two distinct areas or phases, which further underscored key differences between the UBC and Pittsburgh projects. The first area was defined by methods employed by creators and users of active and semi-active records to ensure authentic and reliable electronic records (records management), while the second concerned the long-term maintenance and preservation of authentic and reliable electronic records by archives and secondary custodians (records preservation).[33] This separation was due to clear philosophical differences between the UBC project and the Pittsburgh project, which did not separate active recordkeeping needs from those of inactive or archival needs.

The UBC team concluded that the two-phase conceptualization of recordkeeping systems discussed in Chapter One remained essential for creating, maintaining, and preserving records in the electronic environment. As noted, in the active and semi-active phase, creators and records managers were responsible for imposing procedures and methods for ensuring authenticity and reliability through creation, classification, monitored use, maintenance, and disposition over the short term of a few years. In the archival stage, archival repositories and archivists were responsible for imposing

[32] Department of Defense, United States, *DoD 5015.2-STD, Design Criteria Standard for Electronic Records Management Software Applications* (Washington: Assistant Secretary of Defense for Command, Control, Communications, and Intelligence, 2007).
[33] Ibid.

procedures and methods for the selection, description, arrangement, preservation, and access of authentic and reliable records over the long term. This necessarily assumed that the needs of records creators and current users differed significantly from those of archivists preserving and making accessible records for historical purposes, and that the creators of active records were those best suited to ensure authenticity and reliability for their own business purposes, while preserving bodies (primarily archives) were best suited to ensuring authenticity and reliability over time. Specifically, the UBC project concluded that creators had a direct business interest in maintaining the trustworthiness of records that were active or semi-active, but that once the records were no longer needed for business purposes, the assurances that come with an active reliance on the authenticity and reliability of records disappear.[34] At that point, for the portion of the record appraised and acquired as archival, the archivist would take over these responsibilities.

Within this two-phase conceptualization, the capabilities of each phase also necessitated the physical and intellectual separation of current recordkeeping practices from archival preservation. The UBC project concluded that records in active environments are dynamic, constantly changing, moving, and altering the documentary context within which they exist. Maintaining and preserving integrity during this phase is neither the goal of the creator (as it would prevent the creation and active use of business records), nor is it within their capability to control (dynamic recordkeeping systems are naturally unstable). Only once the records are removed from the active recordkeeping system (where each addition, deletion, edit, etc. adds new information to the archival bond) can they be managed to preserve their integrity over time.[35] And only in this fixed state, posited the UBC researchers, could records be selected, arranged, described, and preserved in large volumes, at the series level. While Bearman and the Pittsburgh project also recognized the dynamic nature of

[34] Ibid., 60.
[35] Ibid.

recordkeeping systems, their functional requirements focused on designing and implementing recordkeeping systems that created and maintained the necessary metadata at the item-level to allow for all aspects of recordkeeping (management of active, semi-active, and inactive and archival records within a single recordkeeping system), rather than on isolating, segregating and preserving records intended to stand as evidence of activity.[36] The only reason this had not been done in traditional archival practices, argued Bearman, was because it was impractical to affix such detailed metadata at the document-level in modern organizations. Given that it was possible to program technologies to do this automatically, records could be aggregated in multiple ways, more accurately reflecting their creation and use. The UBC interpretation assumed that records within current recordkeeping systems are driven exclusively by the item-level needs of individual creators, until such time as they can be aggregated at higher levels. Only once these records became inactive, concluded the UBC project, could they be managed within the much larger context within which they were created. In this sense, preserving bodies were better equipped and suited to ensure the proper selection, arrangement, description, and preservation of records no longer needed for business purposes, because they were able to manage records in a fixed state and in broad terms, rather than at the file or document level of fluid systems of active records.[37]

This distinction was not just limited to an intellectual separation of current recordkeeping systems and archival recordkeeping systems. Rather, the UBC project concluded that "authenticity must be protected by physically transferring [records] to an archival institution or programme and, once transferred, by arranging and describing them."[38] These conclusions were at odds with those of David Bearman, who argued that creators were best suited to maintain the systems required to

[36] David Bearman, "Item Level Control and Electronic Recordkeeping," *Archives & Museum Informatics* 10:3 (1996), 195-245.
[37] Duranti and MacNeil, "Protection of the Integrity of Electronic Records," 60.
[38] Ibid., 59.

maintain and preserve records after they were no longer needed for active business use, because they already possessed the hardware and software capabilities necessary to maintain them, and that the metadata created and captured by records creators for business purposes could also be used to select, arrange, describe, and preserve electronic records for archival purposes.[39] Bearman argued that archival interests needed to integrate their particular recordkeeping needs into the recordkeeping system of creators at the front end through functional requirements and metadata standards, and for the continued storage, migration, and preservation of electronic records within the creator's recordkeeping system, that portion under the control of the archivist in a partnership agreement. Under this distributed or shared custody model, archives would cease to be passive repositories of electronic records and instead become hubs of information, liaising between the information technology specialists in creating agencies who manage and maintain recordkeeping systems and the users who wish to access them as archival records.

While Duranti and her colleagues at the UBC project doubted the motivation and professional capabilities of creating entities to preserve an archival record, Bearman saw concrete business motives for this preservation, with the help of a revamped archives:

> Ultimately the job of the archives is to ensure accountability; the cost of the lack of accountability is organizational legitimacy and perhaps legal liability which are more concrete that [sic] the imagined future benefits to humanity and society of keeping archives in cost/benefit equations. [40]

Others, however, have not shared Bearman's views on the changing role of the archives, nor his optimistic interpretation of the business case of this arrangement. While conceding the

[39] For more on Bearman's position on distributed or non-custodial archives, see David Bearman, "An Indefensible Bastion: Archives as Repositories in the Electronic Age," in David Bearman, ed., *Archival Management of Electronic Records* (Pittsburgh, 1991), 14-24; David Bearman and Margaret Hedstrom, "Reinventing Archives for Electronic Records: Alternative Service Delivery Options," in *Electronic Records Management Program Strategies*, Margaret Hedstrom ed., (Pittsburgh, PA: Archives and Museum Informatics, 1993), 82-98.
[40] Bearman, *Electronic Evidence*, 286.

advantages and potential of Bearman's distributed custody conceptualization, both Terry Cook and Margaret Hedstrom have made strong cases that there is little evidence to show that, given the opportunity (and responsibility), creators can be universally relied on to bear the costs and efforts associated with the long-term preservation of records that no longer have any active or even dormant business use.[41] Both Cook and Hedstrom argued for a blended approach, whereby the capabilities and requirements of the creating entities were evaluated to determine where the best chance for the long-term preservation of records lay. Indeed, Cook was instrumental in the development and implementation of such a policy at the then National Archives of Canada, whereby certain archival electronic records were maintained by the government agencies that created them, while others – which could not be adequately maintained by the creating organization – were physically transferred to the archives.[42] Others, like the Australian archival community, which had developed and embraced the continuum model discussed in Chapter One, also favoured the Pittsburgh project's conceptualization of corporate records as not time- or space-bound static objects, but rather as part of a fluid and overlapping system encompassing recordkeeping, evidence, transactions, and creators.

Like the Pittsburgh project, the UBC researchers also concluded that the reliability and authenticity of electronic records could best be achieved by integrating recordkeeping requirements into business systems, which also necessitated the integration of business and recordkeeping requirements. While it was not within the scope of the UBC project to carry out this integration, the project did lay the groundwork for others to do so by clearly articulating the needs of secondary or archival custodians. The project also made specific recommendations about the ways in which

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[41] See Terry Cook, "The Impact of David Bearman on Modern Archival Thinking: An Essay of Personal Reflection and Critique," *Archives and Museum Informatics* 11:1 (1997), 15-37; and Margaret Hedstrom, "Archives as Repositories: A Commentary," in *Archival Management of Electronic Records*, David Bearman, ed., (Pittsburgh, PA: Archives and Museum Informatics, 1991), 25-30.

[42] Terry Cook, "Leaving Archival Electronic Records in Institutions: Policy and Monitoring Arrangements at the National Archives of Canada," *Archives and Museum Informatics* 9 (1995), 141-49.

authenticity and reliability could be strengthened, namely through procedures (applied to both electronic and non-electronic records) that bolster the archival bond (the relationship that links the record to others within a group of related records), particularly with regard to the classification of records (numbering, registration, and profiling). This integration of electronic and non-electronic components of the recordkeeping system was important because it accounted for the management of hybrid systems (the mixed use of paper and electronic records to document transactions) by creating an electronic record, or placeholder, which ensured the capture of greater contextual information by linking paper records with their electronic counterparts.[43] The research team realized that the vast majority of recordkeeping environments at the time of the project relied on at least some mixture of paper and electronic records, and any system designed to manage electronic records needed to include provisions for including metadata linking electronic records with paper counterparts, primarily through classification and registration. While the Pittsburgh project did address the need to link all the records of a particular transaction within the context section of their metadata requirements, the explicit statements relating to the capture of paper records within electronic recordkeeping systems was unique to the UBC Project, one which others would later adopt.

In Cook's critiques of the Pittsburgh project, and Marsden's comparison of the Pittsburgh and UBC projects, both cited the lack of consideration for private and non-institutional records, as well as the real-world applicability of these requirements, as areas of concern. Both Cook and Marsden noted that a definition of records as evidence of transactions was problematic, in that it left out much of what is currently in archival holdings, because these holdings do not qualify as "records." This, Cook argued, was not a failure of Bearman and the Pittsburgh project's concepts, but an acknowledgement of the practical realities of archival work, which does not conform to the

[43] Duranti and MacNeil, "Protection of the Integrity of Electronic Records," 58.

narrow theoretical constructs established by Bearman. In looking at the Pittsburgh project's functional requirements, Cook noted that they are rooted in a theoretical ideal, not bound by real world limitations common to most archives:

> constraints of legislation, mandates, budgets, work plans, recalcitrant partners in other institutions, conflicting priorities, pressing client and donor demands and expectations, senior managers to bring on side, employees afraid of or untrained or untrainable in electronic records, and so on.[44]

While acknowledging that the UBC project's definition of a record provided greater opportunity for application in real-world archival settings, Marsden also noted deficiencies in the applicability of the UBC concepts. Most notably, the UBC models relied heavily on a highly organized and centralized recordkeeping structure, where records of business, legal, and historical value were set aside as records, where they were classified, where quality controls were applied, and where they were maintained as authentic and reliable records.[45] This well-funded and well-staffed central recordkeeping apparatus did not reflect the trends of modern office environments at the time Marsden delivered his assessment in 1997, which was characterized by extensive decentralization and downsizing of records management. It also has not improved any over a decade later, nor does it reflect the recordkeeping capacity of most individual creators.[46] Indeed, the two projects developed what Marsden dubbed, "ideal solutions for different organizational contexts," rather than a unified theory which could be applied in real-world settings.[47]

The conceptual differences between the two projects led to two distinct evolutionary routes taken by the successors of these projects. Indeed, testing, refinement, and application of the functional requirements developed by the two projects began even before they were completed. As

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[44] Ibid., 31.
[45] Paul Marsden, "When is the Future? Comparative Notes on the Electronic Record-Keeping Projects of the University of Pittsburgh and the University of British Columbia," *Archivaria* 43 (Spring 1997), 158-173.
[46] Ibid., 171.
[47] Ibid.

noted, researchers from the UBC project team applied their findings to the 1997 U.S. Department of Defense DoD 5015.2 standard, which carried forward the findings of the UBC project in a distinct way. And following the conclusion of the UBC project, Luciana Duranti, and other former members of the project, expanded further on their initial theoretical efforts with the first of a three-part international research project (the International Research on Permanent Authentic Records in Electronic Systems-InterPARES) that focused on the preservation and authenticity of electronic records based on the findings of the UBC project and their collaboration with the Department of Defense. Both follow-up projects carried forward the two-phased approach put forward by the UBC research team, which separated active recordkeeping requirements from long-term preservation requirements.

Following up on the initial findings of the Pittsburgh project was the Indiana University Records project, which sought to test and develop methodology and procedures for implementing the model developed by the Pittsburgh project team.[48] The National Historical Publications and Records Commission (NHPRC) funded project used the Pittsburgh project functional requirements, procedural rules and metadata standards to test existing Indiana University systems and then to make recommendations and methodologies to meet them. They validated much of the findings of the Pittsburgh project, particularly with respect to identifying the functions and transactions they sought to document and with establishing the metadata necessary to describe recordkeeping systems.[49] Also significant were the Indiana team conclusions that the Pittsburgh project methodology was better able

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[48] For a detailed account of the Indiana University Electronic Records Project, see Philip C. Bantin, "Developing a Strategy for Managing Electronic Records: The Findings of the Indiana University Records Project," *The American Archivist* 61 (Fall 1998), 328-361; and Indiana University, Libraries, *NHPRC Funded Indiana University Electronic Records Project, Phase II, 2000-2002* (Bloomington, IN: Office of University Archives and Records Management, 2002), available at http://www.libraries.iub.edu/index.php?pageId=3313, accessed 1 April 2012.
[49] Ibid., 335.

to identify and capture archival records (records documenting significant activity) than traditional methods, which required physically reviewing records series, that it was better able to accommodate the multiple authors and agents that act in electronic recordkeeping systems, and that the Pittsburgh approach more accurately reflected the design and logic of information systems.[50] These, along with findings that pointed to the need for the development of different classes or levels of requirements, more clearly written functional requirement statements, the development of a methodology for implementing the requirements and standards, and methodologies for the identification of business functions and transactions, highlighted areas for further development of the Pittsburgh project's findings.

Neither the Pittsburgh nor the UBC projects were intended to be the final authority on the creation, maintenance, and preservation of electronic records. Rather, they were remarkable explorations of the principal recordkeeping and archival challenges surrounding electronic records and initial attempts to establish the frameworks and tools which would address them. Whether drawing from multi-disciplinary sources, like the Pittsburgh project, or from archival and manuscript traditions, like the UBC project, both succeeded in establishing foundational conceptualizations that would guide future efforts at establishing guidelines for creating, maintaining, and preserving electronic records in order to provide trustworthy evidence of activity. Each project contributed significantly to the projects that followed, and each offered areas upon which to build. Successor projects to the Pittsburgh project could draw from the essential elements of trustworthy records found in the functional requirements, the integration of recordkeeping requirements with business requirements found in the metadata specifications, the technical specifications found in the production rules, or ground-breaking conceptualizations of archives as information hubs, rather than

[50] Ibid., 337.

traditional repositories. Similarly, the UBC project provided theoretical foundations for the development of tools to identify, segregate, and preserve trustworthy records over time, by establishing stable conceptualizations of authenticity and reliability in the electronic realm, and by modeling these findings, which enabled the translation of recordkeeping requirements to systems designers, and the development of strategies, guidelines, and standards designed to enable the creation, maintenance and preservation of authentic and reliable records. Indeed, these two projects set the agenda for future debate and informed the direction future efforts would take to improve the quality and conditions of records created in electronic form.

Chapter Three

Standing on the Shoulders of Giants: Building on the Foundations of the Pittsburgh and UBC Projects

The Pittsburgh and UBC projects proved to be important early efforts to identify and address second-generation electronic recordkeeping issues. Both began their efforts by defining what a trustworthy record should look like within the electronic environment. The Pittsburgh project did this by studying patterns within the recordkeeping practices of high-risk real world sectors to establish and isolate the functional requirements that enabled those sectors to enjoy legal and regulatory reliance for their own electronic records. The UBC project did so by applying diplomatic analysis of traditional records to discern by analogy the elements of a trustworthy record, using this elemental breakdown of trustworthy records to develop activity models to guide the development of systems and tools to create, maintain, and preserve electronic records. As noted, the Pittsburgh project developed a different understanding of a record in the electronic environment, identifying business transactions as the site of records capture. This conceptualization altered the tactics used by the Pittsburgh project to satisfy the high-level functional requirements, leading to the development of a set of system requirements to ensure the capture of these transactions in a recorded form, along with production rules to test them, and to establish metadata standards and tools for the integration of business requirements within electronic recordkeeping systems.

The important works inspired by the Pittsburgh and UBC projects span both wide geographical areas and lengthy periods of time. Efforts to refine and build on these two projects have emerged across the globe, in North America, Europe, Australia, Asia, and elsewhere. And in the time since the projects concluded (1996 for the Pittsburgh project and 1997 for the UBC project), both have continued to exert considerable influence on subsequent work in this area. As the influence of these two projects is not limited to specific tidy geographical areas, and since their influence cannot be tied to specific periods in time, their successors do not lend themselves well to geographic or chronological analysis. For the purposes of this study, a more useful analytic framework is the projects themselves, tracing the development of the work each inspired. As such, this chapter will look first at the works clearly inspired by these projects, and then finally at works (some of which pre-date ones already examined) which drew from, but are not easily recognizable as, either Pittsburgh- or UBC-inspired.

Although not the only defining feature that distinguished the two projects, the one that most significantly sets the offshoots of the UBC project apart from those that built on the findings of the Pittsburgh project was the differing views on the two-phased or life-cycle recordkeeping model. As discussed in previous chapters, the authors of the UBC project subscribed to the life-cycle conceptualization of recordkeeping, which maintained a clear divide between the active records phase (including creation, classification, maintenance, use, and disposition), and the archival phase, which includes appraisal, selection, and acquisition, description, preservation, and secondary (historical) use of records. Following the conclusion of the UBC project in 1997, Luciana Duranti and other former members of the project expanded their initial theoretical efforts with work on projects designed to address separately both phases of the records life-cycle. The first of these projects, which looked at the current or active recordkeeping phase, resulted in a metadata standard

for records management software applications, while a further set of projects focused on the preservation of records within the secondary (archival) phase.

In an effort to ensure systems that could create and maintain authentic and reliable electronic records as outlined by the UBC project, members of the UBC research team collaborated with the United States Department of Defense (DoD) between 1995 and 1996, to establish a design standard for records management applications. This collaborative effort was driven by sharp criticisms of the electronic recordkeeping capabilities of the DoD in the wake of the Persian Gulf War (1990-91) and in the subsequent congressional orders to improve how the DoD created and maintained its electronic records.[1] Based on the theoretical findings of the UBC project, and on a framework of testable functional requirements established during other functional process improvement initiatives undertaken by the DoD, the research team developed minimum recordkeeping capabilities of records management software applications necessary to satisfy the legal and operational requirements of DoD bodies. Released on November 24, 1997, the Department of Defense *DOD 5015.2-STD, Design Criteria Standard for Electronic Records Management Applications* thus established baseline functional requirements necessary for procurement and implementation of Records Management Application (RMA) software to be used in Department of Defense (DoD) components within their records management programs.[2]

Unlike the functional requirements presented by the UBC project, which established essential elements of a record and recordkeeping systems, the DoD 5015.2 standard was aimed at ensuring

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[1] Joint Interoperability Test Command, *Records Management Application* http://jitc.fhu.disa.mil/cgi/rma/dod50152bigdeal.aspx, accessed 1 April 2012; See also William Underwood, Mark Kindl, and Daryll R. Prescott, *Baseline Requirements for DoD Records Management Application Software* (Atlanta, GA: Army Research Laboratory, August, 1995).

[2] Department of Defense, United States, *DoD 5015.2-STD, Design Criteria Standard for Electronic Records Management Software Applications* (Washington: Assistant Secretary of Defense for Command, Control, Communications, and Intelligence, 2007).

records management applications were capable of meeting the recordkeeping requirements of the DoD. The DoD 5015.2 standard integrated requirements of a reliable electronic record generated by the UBC project with specific DoD directives, policies, guidelines, and procedures, as well as applicable executive orders, national and international standards, codes, and regulations. Once researchers had established the DoD's recordkeeping requirements (for active records), they were able to graphically express them using the Integrated Definition for Function (IDEF) modeling technique already employed by the UBC project.[3] The resulting activity models were then used to describe recordkeeping functionality necessary for software applications whose primary function is to identify, categorize, store, locate, retrieve, and dispose of records. This resulted in an end product which consisted of mandatory high-level requirements accompanied by detailed specifications which could be tested against design, testing, and procurement of records management applications capable of meeting DoD recordkeeping needs.

While DoD 5015.2 dealt with activities falling within the active records management phase of the two-phased approach advocated by the UBC project, a second project focusing on the inactive or archival records phase soon followed. Between 1999 and 2001, Luciana Duranti led an international research project focusing on the preservation and the authenticity of inactive electronic records (records no longer needed for active business use, but still needed for long-term operational, legal or historical purposes). The project also included UBC project members Terry Eastwood and Heather MacNeil, as well as Ken Thibodeau, who was the senior manager for the electronic records archival program at the National Archives and Records Administration (NARA) in the United States. *The International Research on Permanent and Authentic Records in Electronic Systems*, or

[3] For a detailed critique of the IDEF model, see Brien Brothman, "Designs for Records and Recordkeeping: Visual Presentation in Diplomatics, the Record Continuum, and Documentation Strategy," in Terry Cook, ed., *Controlling the Past: Documenting Society and Institutions. Essays in Honor of Helen Willa Samuels* (Chicago: Society of American Archivists, 2011).

InterPARES as it became known, sought to extend the diplomatic theory and methodology employed by the earlier UBC project to establish the criteria for the long-term preservation of authentic electronic records.[4] Still primarily theoretical, the InterPARES project set out to develop a theoretical and methodological framework of electronic records from which strategies, policies, and standards could eventually be designed to ensure the long-term preservation of electronic records no longer required for active business use.[5]

The project relied heavily on the conceptual framework established by Duranti and the UBC project that used of diplomatics as a tool to identify and describe elements of trustworthy electronic records in order to segregate and preserve them. As noted, these elements were comprised of documentary form, content, context, and the archival bond, or relationship between similar or supporting records. Once the framework for identifying and isolating these records was refined by the InterPARES project, researchers next sought to develop the theoretical and methodological means by which these trustworthy records could be appraised, transferred, and preserved by archival or other preserving custodians. As outlined in both Duranti's work on diplomatics in the electronic environment and in the UBC project findings, the key to the long-term preservation of electronic records was the verification of authenticity, which is derived from evidence of reliability and integrity, over space and time.[6] Although authenticity was identified as a primary element for the preservation of traditional physical archival records, both the UBC project and InterPARES believed it to be particularly important in the electronic realm due to the heightened risks within electronic recordkeeping systems of inadvertent or unauthorized alteration of records, vulnerabilities which the

[4] InterPARES Project,"The Long-term Preservation of Authentic Electronic Records: Findings of the InterPARES Project," [electronic version] in *International Research on Permanent Authentic Records in Electronic Systems* (InterPARES), Luciana Duranti, ed. (Vancouver, BC: 1997), available at http://www.interpares.org/book/index.cfm, accessed 1 April 2012.
[5] InterPARES Project, "Introduction," 2.
[6] InterPARES Project, "Authenticity Task Force," 2.

InterPARES project concluded could be addressed by identification and then satisfaction of its specified requirements for authenticity.

Thus, establishing the requirements for authenticity became a key part of the first of five domains, or task forces, which contributed to the larger InterPARES project. The first and most substantial domain was the Authenticity Task Force, which worked to identify conceptual requirements necessary for identifying, verifying and preserving the authenticity of electronic records over time. Much like the UBC project on which it was based, the Authenticity Task Force used the theoretical and deductive methodology of diplomatics to deconstruct an authentic electronic record into its constituent parts, analysing the extent to which each element contributes to the authenticity of the record.[7] This work resulted in the development of two sets of recordkeeping requirements: the first established the ideal set of benchmark requirements for authenticity of electronic records in active or semi-active recordkeeping systems in the creator's custody; and the second set established baseline requirements for authenticity of inactive or archival electronic records in the preserver's or archivist's custody.

Released as the *Benchmark Requirements Supporting the Presumption of Authenticity of Electronic Records,* the first set of requirements consisted of eight high-level conditions on which preservers may rely to support a presumption of authenticity of records created and maintained by a given system.[8] The eight conditions established the identity and integrity of a record; controls which governed creation, alteration, transfer and destruction of records; procedures governing security; provisions to ensure accessibility over time (software/hardware); rules for authentication of records;

[7] Ibid., 3.
[8] InterPARES Project, "Appendix 2: Requirements for Assessing and Maintaining the Authenticity of Electronic Records."

and procedures for documenting removal or destruction of records from the recordkeeping system.[9] The second set of requirements, which was intended to act as a guide by which preservers could assess the authenticity of a recordkeeping systems was released as *Baseline Requirements Supporting the Production of Authentic Copies of Electronic Records.*[10] Consisting of three main requirements, the baseline set of requirements included high-level requirements for the transfer of records to archives and for the care of the records once there; for documentation of alterations or use of the preserved records; and requirements for documenting changes to the recordkeeping system within the preserver's care.[11] It is important to note that neither set was intended to guide the design or implementation of a recordkeeping system, or a records management application, such as the DoD 5015.2 standard. Rather, they were intended to serve as guidelines by which preservers (archives) could appraise, accept, and preserve authentic electronic records no longer needed for active use by the creating entity.

Along with the three major products delivered by the original InterPARES project (benchmark and baseline requirements, appraisal methodology, and a framework for the development of policies, strategies, and standards for the preservation of electronic records), were a number of important findings for future research. The first was the realization that because authenticity depends on assurances about the identity and integrity of the information, the preservation of records begins at the time of creation and continues through to maintenance, rather than simply at the point of transfer to preserver. As such, more effort would be necessary up front, through the creation of metadata during records creation and use, to ensure archives had sufficient information about the records to appraise, acquire, and preserve them in a manner that ensured their authenticity was preserved. This would necessitate a blurring of the two-phased approach (though not a full departure from it) with the

[9] InterPARES Project, "Authenticity Task Force Report."
[10] InterPARES Project, "Appendix 2."
[11] Ibid.

development of more detailed requirements and standards aimed at active recordkeeping systems, and more importantly, the inclusion of requirements typically applied in post-custodial environments. Without admitting it, the UBC team was de facto implementing the core insights and strategic positioning methodology of David Bearman and the Pittsburgh project.

The InterPARES research team also concluded that different socio-juridical contexts often had unique recordkeeping requirements in varying degrees, which were either not represented or misrepresented within the elemental breakdown of trustworthy records produced by both the UBC and InterPARES research teams, once again mirroring the work of the Pittsburgh project, which had looked at a dozen separate societal sectors. This meant a review of universal principles previously articulated by the UBC project and the recognition that policies, strategies, and standards for electronic records would also need to include options for customization according to the recordkeeping environment in which they operated. A further consequence of their efforts to find the basic constituent parts of a trustworthy record was that the resulting guidelines were aimed at the level of the record, rather than at groups of records which could be appraised, arranged, described, and preserved using established archival methodology, as originally intended. And in attempting to identify and isolate trustworthy records, researchers also realized the established recordkeeping elements were not a particularly effective way to separate records from data in an environment which produced myriad documentary forms in often-unrecognizable ways. InterPARES researchers ultimately found "that understanding the nature and boundaries of electronic records required a detailed understanding of the business functions and activities of the record-keeping systems being studied," rather than merely the tools to identify certain record elements.[12] This too represented a step closer to the Pittsburgh project's understanding of records as resulting from business functions and

[12] InterPARES Project, "Authenticity Task Force Report," 19.

transactions, and very much reflected contemporary thinking about macroappraisal, and its widespread implementation from the 1990s onward.

The findings of the InterPARES project led to a significant re-evaluation of both the framework and principles on which it was based. Between January 2002 and December 2006, the original InterPARES team extended their findings in a follow-up project called *International Research on Permanent Authentic Records in Electronic Systems (InterPARES): Experiential, Interactive and Dynamic Records*.[13] Commonly known as InterPARES 2, the follow-up to the original was led again by Luciana Duranti, and the purpose of the international and interdisciplinary project was to develop the findings of the initial InterPARES project (hereafter InterPARES 1) and to extend them beyond the tightly structured legal and administrative environments which were the focus of the initial project. In doing so, InterPARES 2 examined diverse recordkeeping environments, from those of individuals, small groups, and communities, from the artistic, scientific, and government sectors, covering experiential, interactive, and dynamic records. Dozens of case studies were undertaken by the project in order to establish necessary criteria for determining the degree to which different recordkeeping systems create and maintain authentic and reliable records; to establish common or essential elements of appraisal and selection of records of long-term business, social, or cultural value; and to evaluate technologies employed for the implementation of recordkeeping requirements.[14]

InterPARES 2 addressed findings of InterPARES 1 by beginning its study with neither preconceived nor established conceptualizations of authentic records, as the previous project had

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[13] InterPARES 2, *International Research on Permanent Authentic Records in Electronic Systems (InterPARES) 2: Experiential, Interactive and Dynamic Records*, [electronic version] Luciana Duranti and Randy Preston, eds., (Padova, Italy: Associazione Nazionale Archivistica Italiana, 2008), available at http://www.interpares.org/display_file.cfm?doc=ip2_book_introduction.pdf, accessed 1 April 2012.
[14] Ibid.

done. Rather, researchers began the project by looking at non-traditional records (interactive databases, moving images, geographical information systems, scientific data, electronic registries, on-line services, etc.) as well as records that are not highly standardized or regulated in scientific, artistic, and government sectors. The project consisted in large part of case studies in the various sectors in order to understand deeply the purpose for which the records were created, the activities that generated them, their various phases and components, their structure and content, as well as the technological environment in which they exist.[15] The results of the case studies were analysed and graphically modeled using the Integration Definition for Function (IDEF) modeling techniques used in both the UBC and InterPARES 1 projects.[16] The researchers then used diplomatic analysis to draw out the intrinsic and extrinsic elements of a record to determine the extent to which they contained the five essential elements of authenticity identified by both the UBC and InterPARES 1 projects. As noted, these five essential elements included a fixed form and content, participation in action, possession of an archival bond, having agents (author, addressee, writer, creator, and originator), and having an identifiable context.[17] The results of the case studies in the differing sectors were aggregated, their unique vernaculars were translated to archival equivalents, and the data analysed to draw out the consistent characteristics that were present in each.

Through this work, InterPARES 2 researchers confirmed the validity of the baseline and benchmark requirements put forward by the first InterPARES project for identifying, evaluating, and preserving authentic records. However, the researchers also noted that conceptual and methodological changes would need to be made based on the realities of records creation. InterPARES 2 researchers found that the benchmark and baseline requirements were useful in the

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[15] Ibid.
[16] See IDEF (1993), *Integration Definition for Function Modeling (IDEF0) Draft* Federal Information Processing Standards Publication FIPSPUB 183 (Springfield, Virginia: U.S. Department of Commerce, 1993).
[17] InterPARES 2.

strictly controlled legal and administrative environments on which they were based, but they often broke down in the individual, experiential, interactive, and dynamic environments found in diverse socio-juridical environments.[18] Indeed, virtually all modern electronic communication systems behave in these individual, experiential, interactive, and dynamic ways, no matter the kind of environment within which they exist, including government, as studied in the UBC and InterPARES 1 projects. To assist preservers in their work, researchers produced two important guidance documents: one designed to help individual and corporate records creators "make informed decisions about making and maintaining" electronic records;[19] and the other was designed to guide preservers in identifying elements on which to determine authenticity.[20]

Based on the benchmark and baseline requirements established by InterPARES 1 and the results of the InterPARES 2 case studies, a set of Creator Guidelines was developed to guide both individual and corporate creators in the creation of records which contained the necessary metadata to ensure the long-term preservation of electronic records.[21] The creator guidelines encouraged consideration of, and recommendations to address, issues related to hardware, software and file formats, fixed forms and stable content, the identification of records, the inclusion of metadata to verify integrity, the organization/classification of records, the authentication of records (declared authentic at a point in time), and the protection of records (after that point in time) against unauthorized alteration, reproduction, transmission, or destruction.[22] To complement the Creator Guidelines were Preserver Guidelines, which were intended to provide preserving organizations with

[18] InterPARES 2, "Part Three: Authenticity, Reliability, and Accuracy of Digital Records in the Artistic, Scientific, and Governmental Sectors – Domain 2 Task Force Report," 152.
[19] InterPARES 2, "Appendix 20: Creator Guidelines: Making and Maintaining Digital Materials: Guidelines for Individuals."
[20] InterPARES 2, "Appendix 21: Preserver Guidelines: Preserving Digital Records: Guidelines for Organizations."
[21] Ibid.
[22] Ibid.

recommendations regarding the long-term preservation of electronic records.[23] Focusing on strengthening the chain of preservation outlined by the project, the Preserver Guidelines included recommendations for preservation policies, strategies, and methodologies established by preserving organizations; the appraisal and physical acquisition of electronic records; storage, description, and retrieval of electronic records; and ensuring accessibility over time.

The creator and preserver guidelines neatly and attractively assembled the major recordkeeping issues facing creators, and offered recommendations and explanations for both a general audience, which included individual and organizational creators, as well as a more specialized audience, which included individual and organizational preservers. Both guidelines conveyed the benchmark and baseline requirements in accessible terms, but did not provide specifications, a methodology for their implementation, nor did they enable the design, testing and evaluation of recordkeeping systems. In response to this, a third InterPARES (InterPARES 3) project was undertaken in 2007. Scheduled to end in 2012, the primary objectives of InterPARES 3 are to further test, assess, refine, and extend the research findings of the first two projects and to develop and the promote their use by small- and medium-sized institutions**.** At the time of writing, the results of these efforts have not yet been released, beyond a few pilot studies still being tested.

The InterPARES projects focused on developing policies, strategies, and procedures based on theoretical understanding of trustworthy electronic records, rather than on developing detailed and prescriptive requirements for either recordkeeping systems or technological applications. Though InterPARES 2 did translate the benchmark and baseline requirements developed by the initial InterPARES project into guidelines for both creators and preservers, the conceptual differences, highlighted by the two-phased approach to recordkeeping, set their efforts apart from the other major

[23] Ibid.

stream of functional requirements which emerged to build on the efforts of the Pittsburgh project, despite some blurring and de facto concessions by the UBC to some of the original Pittsburgh insights.

Representing a new generation of functional requirements, recordkeeping models based on the Pittsburgh project's conceptualization of the records life-cycle, on where the focus of recordkeeping requirements should be, and on the necessary strategies for ensuring the creation and preservation of trustworthy electronic records began to appear. They were not designed solely as a prescriptive standard for records management software applications, like the DoD 5015.2 standard, nor were they aimed at providing tools for the identification and segregation of trustworthy records in an archival environment, like the InterPARES projects. Rather, there emerged a number of national and international efforts to articulate functional requirements for electronic recordkeeping systems which were intended to describe the minimum functionality required for credible electronic recordkeeping systems. Like the Pittsburgh project before them, these efforts were predicated on the assumption that credible recordkeeping systems produced records which could be relied on as trustworthy evidence of activity, and that the best way to ensure the preservation of these records was to develop policies, standards, and specifications which controlled the application of metadata throughout the entire lifetime of the record.

As early as 1997, the electronic records pioneer, author, and then National Archives of Canada (NAC) archivist, John McDonald, led the International Council on Archives' (ICA) acceptance of Bearman's and the Pittsburgh project's call to change both conceptions of the records life-cycle, and preservation methodologies.[24] In a report released in 1997, the ICA Committee on

[24] John McDonald was chair of the International Council on Archives (ICA) Committee on Electronic Records and is credited for almost all of the key ICA e-records documents from the early 1990s up to around 2000-01.

Electronic Records concluded that to avoid relegation to irrelevance, archivists and archival institutions would need to play a more active role in the conception and creation of records. Rather than traditional archival functions of appraisal, acquisition, arrangement, description, preservation and use being carried out on inactive records, archivists and archival institutions would need to perform new functions of "informing, guiding or directing system designers and developers, and record creators, so that authentic, reliable and preservable records are created and maintained, or else by issuing standards and guidelines for others to apply and/or by drafting appropriate legislation and/or rules."[25] This should be done, the report concluded, by the inclusion of functional requirements for electronic recordkeeping systems in the design and specification of electronic information systems in order to ensure the creation and capture of metadata attesting to the necessary content, context, and structure.

As recordkeeping requirements often vary according to the socio-juridical environments in which the creator operates, the emerging functional requirements of the late 1990s and early 2000s were typically local, national, or supra-national efforts to satisfy the recordkeeping requirements of a specific legal or regulatory context. These Pittsburgh project-style efforts began in the mid and late 1990s, in Europe, Canada, Australia, New Zealand, and Asia. Among the first of these released was the Norwegian public administration recordkeeping standard by the National Archives of Norway as part of the "Norsk arkivsystem" (NOARK).[26] The 1999, or fourth revision, of the Norwegian national recordkeeping standard established the basic recordkeeping requirements for recordkeeping systems used in Norwegian public administration, but also included specifications for electronic recordkeeping systems. The standard's general requirements were arrived at by reviewing applicable

[25] International Council on Archives, Committee on Electronic Records. *Guide for Managing Electronic Records from an Archival Perspective – ICA Study 8* (Paris: International Council on Archives, 1997).
[26] Riksarkivet, National Archives of Norway, *NOARK 4 Part 1 – Norwegian Recordkeeping System: Functional Description and Specification of Requirements* (1999, English translation, 2000), available at http://www.arkivverket.no/eng/Public-Sector/Noark/Noark-4, accessed 1 April 2012.

laws, regulations, and administrative provisions which had shaped the *NOARK* standard since 1984, along with established records management practices.[27] The standard was aimed at system vendors wishing to design and implement recordkeeping systems to meet the NOARK Standard to be eligible for purchasing their products, and at administrative bodies seeking to purchase, develop, implement, or test a recordkeeping system meeting the NOARK-4 Standard.

Although the NOARK-4 standard did not cite the Pittsburgh project as a source for their specifications, it did contain many of the elements which characterized Bearman and Cox's ground-breaking work. Unlike the DoD 5015.2 standard, which applied to records management software applications for current or active records, the NOARK-4 standard covered the whole of the recordkeeping system, whatever form it took and regardless of the state of activity in which the records existed. It contained requirements for the creation, classification, maintenance, and disposition of records, with the assumption that the metadata added during those activities would also consist of or at least enable the appraisal, acquisition, description, preservation, and long-term access either within the custody of the creator, or to enable transfer to the custody of another preserver, including archives. Also like the Pittsburgh project products, the NOARK-4 functional requirements contained both high-level statement requirements (both functional and non-functional) along with detailed and unambiguous specifications for testing and implementation of those requirements, and with defined metadata elements to ensure clarity and consistency.

Also released in 1999 was the then Public Records Office (PRO) of the United Kingdom (U.K.) *Functional Requirements for Electronic Records Management Systems (ERMS)*.[28] The U.K. functional requirements, which were developed by the PRO in collaboration with IT professionals,

[27] For more on the Norwegian Recordkeeping System Standard, see Gudmund Valderhaug, "Recordkeeping in Local Government in Norway 1950–2000," *Archival Science* 2:3 (2003), 205-212.
[28] United Kingdom, Public Record Office, *Requirements for Electronic Records Management Systems, 1-4: Functional Requirements, 2002, Revision – Final Version* (Surrey: 2002).

archivists, records managers, and various U.K. government agencies, were intended to develop cross-government recordkeeping and functional requirements for electronic recordkeeping systems using the applicable U.K. laws, regulations, and practices. They developed a generic set of specifications to design, implement, and assess electronic records management systems (ERMS) for use in U.K. government organizations. These ERMS requirements were generally considered to be manifested in various software applications which support the recordkeeping needs of an organization "from capture and declaration through 'trusted record-keeping' to eventual destruction or permanent preservation, while retaining integrity, authenticity and accessibility."[29]

The specifications for ERMS were intended to be a baseline of minimum requirements for credible records management systems, noting that each implementing organization would need to tailor the requirements to suit their particular needs. In order to allow for this customization, the U.K. requirements included both mandatory and additional desirable requirements for enhanced records management capabilities based on the specific needs of the creator. And like the non-functional requirements found in both the Pittsburgh and NOARK-4 requirements, the U.K. Functional Requirements also included customizable specifications for business requirements, including technical requirements for integration with other business applications, user interface requirements, performance needs, size and scalability, and training requirements.

The resulting suite of products (collectively known as the U.K. Functional Requirements for ERMS) consisted of statements of generic requirements, along with testable detailed specifications to be used by vendors for the design, testing, and implementation of software applications and by business areas for generating more specialized versions of the functional requirements for testing, procurement, and implementation of site-specific solutions. Like those found in the NOARK-4

[29] Ibid.

standard, the U.K. requirements contained high-level requirement statements, followed by mandatory core requirements, and then desirable requirements for added recordkeeping functionality. Along with these specifications, were companion pieces, which provided background information, supporting materials, and tools for testing and implementation. Further expanded in the subsequent 2002 revision, these companion pieces included explanatory notes, metadata standards, case management and workflow software models, testing software and procedures, and guidance for the implementation of the functional requirements.[30]

Two particularly innovative aspects of the U.K. requirements were the adaptation of the Pittsburgh project's modular division of requirements (also employed by the NOARK-4 standard) to allow for discretionary use by the creator, and the use of entity relationship models to guide the use of the requirements. The four modules of the U.K. requirements included one for core electronic records management requirements (records declaration/capture/classification, maintenance, and disposal); one for additional recordkeeping requirements (access management, security, system audits, and authentication); one for supporting systems (document management, advanced search and retrieval, and bulk importing); and one for non-functional requirements (user experience, performance, scalability, maintainability). Together, these components allowed for the customized design, testing, and implementation of recordkeeping systems, in addition to being a powerful procurement tool that allowed companies promoting prospective records management applications to test their effectiveness against specific requirements modified to suit particular environments.[31] The inclusion of entity relationship models, albeit much more simple than those of the UBC and InterPARES projects, which graphically expressed the requirements along with providing

[30] The case and workflow modules, and additional reference documents, were added only in the 2002 and subsequent versions. See Public Record Office, United Kingdom, *Functional Requirements,* available at http://collections.europarchive.org/tna/20080108102455/http://www.nationalarchives.gov.uk/electronicrecords/function.htm, accessed 1 April 2012.

[31] The PRO specifications would later be converted into testing scripts to certify ERMS applications.

explanatory notes, also proved to be a significant clarifying tool, one that was adopted by others during this period.

As the U.K. functional requirements were being released, continental Europe was also moving in similar directions. As early as 1996, the European Council's Données Lisibles par Machine (DLM) Forum recognized the need for a comprehensive recordkeeping specification for electronic records management systems, and by 1999 the forum had commissioned the compilation of a set of functional specifications to address this need.[32] Produced by Cornwell Management Consultants plc. in 2001, the *Model Requirements for the Management of Electronic Records* (MoReq) specifications were designed to provide both public and private organizations with a set of specifications that, if satisfied, would ensure electronic recordkeeping systems would have the capabilities to create, maintain, and preserve the evidentiality required for general operational, legal, and archival purposes. Although their wording and delivery differed marginally from the U.K. requirements, and their recordkeeping requirements stemmed from the European Union laws and regulations, the MoReq standard shared common Pittsburgh project concepts and employed the modular, customizable, testable type of requirements found in the U.K. requirements, as well as similarly structured metadata standards and entity relationship models. And like the U.K. and NOARK-4 requirements, the MoReq specifications were offered as a guide to those looking to introduce a new ERMS and applications, as well as to those who wished to assess the capabilities of their existing solutions.

[32] DLM is an acronym for the French "Données Lisibles par Machine," in English "machine-readable data." The DLM-Forum is based on the conclusions of the European Council (94/C 235/03) of 17 June 1994 concerning greater cooperation in the field of archives. See Serco Consulting (for the European Commission interchange of Documentation between Administrations Programme), *MoReq2: Model Requirements for the Management of Electronic Records, Update and Extension* (Bruxelles-Luxembourg: 2008).

The common concepts, structure, and execution of the two sets of functional requirements led both to see the potential for a joint effort moving forward. Rather than continue on their own, the National Archives of the U.K. (TNA, as the Public Record Office had become) appointed staff to join the MoReq team in an effort to merge the best of both sets of requirements, thus pooling their resources and establishing a common set of requirements which vendors would have even greater incentives to work towards meeting. The resulting set of specifications was initially released in 2008, as the *Model Requirements for the Management of Electronic Records, Update and Extension* (MoReq2), and subsequently revised in 2010.[33]

MoReq2 combined the smooth narrative and testing regime of the U.K. requirements with the flexibility and applicability of the original MoReq. In addition, MoReq2 benefitted from the implementation and operational experience gained from the use of these two specifications over the previous eight years, resulting in an expanded and more polished set of functional requirements. This new release included modules for classification and file organization, for ensuring access controls and security, for enabling retention and disposition, for capturing and declaring records, for referencing (including system identifiers and classification codes), for enabling search, retrieval, and display, for systems administration (audit, reporting, and review), a much larger set of optional modules (including workflow, case management, encryption, digital rights management, and more), and a wide range of non-functional requirements to meet organization-specific preferences and needs.

It is important to note the wider confluence of interests at work coinciding with the U.K. and MoReq merger under the MoReq2 banner, beginning with the re-orientation of the NOARK-5

[33] Ibid.

standard to align the Norwegian national standard with the MoReq2 set of requirements.[34] Meanwhile, Australian efforts to develop a set of national functional requirements were also being re-directed towards international collaboration. Even before releasing its completed *Functional Specifications for Electronic Records Management Systems Software* in 2008, the National Archives of Australia (NAA) came to the conclusion that too many competing specifications were causing confusion and in fact hindering efforts to develop commercially viable software applications which could meet the range of requirements being developed at this time. **[35]** Thus, by 2008, the NAA had moved to abandon its own national functional requirements in favour of collaborating with other jurisdictions that were undertaking similar efforts to produce a truly international set of model requirements for electronic records management systems.[36] Thus, the NAA incorporated much of its work (along with that of representatives from Asia, Africa, Europe, and North America) into an effort to create a truly international set of functional requirements under the banner of the International Council on Archives (ICA), continuing the initiatives at ICA that John McDonald had started.

The ICA and NAA collaboration resulted in the 2008 release of the ICA *Principles and Functional Requirements for Records in Electronic Environments.*[37] As with the others in the second-generation of functional requirements, the developers consulted governments, software vendors and other industry groups, private-sector organizations, the International Standards Organization, and the

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[34] Riksarkivet -The National Archives of Norway, *NOARK-5 Standard for Records Management,* (2009) http://www.arkivverket.no/arkivverket/Offentlig-forvaltning/Noark/Noark-5/English-version, accessed 1 April 2012.
[35] National Archives of Australia. *Specifications for Electronic Records Management Systems Software and Guidelines for Implementing the Specifications for Electronic Records Management Systems Software (ERMS)*, (Canberra, Australia: 2008).
[36] Adrian Cunningham, "Going Global: Developing globally harmonised software specifications for records," National Archives of Australia, Staff Paper (2008), available at http://www.naa.gov.au/about-us/partnerships/conferences/asa.aspx, accessed 1 April 2012.
[37] International Council on Archives, *Principles and Functional Requirements in Electronic Office Environments* (2008) http://www.ica.org/4127/strategic-objective-2/icareq-principles-and-functional-requirements-for-records-in-electronic-office-environments-guidelines-and-training-material.html, accessed 1 April 2012.

International Records Management Trust.[38] Based on existing ISO standards, the ICA functional requirements were accepted as the ISO 16175-2 standard for ERMS in 2011.[39] The ICA team worked closely with DLM members in the development of MoReq2, as a key stakeholder and contributor.[40] The authors of the ICA functional requirements did not intend to compete with MoReq2, but rather attempted to develop a set of requirements that were in alignment, but less costly to implement and ones that were less EU-specific. In doing so, the ICA also looked to the functional requirements of Archives New Zealand, which had already scaled-down the MoReq requirements for their own 2005 release.[41] Thus, the ICA developed what they claimed were less daunting requirements for their diverse membership, especially in the countries of the developing world, and so their statements are more principle-based, though still maintaining the essential concepts, content, and structure of the European functional requirements, as with the Pittsburgh project's original articulation.[42]

With their focus on prescriptive specifications intended to enable design and testing of electronic records management systems, the emerging European and ICA/ISO functional requirements were similar enough that they are easily recognizable among the growing stable of functional requirements available. There were others, however, which did not conform so neatly to this post-Pittsburgh mold. Taking an alternative approach was the Strategic Partnerships with Industry – Research and Training (SPIRT) Recordkeeping Metadata Research Project out of Monash University in Melbourne, Australia, between 1998 and 1999.[43] Officially known as *Recordkeeping Metadata Standards for Managing and Accessing Information Resources in Networked*

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[38] Cunningham, "Going Global," 3.
[39] ISO 16175-2:2011, *Information and Documentation – Principles and Functional Requirements for Records in Electronic Environments – Part 2: Guidelines and Functional Requirements for Digital Records Management Systems* (Geneva: International Organisation for Standardization, 2011).
[40] Cunningham, "Going Global," 4.
[41] Archives New Zealand, *Electronic Recordkeeping Systems Standard* (Wellington, New Zealand: June 2005).
[42] Cunningham, "Going Global," 4.
[43] Sue McKemmish, Glenda Acland, and Barbara Reed, "Towards a Framework for Standardising Recordkeeping Metadata: The Australian Recordkeeping Metadata Schema" *Records Management Journal* 9:3 (1999), 173-198.

Environments Over Time for Government, Commerce, Social and Cultural Purposes, the SPIRT research project set out to "specify and codify recordkeeping metadata" in a way that could be applied by the recordkeeping community as well as those in other areas affected by the growing use and reliance on digital media.[44] The project looked to draw the best of the existing functional requirements, while consulting with a wide range of those with recordkeeping interests, including industry, to develop standard metadata elements with clear definitions, a framework which could be used to develop further sector-specific metadata standards, and a framework for reading and mapping metadata sets across systems.[45]

The project, very much reflecting the rhetoric of Australian continuum thinking, established necessary metadata requirements which would ensure "intellectual controls that enable reliable, authentic, meaningful and accessible records to be carried forward through time within and beyond organisational boundaries for as long as they are needed for the multiple purposes they serve."[46] The standard metadata elements were articulated in the Australian Recordkeeping Metadata Schema (RKMS), which – because it was based on the records continuum model – did not separate recordkeeping requirements for active and semi-active records from those of inactive or archival requirements. Rather, the RKMS included recordkeeping requirements regardless of the phase the record was in, and included fifty-one metadata elements covering four key entities which exist in a recordkeeping system: the creating business/organization, the agents or people conducting the activity, the business context in which the records were created, and the records themselves. Differing from the other electronic records management projects of the time, the SPIRT project did not attempt to set out the functional requirements for trustworthy electronic record, nor did it attempt

[44] Sue McKemmish, Glenda Acland, Barbara Reed, and Nigel Ward, "Describing Records in the Context in the Continuum: The Australian Recordkeeping Metadata Schema," *Archivaria* 48 (Fall 1999), 3-37.
[45] Ibid.
[46] Ibid.

to identify them in a particular environment. Rather, the SPIRT project provided creators and preservers the necessary metadata elements which they could select to formulate their own specific metadata standards.

The Government of Canada also built on the work of the Pittsburgh project, though in a different direction. As noted in Chapter Two, Bearman's work in the late 1980s and early 1990s had begun to align with the efforts undertaken by the then National Archives of Canada (NAC) to modernize archival practices, particularly with regard to the appraisal of functions, structures, processes, and citizen-state interactions (transactions) embodied in macroappraisal.[47] As senior managers with NAC during the late 1980s and early 1990s, John McDonald (in addition to his key contribution to most ICA work on electronic records during the 1990s) and Terry Cook both participated in the Pittsburgh project's consultation process, while also developing and implementing NAC methods which aligned with Pittsburgh project requirements (McDonald through functions-based electronic recordkeeping, and Cook through functions-based macroappraisal). In applying an early version of functional requirements he had developed in the Information Management and Office Systems Advancement (IMOSA) project in the late 1980s and early 1990s to government systems, McDonald, along with Cook, pushed the adoption of familiar Bearman concepts within the Canadian federal government, including the combined use of policy, procedural rules, functional context, functional requirements, integration with business processes, and information technology specifications and standards in order to address issues of authenticity, accessibility, and preservation.[48] As noted, this functional context was a key part of the macroappraisal methodology, which relied on functional context and significant business transactions for appraisal and description.

[47] See Terry Cook, "Macroappraisal in Theory and Practice: Origins, Characteristics, and Implementation in Canada 1950-2000," *Archival Science* 5 (2005), 101-161.
[48] John McDonald, "Managing Information in an Office Systems Environment: The IMOSA Project," *American Archivist* 58 (Spring 1995), 142-153.

In addition, Cook and McDonald also led the charge to adopt Bearman's conceptualization of the site of records creation and capture, with McDonald anticipating in 1995 that "future filing systems will be molded around the transactions that comprise the business processes of the organization,"[49] to better reflect the context of creation than traditional paper-based approaches.

McDonald's understanding of Bearman's principles was instrumental in the development of the Government of Canada's efforts to ensure the creation and maintenance of trustworthy records through the Records Document Information Management System (RDIMS). Designed, built, and implemented by CGI Group Inc. in the late 1990s and early 2000s, under McDonald's general direction and with Bearman's input, RDIMS is a suite of software products that were integrated with business processes to "enable the full life-cycle management of electronic documents such as email, correspondence, reports, presentations etc., and non-electronic documents such as paper and audio and video recordings."[50] As a standalone recordkeeping system, RDIMS enables the ingestion of records containing five minimum metadata elements (date, creator, title, language, and function or work-process-based subject of the declared record).[51] It also allows for the capture of these metadata at the time of creation by running Microsoft applications from within the RDIMS system itself.

While most follow-up work fell decidedly on either side of the theoretical differences between the UBC and Pittsburgh projects, some combined elements of both. The Victorian Electronic Records Strategy (VERS) standard, for example, applied concepts of function-based capture and integration of metadata with records at the time of active business use, as promoted by the Pittsburgh project, while allowing for the addition and supplementation of metadata after transfer

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[49] Ibid.
[50] Government of Canada, *Records, Document and Information Management System (RDIMS) User Guide*, (Ottawa: Office of the Information Commissioner, 2010).
[51] Treasury Board of Canada, Secretariat, Canada, *Records Management Metadata Standard*, (Ottawa: Government On-Line Metadata Working Group, Records Management Sub-Group, February 7 2006).

of electronic records to archival holdings, as promoted by the UBC project.[52] The initial version of VERS, released in 2000, included a specification *of System Requirements for Archiving Electronic Records*.[53] It included basic recordkeeping requirements (capture, classification, record linking, access, retention and disposition, search and retrieval, rendering, auditing, etc.), along with metadata specifications to guide the development of recordkeeping systems. The second version, released in 2003, removed the specifications for a general electronic recordkeeping system and replaced them with minimum system requirements for the preservation of an electronic recordkeeping system (reliability, authenticity, integrity).[54] This was presumably to simplify the specifications and as a nod to the fact that most existing recordkeeping systems do not at present operate according to their specified standards, and therefore, at least for a transitional period, will require the type of back-end appraisal, arrangement, description, and preservation capability advocated in the UBC project findings. The VERS standard thus produced both front-end recordkeeping requirements and back-end standards to ensure the ingestion of records with minimum metadata in preservable formats for archives.

Given nearly fifteen years to judge their impact, it is clear that neither the UBC nor Pittsburgh projects produced ready-made "silver bullet" solutions for ensuring the creation, maintenance, accessibility, and preservation of electronic records. They did provide, however, a solid theoretical foundation on which others could build. Building on the UBC project's elemental

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[52] Public Records Office Victoria, "Introduction to the Victorian Electronic Records Strategy (VERS), PROS 99/007 (Version 2)," (July 2003), available at http://www1.unece.org/cefact/platform/download/attachments/31850501/Explanation_99-7_Advice_ver_2-0.pdf?version=1, accessed 1 April 2012.

[53] Public Records Office Victoria, "Specification 1: System Requirements for Archiving Electronic Records, (VERS), PROS 99/007," (2000), available at http://210.8.122.120/vers/standard/ver1/99-7-1toc.asp, accessed 1 April 2012.

[54] Public Records Office Victoria, "Specification 1: System Requirements for Preserving Electronic Records (VERS) Version 2, PROS 99/007," (2003), available at http://210.8.122.120/vers/standard/spec_01/, accessed 1 April 2012.

desconstruction of authentic and reliable electronic records, and using the entity and activity models they generated, the creators of the DoD 5015.2 standard reverse-engineered system requirements which enabled the creation and maintenance of trustworthy electronic records. In developing these general concepts, the DoD 5015.2 standard also added detailed and testable system specifications for use by creators in the design, testing, and procurement of software products. The National Archives and Record Administration's (NARA) endorsement of the use of the DoD standard, and thereby acceptance of it as the de facto standard for transfer of electronic records to NARA holdings, has also had an enormous impact on both the quality of records acquired and on the archival functions performed in support of this transfer. As the DoD standard is primarily an electronic document management system (EDMS) standard, it does not, however, include the full suite of "hard" and "soft" functional requirements of either the Pittsburgh or UBC projects.

The UBC project's theoretical formulations were further developed by the InterPARES projects to produce the tools for guiding both records creators and preservers. Though these two distinct phases began to cross over and blur as the projects progressed, the legacy of the UBC project's influence continues to be felt in both the understanding of key records elements, particularly as these relate to reliability and authenticity, and in the use of entity and activity models to express activities and relationships in an electronic environment. Others also extended the UBC project findings. The Victorian Electronic Records Strategy (VERS), for example, extended these findings to actually identify and affix metadata to records of enduring value so that they can be captured or ingested into an electronic repository for long-term preservation as an archivally driven complement to the metadata encapsulating the digital records already put there by the creator.

The influence of the Pittsburgh project equalled and perhaps overshadowed the theoretical work of the UBC and successor projects. The conceptualization of a record as evidence of a business

transaction allowed for the smooth integration of business processes with recordkeeping systems. Furthermore, the single-phased approach combined requirements for active, semi-active, and archival recordkeeping in one set of requirements. Those who followed in the footsteps of the Pittsburgh project also developed the structural model of high-level functional requirements with detailed specifications, which could be tested to ensure systems met the basic requirements they established. Evidence of the Pittsburgh project's strategic and structural influence can also be seen in the metadata schemas developed by the European, Australian, and Canadian models, as well as the modular and customizable specifications they inspired. These inspired projects are the focus of the next chapter, which examines in more detail the functional requirements and other specifications which followed the UBC and Pittsburgh models.

Chapter Four

Implementation and Analyses of the Functional Requirements for Electronic Recordkeeping Systems

The many national and international functional requirements for electronic recordkeeping systems emerging out of the Pittsburgh and UBC projects have advanced our understanding of records in the electronic environment and provided specifications for the computer systems to manage them in order to produce trustworthy records, or evidence, for contemporary and historical use. Their sometimes different and competing specifications have served both to make significant contributions to global efforts to create and preserve trustworthy records, but also to send mixed messages to creators, vendors, and preservers. This chapter looks at what the implementation of each of the major types of functional requirements might look like in three key areas, including creating organizations, archives, and for individual users. It analyzes the content, structure, and implementation of the major functional requirements, and explores opportunities for growth and further development.

For the purposes of comparison and analysis, the currently available functional requirements can be divided into four broad categories. First, the Department of Defense's *DoD 5015.2-STD, Design Criteria Standard for Electronic Records Management Applications*, is an outlier among the others, in that it is a design specification for records management application. Although it specifies

the capabilities to ensure reliability and authenticity in records, it does so only for the creation, classification, maintenance, and disposition of active records. Any benefits the addition of metadata provides for the long-term preservation of records, including the appraisal, selection, description, preservation, and reference of archival records is incidental to the primary function of the management of current or active records. Secondly, the benchmark and baseline requirements produced by the InterPARES projects comprise their own distinct group, as they are unlike the other technical specifications. They act, not as system specifications which can be tested and used to design software applications and recordkeeping systems, but rather offer procedural guidance for the creation, use, and preservation of electronic records. Thirdly, the functional requirements developed by Norway, the United Kingdom, the European Commission, Australia, the International Council of Archives (ICA), and the International Organisation for Standardization (ISO) share basic concepts, strategies, terminology, and accompanying tools, which set them apart as a recognizable group. As MoReq2 has been adopted by much of Europe, and the ICA/ISO standard was developed to align rather than compete with it, MoReq2 will be used to represent this group. And finally, in what amounts to an "other" group, lie the Victorian Electronic Records Strategy (VERS) of the Public Record Office of Victoria and the Records Documents and Information Management System (RDIMS) of the Government of Canada, both of which combine elements of both software specifications and procedural guidance.

Growing out of the two-phased recordkeeping approach which defined the UBC and InterPARES projects, the DoD 5015.2 standard should be considered a records or document management specification, rather than a holistic recordkeeping system standard. Its specifications targeted the North American concept of active recordkeeping domain, which comprised the functions of creation, classification, maintenance, and disposition of records (transfer to preserving entity or destruction). As such, it occupies a unique place among the other functional requirements available

to date, which do not distinguish between the active and inactive, or archival, domains. Thus, while the DoD specification ensures records management applications have the technical capabilities to attach metadata concerning the reliability of records, as well as for the transfer of records to a preserver's custody, it was not designed to ensure the long-term preservation of electronic records.

Implementation of the DoD 5015.2 standard ensures records are reliable using concepts about trustworthy records developed by the UBC project. These concepts held that reliability is derived from complete records, from attestations about the level of control exerted on the creation procedure, and from the known reliability of the author. In order to meet these requirements, the DoD 5015.2 standard includes provisions for the implementation and alteration of DoD fileplans (C2.2.1), which ensure both the completeness of the recordkeeping system, as well as situating records within the larger system; for the creation, viewing, editing, and deletion of records disposition schedules (C2.2.2), ensuring the authorized and scheduled removal (destruction or transfer) of records from the system once no longer required; for the capture, identification, and grouping (classification/filing) of records so that they can be managed at various levels (C2.2.3); for the management of emails as any other records (C2.2.4); for the storage of records, providing security, and enabling access to records regardless of format (C2.2.5); for the management of records, including reporting ability, search and retrieval of records, and the authorized file manipulation, such as addition, edit, closing, transfer, alteration, or suspension of retention/disposition, destruction etc. (C2.2.6); for the retention of records for as long as needed, and then to enable the transfer of select records to the National Archives and Records Administration (NARA) for the implementation of records access controls (user, admin, etc.) (C2.2.7-8); for the conducting of system audits to ensure all aspects of the system are performing according to design; for the management of the system (backups, recovery, updates, storage monitoring etc.) (C2.2.9); and additional miscellaneous requirements to be met, not by the records management applications, but by the organization, which cover the maintenance of

proprietary calendars and task lists, external email systems, native software and hardware format preservation, email lists, NARA hardware and software requirements (for transfer to NARA), and the destruction of backup copies (C2.2.10-12).[1]

As the DoD 5015.2 standard was not intended to deal with records which exist in the inactive, or archival, phase of the traditional life-cycle, it does not contain specific requirements designed to aid the appraisal and acquisition of records, archival description, long-term preservation, or reference and use for historical purposes. Records created and maintained using only the mandatory requirements set out by the DoD 5015.2 standard will contain information about the fileplan and folder structure within which the record was created, the unique identifier of the record, the subject or title, the dates on which the records were filed/published, the author or originator, the creating organization, the media type and format of the record, the dates they were received, addressee information, the location, information detailing the transmission of the record, technical and supporting metadata about records capture for scanned images, photographs, and web records, as well as search and retrieval tags based on the creator's own standards. In addition, upon transfer to the preserver (NARA), the records produced and maintained by a system implementing the minimum DoD 5015.2 standards would include evidence that access, edit, and deletion controls were maintained, and that disposition was scheduled, authorized, and audited.

The metadata attached to records within a system implementing the mandatory elements of the DoD standard would ensure the capture of necessary content, context, and structure which meet the minimum requirements articulated by the UBC project. Indeed, a system employing the mandatory requirements of the DoD standard would include the UBC-determined minimums for

[1] Department of Defense, United States, *DoD 5015.2-STD, Design Criteria Standard for Electronic Records Management Software Applications* (Washington: Assistant Secretary of Defense for Command, Control, Communications, and Intelligence, 2007).

reliable records, which included date, time, author, addressee, subject, name of the recipient, date of receipt, and classification code, and registration number, if applicable. The primary archival use of records metadata produced by systems meeting the DoD 5015.2 standard is to enable authentication of the records. The preservation of the records leading to and following transfer would require additional efforts on behalf of the preserving entity. First, the preserver/archivist must engage in the complex process of macroappraisal to decide what small portion of the total record should be selected for transfer and long-term preservation as archives. Depending on the classification scheme used in the metadata (functional and business process, transactional, traditional subject, nominal, geographical, structural, etc.), the DoD 5015.2 standard could help or hinder the appraisal process, but at best it only helps to locate records that are first identified as having archival value through the appraisal research and analysis. Beyond appraisal, preservers/archivists would also need to have the technical capacity to receive the transfer (software and hardware); would need to provide additional metadata for archival contextual description, and to ensure the future migration of the data to new hardware or software platforms; and would need to enable metadata tagging which documents on-going use, alteration, or copying of either the system or the records, all of which is outside the purview of the DoD 5015.2 standard.

Since its release, DoD 5015.2 has become the de-facto standard for electronic records management software applications. It took the lead in articulating functional requirements for the active records management phase put forward by the UBC project in a format that was familiar to software developers, vendors, and DoD agencies. Not only could the requirements be clearly understood by the DoD and the software industry, but the way the requirements were presented also supported a testing regime by which system capabilities could be quantitatively assessed. The standard, however, is unwieldy and impractical for smaller organizations, which often lack the elaborate and formalized organizational structure and formalized records management policies, and it

is almost completely irrelevant for personal, private digital records created by individuals, families, small groups, and community organizations. Indeed, implementation of even just the minimum mandatory DoD 5015.2 requirements would be impossible for most individuals and smaller organizations. It is also important to note that DoD 5015.2 compliant applications are not pre-configured solutions. Rather, they ensure that the application is capable of meeting these requirements. The standard neither prescribes how the requirements will be fulfilled, nor does it provide a guide to configuration of a DoD 5015.2-certified application.

The DoD 5015.2 standard does not provide guidance or specifications for long-term preservation of trustworthy electronic records. This was, however, the primary goal of the InterPARES projects, undertaken following the release of the DoD 5015.2 standard. Not provided in similar manner as technical specifications or functional requirements in the way the DoD standard was, the InterPARES 2 guidelines for creators and preservers nonetheless represented a way for both individual and organizational entities to create, maintain, and preserve reliable and trustworthy electronic records over time.[2] The InterPARES 2 guidelines did not articulate minimum or mandatory requirements to ensure creation, maintenance, and preservation, but rather, they articulated, in accessible language, basic elements which contribute to reliability and authenticity, along with recommendations for ways in which creators and preservers could ensure records possess these characteristics.

As noted in Chapter Three, and to summarize here, the InterPARES 2 creator and preserver guidelines were based on the InterPARES 1 *Benchmark Requirements Supporting the Presumption of*

[2] InterPARES 2, "Appendix 20, Creator Guidelines – Making and Maintaining Digital Materials: Guidelines for Individuals," and "Appendix 21, Preserver Guidelines – Preserving Digital Records: Guidelines for Organizations," in *International Research on Permanent Authentic Records in Electronic Systems (InterPARES) 2: Experiential, Interactive and Dynamic Records*, [electronic version] Luciana Duranti and Randy Preston, eds., (Padova, Italy: Associazione Nazionale Archivistica Italiana, 2008), Appendix 20 and 21, available at http://www.interpares.org/public_documents/ip2(pub)policy_framework_document.pdf, accessed 1 April 2012.

Authenticity of Electronic Records, which contained eight broad areas for creators to consider in creating and maintaining electronic records.[3] The benchmarks' eight areas established the identity and integrity of the record; ensured procedural and security controls on creation, access, alteration, transfer, removal, and destruction; ensured technical accessibility over time, as well as the rules for auditing the recordkeeping system in which it operates.[4] Using these benchmarks as a foundation, the creator and preserver guidelines were designed to be adapted by both individual and organizational creators as determined by their own unique needs. The degree to which these recommendations are followed, in conjunction with the creator's own socio-juridical environment, determine the reliability of the records emerging from the system. This freedom to choose both the scope and level of adoption of the recommendations obviously leads to records with varying degrees of reliability and authenticity. The myriad options and variations in adoption of the recommendations also mean that preservers need effective tools to evaluate the reliability of records once they are no longer needed for active use.

These tools are provided by InterPARES 2 in the form of *Baseline Requirements Supporting the Production of Authentic Copies of Electronic Records.*[5] Together with the *Framework of Principles for the Development of Policies, Strategies and Standards for the Long-term Preservation of Digital Records*,[6] the preserver guidelines provide recommendations for establishing, resourcing, and supporting a preservation program, for appraising records of long-term value, acquisition of

[3] InterPARES Project,"Appendix 2: Requirements for Assessing and Maintaining the Authenticity of Electronic Records," [electronic version] in *International Research on Permanent Authentic Records in Electronic Systems* (InterPARES), Luciana Duranti, ed. (Vancouver, BC: 1997), available at http://www.interpares.org/book/index.cfm, accessed 1 April 2012.
[4] InterPARES Project, "Authenticity Task Force Report."
[5] InterPARES Project, "Appendix 2."
[6] InterPARES 2, "Framework of Principles for the Development of Policies, Strategies and Standards for the Long-term Preservation of Digital Records," in *International Research on Permanent Authentic Records in Electronic Systems (InterPARES) 2: Experiential, Interactive and Dynamic Records*, [electronic version] Luciana Duranti and Randy Preston, eds., (Padova, Italy: Associazione Nazionale Archivistica Italiana, 2008), available at http://www.interpares.org/public_documents/ip2(pub)policy_framework_document.pdf, accessed 1 April 2012.

electronic records, for preserving records (including storage and description), and for on-going application of metadata documenting uses and changes to the records once in the preserver's possession. Use of the preserver guidelines provides a comprehensive plan and methodology for selecting and acquiring electronic records, for appraisal of those records, for the physical transfer of the records, and for the long-term preservation of those records.

Following the InterPARES 2 preserver guidelines requires a significant investment in organizational, financial, technical, and professional resources apart from the initial efforts during the creation and maintenance phase. While the DoD and InterPARES division of active and inactive, or archival, recordkeeping requirements necessitates separate specifications/guidelines for the creation and use phase and for the preservation phase, the Pittsburgh project-based models roll both into one set of requirements. Due to the gradual convergence of Pittsburgh-based successor projects around common expressions of the functional requirements, as outlined in Chapter Three, the European MoReq2 functional requirements may serve to stand as a suitable representative for this stream of functional requirements.

MoReq2 is intended to be used by creators for the design, testing, procurement, and implementation of recordkeeping systems which create, maintain, and preserve authoritative electronic records across time, in all environments, from the creator to the archival. MoReq2 uses the International Standards Organisation *Records Management Standard 15489* definition of authoritative records, which requires records to have characteristics of authenticity, reliability, integrity, and usability.[7] These characteristics are not dependent on the records life-cycle, and may be applied to any record at any stage of its existence, custody, and use. Although the requirements are

[7] ISO/DIS 15489, *Information and Documentation – Records Management*, (Geneva: International Organisation for Standardization, Technical Committee ISO/TC 46 Information and Documentation, Subcommittee 11, Archives/Records Management, 2000).

generic requirements, necessitating customization by creators, they do contain mandatory minimum recordkeeping functionality designed to capture content, context, structure, and presentation, and to enable basic recordkeeping activities (classification, capture, retention, disposition, etc.).[8] Implementation of the minimum requirements should ensure a record which:

- can be proven to be what it purports to be;
- can be proven to have been created or sent by the person purported to have created or sent it;
- can be proven to have been created or sent at the time purported;
- can be depended on because its contents can be trusted as a full and accurate representation of the transactions, activities or facts to which it attests;
- is complete and unaltered; and
- can be located, retrieved, presented and interpreted.[9]

MoReq2 ensures the creation, maintenance, and preservation of authoritative records by ensuring appropriate metadata is applied to the record concerning:

- classification of a record within the organization's established classification system (Module 3);
- implementation of controls and security provisions to govern access, creation, alteration, deletion, and removal of records from the system (Module 4);
- retention and disposition of records (Module 5);
- capture and declaration of a record, meaning the fixing or saving of a record within the system (Module 6);
- referencing the types of entities (classes, files, folders, etc.) within the system (Module 7);
- search and retrieval of records (Module 8); and
- administrative control over the recordkeeping system (Module 9).[10]

As with other Pittsburgh project-inspired functional requirements, MoReq2 also contains additional modules for functionality closely tied to the management of electronic records (e.g. workflow, management of physical records, casework, encryption, etc.). Using only the mandatory minimum functionality, a creating organization can expect to create, maintain, and preserve authoritative

[8] Presentation refers to the rendered record, or how the record is viewed or displayed to the user.
[9] ISO/DIS 15489.
[10] Serco Consulting (for the European Commission interchange of Documentation between Administrations Programme), *MoReq2: Model Requirements for the Management of Electronic Records, Update and Extension* (Bruxelles-Luxembourg: 2008).

records to the degree they have configured it and as defined above.

The implementation of the MoReq2 functional requirements enables the type of preservation envisioned by Bearman and the investigators of the Pittsburgh project. Preservers may use the MoReq2 specifications to appraise the recordkeeping system either for physical acquisition or to link users to archival records left with their creators in the distributed custody model described in Chapter Two. If the appraised system has been certified compliant with the MoReq2 specifications, preservers can reasonably assume the containing records have the necessary characteristics which make them authoritative records. Indeed, the records of a MoReq2 compliant system will contain the necessary metadata about the content, context, structure, and presentation to make them accessible over time. Once no longer required for active use, the records will be exportable for physical acquisition by preserving bodies and/or maintained in an accessible way in the custody of the creating organization.

As with the DoD 5015.2 standard, the MoReq2 standard is designed for use within large organizations with established recordkeeping policies, procedures, and practices. Although the requirements are scalable and presented in accessible terms for a wide variety of users, private individuals and small corporate or group creators — all of whom lack the rigid organizational structure, procedural rules, and technological capabilities required by the requirements — are unlikely to implement them. At seven hundred pages, the standards are likely inaccessible to individual users, though preserver organizations may use the MoReq2 requirements to assess the recordkeeping systems of individual or small organizational bodies whose records are of long-term organizational or historical value. It is, however, unlikely that that such creators will create records with the necessary characteristics required for authentication under the MoReq2 requirements without further guidance and more user-friendly implementation tools.

For those that combine elements of creator and preserver requirements, the implementation of the specifications differs, though the results are intended to be the same. The most recent version of the Public Record Office of Victoria (PROV) Victorian Electronic Records Strategy (VERS),[11] for example, contains five separate specifications covering system specifications, standard metadata to be employed, acceptable preservation formats, and exporting requirements for records to be transferred to the PROV's digital archives. Together, these specifications are intended to ensure implementing organizations create, maintain, and preserve authoritative, or trustworthy, electronic records. The functional requirements and accompanying detailed specifications for system requirements which conform to the VERS standard are neatly separated into six broad areas: Record Authenticity (the definition of which conforms to the ISO 15489 standard); Record Integrity (the system must prove the records have not been altered, deleted, removed or otherwise modified other than as authorized); Document Conversion to an accepted software and storage format; Metadata Capture (capable of capturing metadata as specified by the Metadata Schema Specification), concerning documentation of use, alteration or modification of declared records; Reliability (complete and accurate records); and Migration to move to new software and hardware platforms and the ability to export records, without losing the context, structure, or content.[12] For creators, compliance with the VERS system requirements ensures records will be authentic, reliable, have

[11] Public Records Office Victoria, "Victorian Electronic Records Strategy (VERS), PROS 99/007 (Version 2)," (July 2003) http://210.8.122.120/vers/standard/version2.asp, available at http://www1.unece.org/cefact/platform/download/attachments/31850501/Explanation_99-7_Advice_ver_2-0.pdf?version=1, accessed 1 April 2012.

[12] Public Records Office Victoria, "System Requirements for Preserving Electronic Records, PROS 99/007 (Version 2) Specification 1," (July 2003) http://210.8.122.120/vers/standard/pdf/99-7-1_Std_ver_2-0.pdf, accessed 1 April 2012.

integrity, and be usable over space and time. The specifications allow for detailed compliance testing, and products meeting the specifications are published on the PROV's website.[13]

The VERS system requirements, however, were established well after many of the electronic records were already in existence or already being transferred to the PROV. In order to address this, VERS also includes specifications for records transferred to their digital archives from non-compliant systems. *Specification 5: Export of Electronic Records to PROV* specifies the criteria required for transfer, import, or acquisition of electronic records, including both the minimum metadata required and the physical means (media) which will be accepted for export to the PROV digital repository.[14] As a work-around solution, the VERS specifications prescribe the encapsulation of certain minimum metadata elements along with the records to be transferred in a specially designed format (VERS Encapsulated Object, or VEO) using eXtensible Markup Language (XML).[15] The VEO consists of the record to be transferred, certain recordkeeping metadata, an XML wrapper to enable search and retrieval, and digital signatures to attest to the reliability of the author. Before transferring electronic records to the PROV, creators are required to encapsulate basic information which captures the content, context, and structure of the records, along with information about how to render the records. VERS was developed by the PROV for use by the State Government of Victoria and its various agencies, departments, and offices. It enables the PROV to point to specific standards which must be satisfied in order to allow government organizations to transfer electronic records to their digital archives. It has been adapted for use in other jurisdictions, by archives, governments, and other organizations, but is not intended to be used by individual creators. Like the

[13] Public Records Office Victoria, "VERS Compliant Products", (2011) http://210.8.122.120/vers/assessment/certifiedv2.asp, accessed 1 April 2012.
[14] Ibid.
[15] Simply put, eXtensible Markup Language is a human and machine-readable open-source markup language developed by the World Wide Web Consortium to enable simple, reliable, and commonly understood display of electronic documents.

other products looked at in this thesis, its technical complexity and reliance on costly applications make it out of reach for most individual users. It requires procurement of a compliant records management application, as well as configuration of that application in order to produce and/or export the type of VEOs accepted by the specification, placing it out of reach for most individual and small organizational users.

The Government of Canada's *Records, Document and Information Management System* (RDIMS)[16] differs from the VERS approach in two key ways. Rather than producing a set of specifications for various vendors to meet, Treasury Board of Canada, Secretariat, issued a tender for a system meeting the functional requirements developed by the *Information Management and Office Systems Advancement* (IMOSA) project in preparation for procurement of software products possessing basic recordkeeping functionality for use across the Government of Canada. Hummingbird Ltd. won the tender for a suite of software products meeting specifications derived from these functional requirements, adapting a version of its pre-existing electronic document and records management system to the contract. The resulting RDIMS solution integrates records management functionality with common business applications (word processing, spreadsheets, presentations, etc.) to allow for the automated or manual capture of up to fifty metadata elements derived from the *Government of Canada Records Management Metadata Standard.*[17]

Like VERS, the RDIMS solution allows for the encapsulation of the document with established metadata elements to form a packet, which is then fixed, irrespective of format or media, within the recordkeeping system. Included in the fifty total elements are five minimum metadata elements required for saving records to the system. This ensures that each record declared or captured within the system contains, at minimum, standard information about the date, creator, language, subject, and title. Additional metadata

[16] Government of Canada, *Records, Document and Information Management System (RDIMS) User Guide* (Ottawa: Office of the Information Commissioner, 2010).
[17] Government of Canada, Treasury Board of Canada, Secretariat, *Records Management Metadata Standard* (Ottawa: Government On-Line Metadata Working Group, Records Management Sub-Group: February 7, 2006).

may also be found as part of the record itself, as most modern business applications automatically generate basic information about who created the record, the dates, the type of file it is, the size, details about modification and printing, though this varies according to application and how it is configured, though this is not typically part of recordkeeping systems. Furthermore, RDIMS also automatically ties records to their individual and organizational creator through user profiles, which further contributes to context and thus the reliability of the records. However, it also allows creators the flexibility to decide, either individually or as an organization, what records are captured in the system, what additional metadata is included, and how that information is managed (retention, disposition, access, etc.) within the system.

Similar to both VERS and MoReq, the RDIMS solution is designed for use by large organizational records creators. It enables the controlled creation and use of electronic records, which supports reliability, as well as a controlled storage environment, which contributes to the authenticity of the records. Together, the metadata and the records contained within the RDIMS solution also contain sufficient content, context, and structure to enable long-term preservation. The system itself has been certified as containing authentic and reliable records, and also enables ongoing and documented use of the records. However, unlike the other specifications covered in this chapter, the minimum metadata elements required for transfer to an RDIMS system are limited to five basic elements, effectively opening up the system to users of various sizes, levels of organization, and work-place complexities. While these five minimum elements may not provide the full spectrum of context, content, and structure provided for in other sets of requirements, their simplicity, coupled with the growing number of metadata elements already being automatically applied to records within common business applications widely used by individuals, small organizations, and large bureaucracies, pave the way for the appraisal, acquisition, and preservation of electronic records otherwise not available to archives. And although RDIMS is not currently configured to accept the records of individual or small organizational donors for archival preservation, it appears the

capability to do so is there.

Each of the four types of functional requirements discussed in this chapter have common requirements which are clearly and explicitly stated. Most important of these is that the functional requirements are not a ready-made electronic recordkeeping solution. They are only tools to be used to meet the needs of the organization. Computer systems need to be given specific instructions, and so each set of requirements begins with the call for what the Pittsburgh project called a "Compliant Organization," which refers to the articulation of formal recordkeeping laws, policies, procedures, regulations, and requirements to which the implementing entity is bound. These internal and external recordkeeping rules must be clearly articulated, regularly updated, and applied consistently to both physical and electronic records, as they inform the capture of supporting metadata and the procedural rules which contribute to evidence of reliability. These procedural rules also include standardized metadata usage, which all require and provide.

These juridical rules, along with the generic rules supplied by the functional requirements for creating, maintaining, and preserving trustworthy records, form the basis of a system which creates and maintains trustworthy records. Each of the requirements apply metadata to records (which differ from data in that they contain content, context, and structure) to ensure: they are complete (they conform to the socio-juridical environment in which they operate); that they are reliable (they are complete, have been acted upon by authorized entities, and possess evidence of relationships with other records); and that they are authentic (they can be proven to be what they claim, to have been created by the person claiming to have created it, and at the time and in the circumstances it claims to have been created).

Specifically, each of the functional requirements require the formation of metadata which can be grouped into six main areas closely resembling the clusters put forward in the Pittsburgh project's Framework for Business Acceptable Communication:[18]

1. Capture: VERS simply called this *Authenticity*, while DoD 5015.2 called it *Implementing File Plans* or *Declaring and Filing Records*, InterPARES called it *Identity of a Record* and *Integrity of a Record*, and MorReq2 called it *Classification Scheme*, *File Organisation*, *Capturing and Declaring Records*, and *Referencing*, but the general concepts concerning the capture, ingestions, declaration, classification, or identification of a record as established by the Pittsburgh project remain consistent. Each of the functional requirements mandates that records be identified and fixed within the broader context of the creator(s) and their activities. It is important to note, however, that DoD 5015.2 also has a separate section on classification, but this is for security and access restrictions on sensitive records, not for the organization of records within a records taxonomy.

2. Integrity: This area concerns the need to establish environments with integrity, by specifying controls on procedures of access, creation, maintenance, destruction and preservation. Dubbed *Integrity* by VERS, *Controls and Security* by MoReq2, *Storing Records* and *Access Controls* by DoD 5015.2, and *Access Privileges and Protective Procedures* by InterPARES, the specifications or recommendations of each are designed to ensure the records within the recordkeeping system are not created, altered, destroyed, or removed other than as authorized.

3. Retention and Disposition: Although VERS includes related elements within *Integrity*, the retention, destruction, and/or transfer of records is a secondary aspect of integrity, which may be separated to form a distinct group. DoD 5015.2 refers to it as *Scheduling Records* and *Retention and Vital Records Management*, MoReq2 as *Retention and Disposition*, InterPARES as *Removal and Transfer*, *Controls over Transfer*, *Maintenance and*

[18] David Bearman, University of Pittsburgh Electronic Records Project, "Towards a Reference Model for Business Acceptable Communications," (December 6, 1994), available at http://www.sis.pitt.edu/~bcallery/pgh/Bearman_TowardaReferenceModel.html, accessed 1 April 2012.

Reproduction. Metadata in in this area enables the system to identify established retention periods, to apply retention times, and to document the disposition of records.

4. Search and Retrieval: This refers to the attaching of descriptive metadata to enable search, retrieval and rendering of records within the system. DoD 5015.2 covers this as *Implementing File Plans* or *Declaring and Filing Records*, while MoReq2 calls this *Searching, Retrieving, and Presentation*, VERS calls it *Records Discovery*, and only InterPARES calls it *Archival Description*, reflecting its two-phased origins. Search and Retrieval metadata acts as a finding aid for the systems, allowing for accessible records to be found or viewed when needed, as well as the display of a record as it was originally intended.

5. Transfer and Destruction: Refers to the exporting of records to another system or to archival holdings, as well as for the removal of records from the system. DoD 5015.2 calls it *Transferring Records*, MoReq2 calls it *Controls and Security*, InterPARES calls it *Removal and Transfer of Relevant Documentation*, and VERS calls it *Records Export*.

6. Administrative Control: This area establishes the metadata for control of the recordkeeping system itself, to ensure it is operating as it should be and to allow for and to monitor administrative actions. DoD 5015.2 refers to this as *System Audits*, MoReq2 as *Administrative Functions*, InterPARES as *Documentation of Reproduction Process and its Effects*, and VERS refers to it as *Documenting the history of records and folders*

Each of the functional requirements explicitly and implicitly state the need for sound organizational records management practices for the success of any efforts to create and maintain trustworthy electronic records. This means assumptions about basic recordkeeping infrastructure, like the establishment and consistent use of records schedules, which set out authorized and approved retention and disposition of records. For some, this means the implementing organization must conduct an analysis of business functions and activities to support the recordkeeping system. The functional requirements influenced by the Pittsburgh project share the concept of the business transaction as the site of records creation. MoReq2 and VERS are both aligned with the ISO 15489

recordkeeping standard, which recommends functional classification for the organization of records. MoReq2, VERS and RDIMS also recommend that the implementing organization undertake a functional analysis to identify transactions where records need to be captured and to supply critical contextual metadata based on function, activity, work processes, and transactions. Interestingly, DoD 5015.2 also defines records as "information, regardless of medium, that details business transactions,"[19] though it does not expressly recommend functional mapping in order to identify recordkeeping sites. In conducting their case studies, InterPARES researchers also found that identifying and isolating trustworthy records strictly using records elements in the environment was a particular challenge. A draft, for example, may possess records elements of documentary form, content, context, and the archival bond, yet still not be a "record." InterPARES researchers ultimately found "that understanding the nature and boundaries of electronic records required a detailed understanding of the business functions and activities of the record-keeping systems being studied," rather than merely an understanding of records elements, which is a very specific (and explicit) compromise of the diplomatics foundations insisted upon as the core of the UBC and InterPARES projects.[20] Thus, while not a full endorsement of Bearman's concepts of recordness, InterPARES also recognized the value of functional analysis to facilitate recordkeeping. Regardless of the specifics, each set of functional requirements assumes a high degree of organizational recordkeeping capacity.

As InterPARES differs most significantly in its approach (procedural rather than articulating software specifications), it does set out organizational requirements more clearly than the others. For example, the InterPARES Benchmark Requirements explicitly require creators to establish procedures to "prevent, discover, and correct loss or corruption of records" (A.3.).[21] DoD 5015.2 also requires organizations to assume responsibility for maintaining necessary hardware and software

[19] DoD 5015.2-STD, 20.
[20] InterPARES Project, "Authenticity Task Force," 19.
[21] InterPARES 2, "Appendix 21: Creator Guidelines: Preserving Digital Records: Guidelines for Organizations."

(C.2.2.12.3), while VERS has specific acceptable formats for capture within the system, so in effect, the preservation procedures are included in the functional requirements. Neither RDIMS nor MoReq2 explicitly require organizations to ensure preservation capacity, although certainly it is implicit in their requirements that records stored within the system which require proprietary software to render, must be supported by tools provided by the organization.

The procedure-oriented InterPARES projects also contain requirements for the "declaration of the record's authenticity at a specific point in time by a juridical person entrusted with the authority to make such a declaration,"[22] requirements which are not presented in such procedurally-driven ways in projects rooted in the Pittsburgh tradition.. Although authenticity is maintained within a MoReq2 system by ensuring integrity, it also contains an optional module for electronic signatures, which is the most commonly employed authentication tool currently in use. The DoD 5015.2 standard does not provide for authentication, as described by InterPARES, though elements that support authentication are present throughout (access controls, creator metadata, etc.).

The functional requirements available to date represent nearly two decades of effort to ensure recordkeeping systems produce records with sufficient metadata to enable them to stand as authoritative or trustworthy evidence and that the records be available over time and space. None fall glaringly short in this regard. To varying degrees, the records created, maintained, and preserved within the systems meeting the requirements established by any of the major projects looked at in this thesis will possess authentic and reliable records, and will therefore be trustworthy and available over time. Where the functional requirements do fall short is in their scope, which by necessity has been limited to organizations, usually large administrative bodies with clearly defined recordkeeping legislation, policies, regulations, and practices, to say nothing of human and financial resources,

[22] InterPARES Project, "Authenticity Task Force."

ongoing educational, and training capacity, and audit or monitoring offices to keep everyone honest. Individual users, smaller organizations, or those without clearly defined recordkeeping regimes have little hope of procuring systems which meet these standards and especially of implementing them effectively. Indeed, implementation of the functional requirements with detailed specifications (DoD 5015.2, MoReq2, and to a lesser extent, VERS and RDIMS) requires solid recordkeeping foundations, which in addition to articulated recordkeeping regimes, also favours functional analysis (which is often difficult or impractical to apply to individual users or small organizations that conduct diverse activities but document these activities in ways that confound such functional organization), as well as defined user profiles, established metadata schema, retention and disposition schedules, and tight administrative controls, to say nothing of a well-resourced archival function to conduct the macroappraisal research and analysis to identify the electronic records that should be retained for the long-term, and resources to do that preservation.

Each of the functional requirements contain basic requirements to ensure the capture of metadata documenting content, context, structure, and in the case of VERS and MoReq2, also presentation or renderability. The implementation of systems meeting these requirements should allow for the application of recordkeeping rules which will ensure the creation, maintenance, and preservation of trustworthy records. The success of these standards, however, lies as much in the presentation and implementation of the specifications as in the content itself. The specifications need to be functional and flexible, while at the same time simplifying the implementation for users. This can be achieved by coordinating the efforts of the authors of functional requirements, by providing comprehensive implementation guidance, by making mandatory non-functional requirements for ease of use and user interface, and by incorporating user behaviour into recordkeeping systems that to date impose ideal practices rather than responding to user behaviour.

The success that such coordination can bring is demonstrated both in the MoReq2 and ISO functional requirements. The collective resources, both financial and professional, behind these efforts have reduced duplication, encouraged adoption of best practices, and opened up the possibility of single, adaptable standards. Reducing the number of standards means that software vendors can concentrate their efforts, that open-source options become viable, and that implementation experience can be used to improve both the standards and their implementation, as well as reduce the huge expense of using one-off or proprietary solutions. Reducing the number of available standards will also mean that more of the basic functionality they contain winds up in widely used business applications. Already, we see the inclusion of metadata in the most common records created in today's world of "office software" applications, like Word, WordPerfect, and so on. These applications now allow the creator to index any document, and assign the date the document was last edited, the creating organization, the file type, size and version, etc. A common standard for functional requirements for recordkeeping, with shared metadata elements, would only encourage more of this type of inclusion, which would benefit both organizational and individual users.

At the risk of further complicating specifications, some of which already total hundreds of pages, providing comprehensive implementation guidance would also be a boon to users. Guidance should include clear steps for planning implementation, establishing the non-system-related recordkeeping requirements (legal, regulatory, financial, human etc.), as well detailed instructions for customizing the available specifications, and user training components. In 2006, the Canadian Government released such an RDIMS best practices handbook, covering both implementation and training, which is necessary because of the reliance on end-users to declare records and manually

enter relevant metadata.[23] Perhaps due to the many variables which affect the implementation of MoReq2 and DoD 5015.2, implementation guidance and the training of users of these specifications is too difficult to achieve on any widespread basis.

A major cross-government recordkeeping initiative, jointly sponsored by the Treasury Board of Canada and Library and Archives Canada with senior-level support of all the deputy ministers, was launched in late 2011, building on the Treasury Board's new policy on mandatory recordkeeping (2009) which will considerably extend the RDIMS approach, in terms of requiring functional classification of all records, embedding functions-based macroappraisal, and encompassing all media (analogue and digital) in a seamless whole.[24] It encompasses massive training programs to build commitment and capacity for all public servants creating records and is a development that could set an international operational standard. This approach will now be continued, however, using GCDocs, an OpenText electronic document/records management systems product still in the development phase at the time of writing.[25] It is at present unclear what, if any, further guidance will be provided to administrators and users, nor is there any indication of how existing use of RDIMS within organizations will impact the move towards GCDocs. Further complicating this transition is the 2010 endorsement by the Government of Canada's Treasury Board of the (then) ICA functional

[23] Public Works and Government Services, Canada, *RDIMS Best Practices* (2006), available at http://louisetestwiki.pbworks.com/f/RDIMS+Best+Practices.pdf, accessed 1 April 2012; see also Treasury Board of Canada, Secretariat, Canada *Government of Canada Records Management Application Profile* (Government On-Line Metadata Working Group, Records Management Sub-Group: 2006), available at http://www.collectionscanada.gc.ca/007/002/007002-5002-e.html, accessed 1 April 2012..

[24] Daniel J. Caron, "The Recordkeeping Initiative: Findings of Assessment Projects and the Way Forward," presented to Ian E. Wilson, Librarian and Archivist of Canada, Library and Archives Canada, http://www.collectionscanada.gc.ca/007/001/007001-6301-e.html, accessed 1 April 2012.

[25] Treasury Board of Canada, Secretariat, Canada, *Enabling Government: The Information Management Challenge* [Corinne Charette] (2011) available at http://www.futuregov.asia/media/uploads/events/1._Corinne_Charette_-_D2.pdf, accessed 1 April 2012.

requirements for EDRMS (now ISO 16175).[26] It is also unclear what impact this shift might have for widespread implementation, and existing guidance and training efforts.

The most effective way to ensure both the application of metadata and the administration of records according to established rules is to automate the process as much as possible. Users are far more likely to adopt recordkeeping tools the less intrusive they are. Automation capabilities are key aspects of each of the requirements looked at, but there still remain times when users must interact directly with the recordkeeping system, whether to declare a record, make changes, add descriptors, apply security settings, or execute disposition schedules. In order to ensure consistent and prescribed use, these interactions should be as intuitive and free from human individual intrusion as possible, by being programmed into machine code based on the research and knowledge of records managers and archivists. Of the requirements looked at, only MoReq2 has provided a module containing optional specifications for ease of use (11.1), which offers hope that this has been recognized as a significant contributor to the success of these requirements. Although there may be considerable difference in how users perceive the usability of the system, based on familiarity and training, certain minimum automated requirements should be included to ensure that users are not faced with an unmanageable system.

Indeed, continued automation of recordkeeping functionality plays the leading role within this group of supporting or "soft" pieces, which will, in the end, factor significantly in determining widespread adoption and effective implementation of functional requirements for recordkeeping systems. With proven recordkeeping foundations already manifested in modern functional requirements, successful implementation moving forward will be dictated by the accessibility of the

[26] Treasury Board of Canada, Secretariat, Canada, *Standard for Electronic Documents and Records Management Solutions (EDRMS)* (2010), available at http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=18910&section=text, accessed 1 April 2012.

requirements, the experience of the user, both individual and corporate, the quality of implementation guidance and training offered, and the consistency of messages delivered to software developers, administrators, and end-users. These are not simply bells-and-whistles, but rather the integration of recordkeeping requirements within society at large. It took nearly a quarter century to build an agreeable framework for functional requirements for electronic recordkeeping systems, but this should not be discouraging. Even as the landscape ahead continues to change, the framework is solid, and the considerable effort it took to get to the current state can now be put towards these crucial supporting pieces.

Conclusion

Over the past three decades, our world has increasingly become an information society. The creation, use, dissemination, and manipulation of information play an integral part of the personal, political, and economic lives of people across the globe. Increasingly, this information is being created, consumed, and spread electronically, through countless sequenced zeros and ones without regard to national or cultural boundaries. Much of the electronically recorded information resulting from modern communication is temporary, inconsequential, and ephemeral. Yet, among this sea of de-contextualized data also lie vital records relating to government, commerce, and individual experiences essential for a functioning society, some of which will form the fabric of history. Records underpinning nations, cultures, human rights, institutional responsibilities, and personal experiences are being created in electronic form, yet they are at severe risk of disappearance.

Early research into this increasing reliance on electronic records for evidence of activity identified both technical and conceptual challenges to the capture and preservation of a long-term record. As technology progressed rapidly in a wild frontier with few rules about hardware, software, and media configurations, archivists immediately identified the fragility of these technologies as a primary barrier to the preservation and availability of records. The proliferation of electronic records also drove archivists to question what, in this new world, constituted a record and what would be the necessary context to give the record meaning so that efforts could be made to identify, capture, and preserve those records having long-term value. There emerged from a consensus that records with

evidential properties needed to have sufficient content, context, and structure as an integrated whole. In the electronic environment, this was best achieved by adding descriptive information about the records (metadata) to the record itself. In paper formats, this metadata was found to be intrinsic in the record's medium, content, documentary form, participants, and movements or transactions.[1] Developing this metadata and applying it to electronic or digital recordkeeping systems thus became the focus for both archivists and other information managers over the past two decades.

Just like the records they aim to create and preserve, modern functional requirements cannot be understood without their context, content, and structure, which begin with their theoretical origins. David Bearman and Luciana Duranti emerged as driving forces, building on earlier theoretical explorations of electronic recordkeeping. Blending traditional diplomatic analysis and archival sciences, Duranti became the leader behind the UBC project to identify, isolate, and segregate authentic and reliable records for long-term preservation. The UBC project developed an influential methodology and conceptual framework which established the vital elements of electronic records which are complete, authentic, and reliable. Furthermore, the UBC project also modelled the various entities and activities within recordkeeping systems for the purpose of developing specifications to ensure sufficient metadata is created and maintained. This work also contributed significantly to the development of the DoD 5015.2 standard, the single most widely used set of functional requirements and model specifications for records management applications, as well as to the InterPARES projects, which refined the electronic recordkeeping framework and produced widely circulated creator and preserver guidelines for ensuring the long-term preservation of electronic records.

[1] Luciana Duranti and Heather MacNeil, "The Protection of the Integrity of Electronic Records: An Overview of the UBC-MAS Research Project," *Archivaria* 42 (Fall 1996), 47.

Taking a different path – one which was in many ways antithetical to the UBC project that followed it– the David Bearman-led Pittsburgh project established a much-emulated framework of policy, design, implementation, and standards. Premised on a conceptualization of electronic records as transactions within business processes, the Pittsburgh-style functional requirements focused on specifications for electronic recordkeeping systems designed to apply and use metadata for descriptive and functional purposes. This conceptualization did not include the familiar separation of active and inactive, or archival, recordkeeping phases, and therefore resulted in specifications capable of both creating and maintaining authoritative records for active administrative use and for the long-term preservation of archival records no longer required for active use. The resulting work took the form of high-level functional requirements, more detailed system specifications, production rules for testing systems, and modules for integration with business processes. The project was rooted in revolutionary archival thinking which integrated (admittedly limited) archival functions with recordkeeping systems at the design and creation stage, thereby changing the custodial model so long entrenched in traditional archivy. In the nearly two decades following the release of the Pittsburgh project, this framework has been further developed by European, Australian, Canadian, and international efforts, particularly with regard to the specifications, their explanations, and the integration of recordkeeping systems with business activities.

The development and refinement of the frameworks put forward by both the UBC and Pittsburgh projects led to a number of offshoot initiatives, some of which coalesced around shared concepts, structure, and methodology, while others continued on their own path. Functional requirements from Norway, the United Kingdom, the European Community, Australia, and the International Council on Archives followed closely the Pittsburgh model, eventually gathering around the MoReq2 and ISO functional requirements for electronic recordkeeping systems. These shared specifications allowed for concentrated efforts by both the authors of the requirements and the

software vendors seeking to meet them, but also required considerable flexibility and implementation options. As the DoD 5015.2 standard benefitted from the tremendous purchasing power of U.S. military and related government agencies, it continued to stand on its own, becoming the de facto world standard for records management applications. Others, like the InterPARES projects, focused not on detailed specifications, but on providing guidance to creators on everything from electronic recordkeeping policies to media format selection, and guidance for preservers for the appraisal, acquisition, authentication, and preservation of electronic records. Others still, VERS and RDIMS, for example, adapted aspects of both the Pittsburgh and UBC projects to define and impose minimum requirements for the creation, maintenance, and preservation of electronic records.

The theoretical and methodological differences between the approaches of the Pittsburgh and UBC projects often put them at odds with each other. The UBC project's deductive approach initially reinforced existing records management and archival theory as solutions in the electronic environment, particularly with regard to the distinct active and archival phases. Meanwhile, the inductive approach of the Pittsburgh project led to a focus on business functions, processes, and systems in the real world, rather than on the individual records they produced, emphasizing a reconceptualised provenance and a reconceived archives as active hub rather than passive custodian of records. Although these differences initially seemed stark, time and further research have perhaps dulled or softened actual distinctions. Through testing and analysis of the original UBC findings, InterPARES contributors Eun Park and Anne Gilliland, for example, both cast doubt on the resonance of UBC theoretical assumptions with records creators and users.[2] Their research led to further case studies focusing on the real world practices of records creators, similar to early

[2] Eun G. Park, "Understanding 'Authenticity' in Records and Information Management: Analyzing Practitioner Constructs," *American Archivist* 64 (Fall/Winter 2001), 270-291; Anne Gilliland-Swetland, "Testing Our Truths: Delineating the Parameters of the Authentic Archival Record," *American Archivist* 65:2 (Fall/Winter 2002), 196-215.

Pittsburgh project work in establishing the social warrant on which their functional requirements were based. Indeed, these studies helped to shift the focus of the InterPARES projects away from diplomatics, and its attention on individual records or record groups, towards the management of whole systems, as recommended by Bearman and the Pittsburgh project. Blurring these distinctions further, Fiorella Foscarini has noted in detail the contributions InterPARES 2 made to the MoReq functional requirements, which, at least in this thesis, have been considered descendants of the Pittsburgh project.[3] Most significantly, David Bearman, after a ten-year absence from commentary on electronic records, extended an olive branch to the UBC project in 2006, formally acknowledging its contributions and downplaying the differences between it and the Pittsburgh project.[4] Both projects, Bearman conceded, agreed that electronic records were the result of personal and business activity, that these records were communicated, and that metadata integrated with the records was the means by which critical content, context, and structure was documented.[5] The principal difference between the two, Bearman argued, was the UBC focus on documents (items lacking the context and structure required to be considered a record until they are formally declared or registered), as opposed to all the records of a recordkeeping system found in the Pittsburgh project (automatically attaching contextual and structural metadata to all items within the system at the time of creation, regardless of their retention period or disposal action). This difference led to the UBC-inspired requirements towards electronic document management systems, such as the DoD 5015.2 standard, while Pittsburgh-inspired functional requirements led to electronic recordkeeping requirements, regardless of the position of records in the records continuum (active, semi-active, or archival). Bearman's concession, however, was perhaps a backhanded compliment, as he credited the convergence of subsequent work on functional requirements to the widespread adoption of

[3] Fiorella Foscarini, "InterPARES 2 and the Records Related Legislation of the European Union," *Archivaria* 63 (Spring 2007), 121-136.
[4] David Bearman, "Moments of Risk: Identifying Threats to Electronic Records," *Archivaria* 62 (Fall 2006), 15-46.
[5] Ibid., 18.

Pittsburgh-style principles, particularly those which dictate up-front capture of records within a function-based recordkeeping system.

Whatever form subsequent work has taken, functional requirements for electronic recordkeeping systems have become comprehensive, sophisticated, versatile, and perhaps more complex even as the requirements have tried to become more accessible. Contemporary functional requirements still do the same things they originally set out to do. They still attempt to describe systems which create, capture, maintain, use, and preserve records which can be relied on as trustworthy evidence of activity. Over time the creators of functional requirements have focused their concepts, clarified their rationale, provided creators and systems designers more detailed specifications, and enabled the flexible application of requirements according to the socio-juridical environment in which they operate.

Yet, as John McDonald noted early on about the efforts of the then National Archives of Canada to establish functional requirements, the power to employ or ignore these requirements ultimately ended up with individual end-users of computer technology as they created, modified, used, or deleted records.[6] Without a doubt, end-users play a crucial role in the success of these sophisticated tools, which require on-going education, training, and monitoring to ensure consistent and accurate application. More recently however, there has also emerged a shift in focus away from electronic recordkeeping systems (rooted in functional requirements) that have been imposed on creators and users, towards systems that are less obtrusive and less divorced from user-driven concepts of classification and order. Adrian Cunningham, for example, recently noted that after years of standards and guidance for electronic recordkeeping systems, poor electronic recordkeeping

[6] John McDonald, "Managing Records in the Modern Office: Taming the Wild Frontier," *Archivaria* 39 (Spring 1995), 70-79.

practices have persisted, largely due to the complicated, onerous, and rigid recordkeeping systems dictated by functional requirements.[7] These systems often leave users feeling alienated and burdened by recordkeeping demands that are too far detached from their business practices. Cunningham argues that the success of digital recordkeeping systems lies in the integration of recordkeeping needs and practices within business practices, something that has been missing in the bolt-on recordkeeping systems resulting from functional requirements. Cunningham points to functional requirements for business systems (Part three of the ICA/ISO requirements), presenting a simplified, jargon-free, and business friendly approach to recordkeeping systems, as a means of making functional requirements more relevant and understood to the users who so often determine the success of implementation. Steve Bailey has also been a strong voice for the integration of automated recordkeeping processes into the business activities of end-users through a series of articles and, most recently, a book dedicated to exploring the automation of records management functions.[8] Bailey looks towards commercial IT enterprises such as Google and Amazon that have successfully integrated user behaviour and participation to shape and reshape the classification of information. The result of this user-participation is the development of a rich and organic user-driven experience, enabling more logical (to the user) and responsive organization, search, and retrieval of information. The future of records management, Bailey portends, lies in recordkeeping systems that respond quickly and effectively to user behaviour, becoming fluid reflections of real world conceptualizations and practices.

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[7] Adrian Cunningham, "Good Digital Records Don't Just "Happen": Embedding Digital Recordkeeping as an Organic Component of Business Processes and Systems," *Archivaria* 71 (Spring 2011), 21-34.

[8] See Steve Bailey, "Forget electronic records management, it's automated records management that we desperately need," *Records Management Journal* Vol. 19, no.2 (2009), 91-97; ---, and Jay Vidyarthi, "Human-computer interaction: the missing piece of the records management puzzle?" *Records Management Journal* Vol. 20 Iss: 3 (2010), 279-290; and --- *Managing the crowd: rethinking records management for the web 2.0 world* (London: Facet, 2008).

Until user-driven classification becomes a proven and employable solution however, successful implementation of functional requirements is dependent on the recordkeeping capacity of the implementing entities. The functional requirements in themselves do not develop or impose the policies, procedures, business processes, or administrative structures required to make them operable. Without clear direction from the organization in the form of recordkeeping rules, metadata and classification schema, retention schedules, user profiles, and administrative structures, and without the systems administrators to make sure the system is running smoothly, or adequate training regimes for end-users who are responsible for entry of certain non-automated metadata elements, the system cannot hope to ensure authenticity and reliability of records. The most significant determiner of success is not the functional requirements adopted, but the recordkeeping infrastructure in place, and the operational culture and work-place norms to support the electronic recordkeeping system being implemented.

It stands to reason that if large, well-resourced and well-funded organizations may be unprepared to successfully implement these requirements, small originations and individual users might be further challenged. Indeed, aside from the guidelines produced by the InterPARES projects, little consideration to date has been given to the ability of individual and small organizational users to meet these requirements. Will future archives refuse to acquire personal electronic records because they do not contain sufficient metadata to enable authentication and preservation? Or will they perhaps add the required metadata prior to ingestion in their repositories, or prior to playing the role of information hub between users and records with dubious authenticity and reliability? Perhaps the best hope of capturing essential metadata lies in the inclusion of even more metadata elements making up the growing complement found in today's business applications. If this is to be relied upon, however, information professionals must push harder for standard metadata usage and the inclusion of metadata which addresses concerns about authenticity, reliability, and preservation.

This may also be a moving target, however. Changes to societal activities and patterns of human communication, particularly changes to the communication technologies, will have an impact on the ability of systems using any of the functional requirements. Increasingly, governments, businesses, organizations, and individuals are relying on collaboration software, social networking applications, cloud computing, and other interactive and dynamic environments. Traditional definitions of what a record is quickly break down in such environments, and, as a corollary, so too does our understanding of how to capture and preserve these communications. As the products of these activities are constantly in flux, being added to, subtracted from, incorporated into others, and re-created, identifying records, then appraising, capturing, and fixing them quickly becomes highly problematic. Each of the functional requirements to date look at capturing or fixing a record, freezing it in time, even though they all allow for documented changes to the record. But managing the myriad changes and uses potentially available in collaborative and social-networking environments, which allow for instant and unrestrained sharing of information, is likely impossible under the models currently available. This may require a further re-conceptualization of records and recordkeeping systems, even as we continue to struggle to manage the electronic records of yesterday. It appears then, that we are now facing again another "wild frontier," before we have tamed the one originally identified by McDonald.

Nevertheless, despite the changes coming on the horizon, functional requirements for electronic recordkeeping systems will continue to be a valuable tool in the preservation of authoritative electronic records. The challenges for future research and development in this area will be to define and identify records patterns in this and other new contexts, to devise the theoretical framework for adding necessary metadata to electronic records which allow for appraisal, acquisition, description, use, and preservation, and to contribute to the development of the technical tools to carry out these functions.

As we move into this new environment, it is important to maintain an eye on how we have arrived at our current solutions, though without being saddled with differing approaches and conflicting rhetoric to achieve similar ends. Indeed, the choices in functional requirements available to date cannot be fully understood without first understanding the ideological origins from which they have emerged. After nearly two decades, these differences continue to exert their influences, but the lines are blurring. In revisiting the work of the Pittsburgh and UBC projects, David Bearman optimistically argued that the common ground that has been struck in more recent times and interpretations allows us to "begin to judge strategies by how well they achieved agreed objectives rather than by whether they appear to be argued from ideologically correct premises."[9] This can only serve to improve both the quality of the solutions available to the current generation, as well as the quality of record we leave behind for future generations.

For over three decades now, individual archival thinkers, professional bodies, and archival institutions have explored, in an impressive array of reports, studies, and scholarship, the content, structure, and context of the functional requirements necessary to produce and preserve trustworthy records in a digital environment. This thesis, in turn, has analyzed the content, structure, and context of that archival exploration across time and space to consolidate these discoveries so the profession may move forward to ever new challenges with digital media and human communication.

[9] Bearman, "Moments of Risk," 44.

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