

Co-Design of Information Systems with Digital Records Management

A Proposal for Research

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Abstract: This position paper, via rationalizing the potentials of carrying out a carefully crafted research project, argues that the three fields of enterprise information system, business process management, and digital records management should join forces in serving the needs of organizations, regardless of their types. By preliminary findings uncovered during the conceiving process of the project, it advocates that the best point of convergence is the design phase, a basic step for all of the three fields and an increasingly critical one in today's digital environment.

1 INTRODUCTION

Information systems (ISs), business process management (BPM), and digital records management (DRM) are typically viewed as independent fields, albeit in the context of enterprises/organizations, they cross paths in more than one ways. Aiming at exploring the relationships between and among these fields, a research project was conceived to identify the most efficient and effective manner regarding their collaboration. This paper introduces the conceiving process of the project, along with the researcher's (earlier) belief that the best way of serving organization needs is to consolidate the needs of business process, enterprise information system, and digital records management at the stage of (re-)design.

2 BACKGROUND IN KEY CONCEPTS

This section illustrates concepts key to the conceived project, in a way that also serves the purpose of providing the necessary background information of this paper.

2.1 Records

Records have been the subject of scientific study since the 17th century and had gone through phases of being associated with the fields of diplomatics, jurisprudence, history, archival science (Duranti, 1996) and records management (see, for example, Schellenberg, 1956). Each field studied records with distinctive focuses, for instance, diplomatics focuses on record authenticity, jurisprudence on record evidentiary quality, history on records traceability of historical figures and events, and archival science including records management on record(s) creation, maintenance, and use. As a result, the characteristics of records were historically articulated variously.

As a common construct in our modern society, records have been defined by a variety of societal actors such as legislative/regulatory bodies, professional associations, and cultural institutions. For instance, the United States Federal law defines records in relation to the operation of the US Federal Government (2006 Edition), the ARMA International (2007) defines records with considerations for the diverse nature of its member organizations, and the Library and Archives Canada (2004) defines records under the guidance of the country's documentary heritage framework. These definitions are typically worded differently, reflecting the different yet legitimate purposes that they were intended to serve. This makes the

common construct rather a complex concept in terms of abstracting or generalizing its defining features from practical usages for disciplinary developments. As a result, the characteristics of records are currently articulated variously, and research on the concept of record has been ongoing (see, for example, Reed, 2005; Yeo, 2007, Xie, 2013). For the purpose of this paper, two definitions of records are selected and analyzed as its communication reference:

- records are documents created in the course of conducting practical activities and set aside for future actions or references (Duranti, 1994, 1998, 2002; Duranti and Thibodeau, 2006), and
- records are information created, received, and maintained as evidence and information by an organization or person, in pursuance of legal obligations or in the transaction of business” (ISO 15489, 2001)

The ISO 15489 is the first international standard on records and their management, and its definition on records represents a comparatively high level of consensus on the subject internationally. These two definitions, therefore, are representative of the concept of record, from which the most fundamental characteristics (MFC) of records can be extracted despite of the different wordings. Two MFCs are identified as directly relevant to the inquiry of this study, and they are:

MFC1. records are a special type of information (indicated by the terms “documents” and “information”), and

MFC2. records possess inherent and inseparable ties with human activities (indicated by the terms “practical activities”, “pursuance of legal obligations”, and “ transaction of business”)

The concept of information in this context refers to data presented in readily comprehensible form to which meaning has been attributed within the context of its use (Reitz, 2015), and data refers to words or figures representing a specific concept or object (ISO/IEC 2382-1, 1999; US, 2005, 20123; ARMA International, 2007, 2012 ; Reitz, 2015). Other terms in the definitions and the MFCs are used with their commonly understood meanings (i.e., face meanings) unless definitions are provided elsewhere in this paper (note please, some of the terms, e.g., “set aside” and “evidence”, will be researched on during the process of this project for establishing their disciplinary relevant meanings).

2.2 Digital Records (DR)

Digital records are records in digital formats. Digital

records are previously called machine-readable records and electronic records due to the changing understanding of the nature of the technologies involved in their productions and existences. In this paper, the terms digital records and electronic records are both used because the former presents an accurate description and the latter, unlike machine-readable records, are currently still existing in many important research findings, thus difficult to be bypassed. The term “digital formats” in the definition are derived from digital technologies, which, in this paper, encompass any technologies that are relied on or related to digital computation. Digital records were initially considered as only a special type of records but increasingly, with the now almost ubiquitous use of digital technologies, have become the dominant type of records. Even though no organizations have so far made for their working environments completely paperless, many organizational functions start indeed operating in an entirely digital manner. As indicated by the manner by which digital records are defined, the international records community holds the consensus that digital formats do not change the nature, i.e., the MFCs, of records, but only give rise to issues and challenges with respect to their management (United Nations, 1989; International Council on Archives, 1997; ISO 15489, 2001; ARMA International, 2012; InterPARES, 2010; ICA-InterPARES, 2012). Given the fact that the issues and challenges associated with digital records were firstly and predominantly exposed in organizations and that the exposure is identified as the backdrop framing the conceived project – digital records thereby refers to only those that are created in organizations.

2.3 Information Systems (ISs)

The term information systems, like records, does not have a universally accepted definition and unlike records, it lacks consistency in expression. According to the Subject Headings developed by the Library of Congress, the term information systems is identified as a variant of the term management information systems (MIS), which is the authorized entry. In this paper, however, the term information systems is chosen to be used for the purpose of being consistent with the name of the Association for Information Systems (AIS), a highly regarded organization which publishes the prestigious Management Information Systems Quarterly (MISQ), MIS Quarterly Executive, and the Journal of the Association for Information Systems (JAIS). The Association, however, does not provide a

definition for IS or ISs, and definitions for IS, as a search for an authoritative IS definition revealed, abound. In one of the recent PhD dissertations on IS, at least 36 IS definitions were identified, all with a certain type of authority, and they collectively cover a group of five views of technology, society, technology-society, modeling, and process (Boell, 2013). For the purpose of this paper, the definition for MIS provided by Gordon Davis in his 1974 book is chosen to be the definition for IS:

[An IS] is an integrated, man/machine system for providing information to support the operation, management, and decision-making functions in an organization. The system utilizes computer hardware and software, manual procedures, management and decision models, and a data base (p. 3).

This book, entitled Management Information Systems: Conceptual foundations, Structure, and Development, is recognized by the AIS as the “bible” for the ISs field, and a preliminary analysis on this definition and the 36 definitions for information systems suggests, in a rather clear manner, its currency despite of the seemingly obsolete usages of the terms of “man/machine” and “data base”. This definition covers indeed all of the five views. More importantly, the ideas conveyed by the definition shows solid relevance to the focus of the conceived research, i.e., digital records in organizations.

Closely related to information systems is the discipline of business process management (BPM), considered a field with roots in both the management science and computer science and one that has matured. At the center of BPM is the notion of a process model, which aims to capture the different ways in which a case (i.e., an instance of a process) can be dealt with. Modeling typically relies on notations, which are used to describe ordered activities. The modeling of business processes not only sets up the stage for business analysis, refinement, what-if stimulation, etc., but also serves the purpose of configuring information systems. Information systems need to be configured and driven by precise instructions in order to achieve expected higher productivity. In the context of the conceived project, both the control flow perspective (i.e., modeling the order of activities) and the data perspective (i.e., modeling decisions, data creation, forms, etc.) of BPM are relevant and will be instructive for data interpretation. The relationships among the key concepts and ideas can be illustrated as follows:

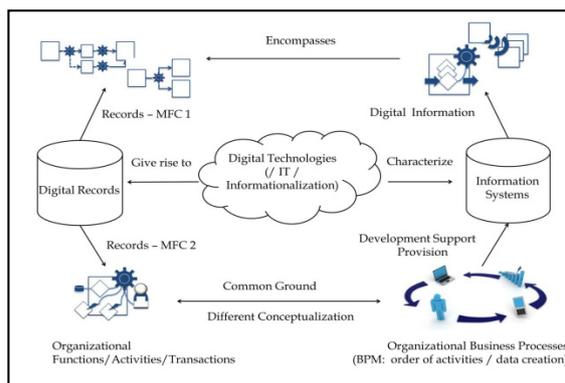


Figure 1: High Level Relationship between DR & ISs.

3 THE CEIVING LOGIC

3.1 Relevant Research

Research on digital records has been going on for over forty years since the time when the National Archives and Records Administration of the United States of America (NARA) first started its inquiry. In brief, the term “digital formats” in the definition of digital records accounts solely for the international interest in digital records research, which has created not only unprecedented intensity in the history of records but also continued momentum. The characteristics of digital technologies, as even life experiences can tell, are *penetrating*, i.e., they impact almost all aspects of human activities, *complex*, i.e., they entail specializations in both academic development and practical application, and *volatile*, i.e., they evolve rapidly. The intricacy of digital technologies, therefore, gives intricacy to digital records in a direct manner. Within the framework of organizational operation, digital technologies manifest themselves typically in the form of ISs, which was encountered as challenges by researchers on digital records from the very beginning. From the early 1980s till now, the challenges with ISs were researched on by the United Nations’ task force on electronic records management, the UBC-MAS project (Canada), the Pittsburgh Electronic Records Requirement project (US), the AC+erm (UK), the Electronic Health Records project (Australia), the InterPARES project, etc. In particular, research has focused on functional requirements for electronic/digital records management system design, which were led by the US Department of Defence (subsequently joined force with NARA), the InterPARES project, the National Archives of Australia, the National

Archives of the United Kingdom, the European Union, and the International Council on Archives (ICA). A sizable body of knowledge has been generated including conceptual frameworks (e.g., the InterPARES Terminology Database with key concepts ontologies), models (e.g., the OAIS Model), specifications (e.g., the EU MoReq specification), and standards (e.g., DoD5015.2 and ISO 16175 1-3).

A preliminary analysis of all these findings and products indicates that the existing research needs to be much strengthened in the area of in-depth collaboration with ISs professionals charged with ISs design. The idea of working with ISs professionals is not an entirely new one as the existing research has long been advocating organizational Digital Records Management (DRM) personnel's communications with IT personnel. However, this call is largely limited to the design and implementation of digital records management system (DRMS), a special type of ISs, and not all of the ISs implemented in organizations for operational purposes. The noticeable exceptions are the InterPARES project, ISO 16175-3, and EU DLM Forum. By its second phase (2002-2007), the InterPARES project had produced a comprehensive model on digital records management (called the COP Model), in which the ties between recordkeeping systems (synonyms with ERMS) and recordmaking systems, i.e., all the other ISs in organizations, were logically established, and mechanisms (i.e., policies and guidelines) for implementing the COP Model were produced. However, it is found, including by the third phase of the InterPARES project (2008-2012), that the application of this model was very challenging, due mainly to the complexities of the various organizational ISs. The ISO 16175-3 is a step further from typical ERMS standards, which embraces the idea of implementing DRM requirements within an IS as opposed to exacting records from recordmaking systems to recordkeeping systems. It, however, only conceptualizes ISs (as in its term "business systems") and does not provide any specifics on how to gain deep understandings of ISs, let alone on how to collaborating with ISs professionals at the stage of system design. The need to gain deep understandings of ISs was made more explicit by the EU DLM Forum, which, through its MoReq 2010 Specification, stated that the next steps of its efforts toward DRM are to develop system design requirements that are industry-specific. By this view, ERMS will be designed with direct relevance with ISs designed for the various business

functions, for instance, finance management, sales management, marketing, education, healthcare, etc. It is this researcher's belief that this is the only approach owning the potential of solving issues of *unreliable, inaccurate, inauthentic, untrustworthy, inaccessible, and/or unusable* digital records in the increasing complex ISs environment, and one that can bring success to all relevant fields.

3.2 Research Areas & Sample Research Questions

A series of research areas and research questions can be devised through analysing existing research findings, which are listed in the following table:

Table 1: Research Areas and Research Questions.

Research Area	Sample Research Question
C1. Organizational & Managerial Theories in today's environment	<i>How are the established organizational behavioural & managerial theories impacting the fields of ISs and DRM? For the notion of ISs-DRM co-design, what are the constructive factors and what are the adverse ones?</i>
C2. ISs design: relationships with organizational operation; methodologies; current issues	<i>How are ISs developed in organizations and what role the Design Science has played in the development process? How can the design of ISs take into considerations of operational needs and records quality requirements efficiently and effectively?</i>
C3. DRM: relationships with organizational operation; mechanisms; tools; current issues	<i>What knowledge of ISs is needed for the DRM professionals to collaborate with ISs professionals? To what degree should they be equipped with knowledge of ISs, of the Design Science as it is applied in ISs development?</i>
C4. Relationships between information and DR (and other tightly related concepts such as data, information resource, authenticity, integrity, evidence, organizational memory, accountability, responsibility, etc.)	<i>Is there a need to rigorously defining these concepts? What are the benefits if defined and what are the consequences if not? How can they be defined, if the benefits of defining prevail, with maximum usage/application friendliness?</i>
C5. Relationships between ISs and DRM	<i>What role can organizational dynamics play with ISs-DRM co-design?</i>
C6. Role of Design Science (DS) in ISs development	<i>Can ISs developments be balanced with operational productivity and legal compliance as represented by quality records?</i>

Table 1: Research Areas and Research Questions(Cont.).

C7. Impact of DS on ISs-DRM co-design	<i>How the relevance of DR and DRM developments is manifested in the field of ISs and ISs design? Can types of digital records be established by the ISs-DRM co-design effort? Can digital records be pre-determined individually at the co-design stage?</i>
C8. ISs-DRM co-design theoretical underpinnings	<i>To what degree the theoretical constructions in each field can be integrated as a coherent whole in this context of ISs-DRM co-design? What are the user friendly manners by which the integrated theories should be articulated and presented?</i>
C9. ISs-DRM co-design implementing mechanisms	<i>To what degree (or at which level of the design process), can concrete joints for ISs and DRM be identified (when existing) or established (when non-existing)?</i>

The following figure demonstrates the high-level logic that guided the conceiving of this project, with the red Xs indicating the areas of issues requiring research attention:

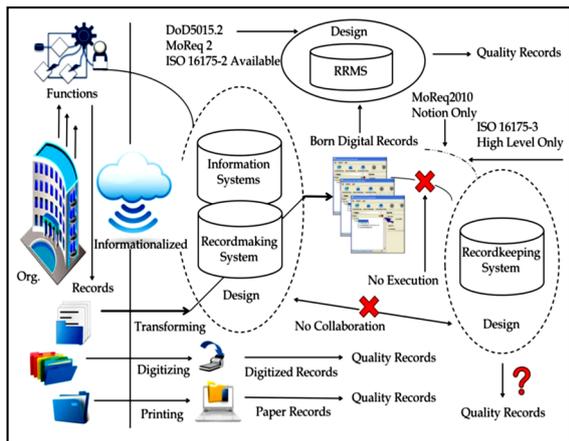


Figure 2: Research Conceiving Logic.

4 RESEARCH METHODOLOGY

The methodological framework devised for this project consists of the methods of systematic literature review (SLR, also called evidence-based literature review), case study (CS), business process analysis (BPA), diplomatic analysis (DA), and design principles for ISs analysis (DP-ISsA). Each of the method serves a specific research need, and for that need, it guides data collection and analysis. SLR is needed to accommodate the interdisciplinary nature of this project, which requires knowledge from the 5 fields of organization behaviour,

management science, ISs, archival science, and records management. By requiring *a priori* identification of questions, SLR helps to narrow down the scope of literature for examination and by requiring being systematic, it ensures both relevance and credibility of the knowledge extracted from the analysis (hence the term evidence-based). This method is expected to lay a solid foundation for the next steps of the research.

The method of CS is needed because ISs is commonly deployed in organizations and as introduced above, ISs can be industry or function specific. To select cases for in-depth analysis is the only way to make a project like this manageable and more importantly, to solve the problems that the existent DRM research projects have failed to solve. The selected cases provide boundaries for the analyses that follow.

BPA, DA, and DP-ISsA are needed for boiling down organizational missions and strategic goals to concrete, executable requirements, for both the ISs development and DR determination. These requirements are the raw findings on which the final research products, through integration and abstraction, can be further developed. The following diagram illustrates the relationships between the components of the framework, in a simplified order of execution (it's simplified because many analytical steps will overlap with each other and new types of analyses may be needed with phase findings being generated). The following figures illustrate the chosen analytic frameworks and the overall methodological framework for all the analyses (omitting the one for SLR):

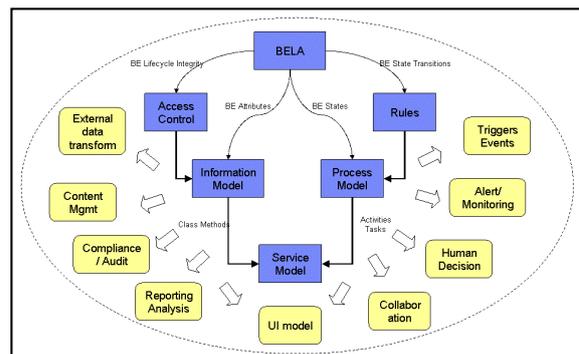


Figure 3: Business Entity Lifecycle Analysis (BELA) (source: IBM).

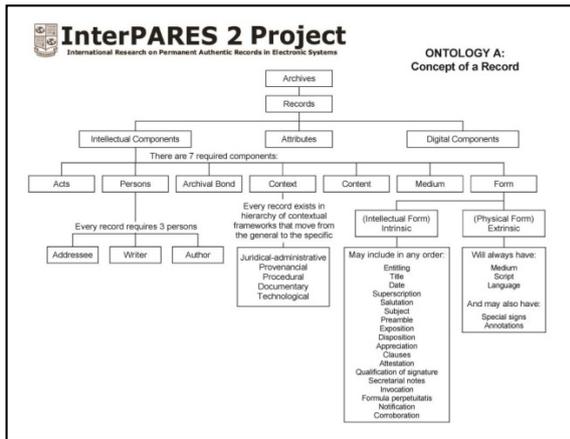


Figure 4: Ontology of Record for Diplomatic Analysis (source: InterPARES).

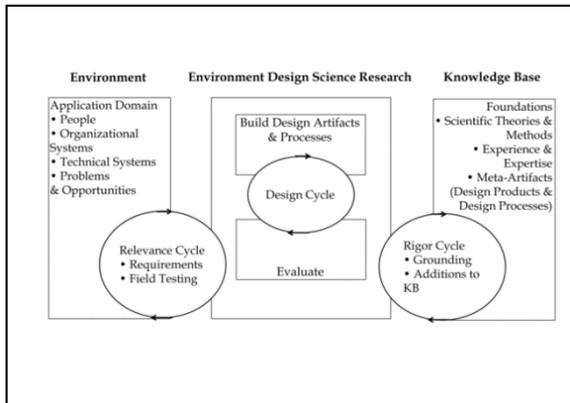


Figure 5: Design Science Research Cycles for DP-ISA (source: Hevner).

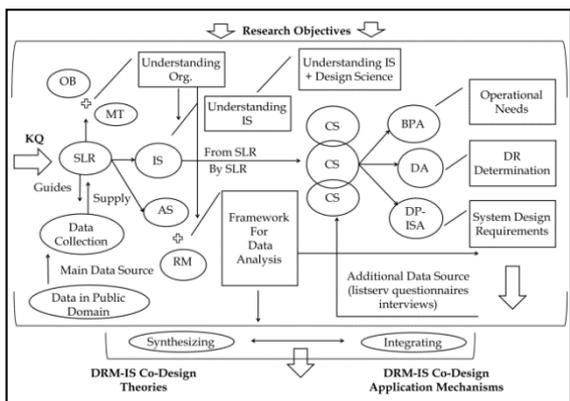


Figure 6: Methodological Framework.

5 CONCLUSIONS

Research on DRM in ISs environment has a

profound impact on the advancement of an organization that relies on digital technologies. Specifically, this project can contribute to advancing both the fields of DRM and ISs, and to optimizing operations of organizations. The field of ISs has long been encountering the issues of satisfactorily fulfilling the operational requirements of organizations and the failures of ISs projects have been widely noticed. ISs projects are typically resources demanding and as such, are expected to greatly enhanced productivity and to yield high ROI. On an isolated view, ISs seems to be separable from DRM, yet, from the viewpoint of the organization, the collaborations between ISs and DRM is logically the most effective way for organizations to achieve the objectives of improving resources allocation, streamlining business processes, detecting risks, protecting rights and interest, being legally compliant, and ultimately being competitively advantaged, both locally and globally.

REFERENCES

ACerm Project Team. (2011). Accelerating positive change in electronic records management. Retrieved from <http://acerm.blogspot.ca>.

ARMA International. (2012). Glossary of records and information management terms. http://www.arma.org/standards/glossary/index.cfm?id_term=369.

Association for Information Systems. (2015). The AIS eLibrary. <http://aisnet.org/?AISELibrary>.

Boell, S. (2013). Theorizing information and information systems (Doctoral dissertation). http://skb.unifind.de/publications/2012_PHD-Boell-Theorizing_Information_and_Information_Systems.pdf.

Centre for Health Communication and Participation La Trobe University, Australasian Cochrane Centre. (2012). Systematic reviews. http://navigatingeffective treatments.org.au/exploring_systematic_reviews_what_authors_do.html.

Davis, G. B. (1974). Management information systems: conceptual foundations, structure, and development. McGraw-Hill, New York.

DLM Forum Foundation. (2015). About. <http://www.dlmforum.eu>.

European Union. MoReq. Retrieved from <http://moreq2.eu>.

Duranti, L. (1996). Archival Science. In A. Kent (Ed.), Encyclopaedia of library and information science (pp.1-19). New York: Marcel Dekker, INC.

Duranti, L. (2002). The Concept of electronic records. In L. Duranti, T. Eastwood & H. MacNeil Preservation of the integrity of electronic records (pp.9-20). Dordrecht; Boston: Kluwer Academic Publishers.

Duranti, L., & Thibodeau, K. (2006). The Concept of record in interactive, experiential and dynamic

- environments: The view of InterPARES. *Archival Science*, 6(1), 13-68.
- Yeo, G. (2007). Concepts of Record (1): Evidence, information, and persistent representations. *American Archivist*, 70 (2), 315-43.
- Hevner, A., & Chatterjee, S. (2010). *Design research in information systems, theory and practice*. New York: Springer.
- Hevner, A. (2007). A Three-cycle view of design science research. *Scandinavian Journal of Information Systems*, 19 (2), 87-92.
- Prom, C. (2011). ICA guidelines and functional requirements for electronic records management systems. Retrieved from <http://e-records.chris.prom.com/ica-guidelines-and-functional-requirements-for-electronic-records-management-systems>.
- IBM. (2011). Match processes to business needs: Apply BELA to case management How Business Entity Lifecycle Analysis (BELA) enriches case management solutions. www-01.ibm.com/software/solutions/soa/newsletter/october11/images/BELA-fig_3.gif.
- InterPARES Project. (2012). Terminology database. [interpares.org/ip2/ip2_terminology_db.cfm](http://inter pares.org/ip2/ip2_terminology_db.cfm).
- InterPARES Project. Diplomatic Analysis. www.interpares.org/display_file.cfm?doc=ip3_template_for_diplomatic_analysis.pdf.
- InterPARES Project. (2015). InterPARES Trust. Retrieved from <http://interparestrust.org>.
- ISO 15489-1. (2001). Information and documentation – Records management. Part 1: General.
- ISO/IEC 2382 -1. (1999). Information technology – Vocabulary.
- Langer, A. M. (2007). *Analysis and design of information systems*. New York: Springer.
- Marco, M.D. (2012). *Organizational systems: An Interdisciplinary discourse*. Berlin: Springer.
- Object Management Group (2011). *Business Process Model and Notation (BPMN)*. OMG, Needham, Mass, USA.
- Reed, B. (2005). Records. In McKemmish, S (Ed.), *Archives: Recordkeeping in society* (pp. 101-130). Wagga Wagga NSW: Centre for Information Studies, Charles Sturt University.
- Reitz, J. M. (2014). ODLIS. www.abc-clio.com/ODLIS/odlis_d.aspx#data.
- Schellenberg, T. R. (1956; 1996). *Modern archives: Principles and techniques*. Chicago: University of Chicago Press.
- United Nations. (1989). *The Role of archives and records management in national information systems: A RAMP study*. United Nations: Paris.
- USA. (2006). 44 U.S.C. Chapter 33. www.archives.gov/about/laws/disposal-of-records.html.
- USA. Federal Enterprise Architecture Program.(2013). www.whitehouse.gov/omb/e-gov/fea.
- Weske, M. (2007). *Business process management: concepts, languages, architectures*, Springer-Verlag, Berlin, Germany.
- Wieringa, R.J. (2014). *Design science methodology for information systems and software engineering*. Berlin: Springer.
- Winter, R. (2010). *Global perspectives on design science research* Springer. St. Gallen, Switzerland.
- Xie, L. (2013). *The Nature of record and the IM crisis in the Government of Canada* University of British Columbia, Vancouver, Canada.