Thesis for the degree of Doctor of Philosophy, Sundsvall 2008

Design for Recordkeeping: Areas of Improvement

Erik A.M. Borglund

Supervisors:
Viveca Asproth
Anita Håkansson

Department of Natural Sciences
Mid Sweden University, SE-851 70 Sundsvall, Sweden

ISSN 1652-893X
Mid Sweden University Doctoral Thesis 52
ISBN 978-91-85317-95-0

Akademisk avhandling som med tillstånd av Mittuniversitetet i Sundsvall framläggs till offentlig granskning för avläggande av filosofie doktorsexamen tisdag, 27 maj, 2008, klockan 13.00 i Olof Högbergsalen, Mittuniversitetet Härnösand.

Seminariet kommer att hållas på engelska.

Design for Recordkeeping: Areas of Improvement

Erik A.M. Borglund

Department of Natural Sciences
Mid Sweden University, SE-851 70 Sundsvall
Sweden

Telephone: +46 (0)771-975 000

Printed by Kopieringen Mid Sweden University, Sundsvall, Sweden, 2008

Design for Recordkeeping: Areas of Improvement

Erik A.M. Borglund

Department of Natural Sciences
Mid Sweden University, SE-851 70 Sundsvall, Sweden
ISSN 1652-893X, Mid Sweden University Doctoral Thesis 52;
ISBN 978-91-85317-95-0

ABSTRACT

This thesis is about problems related to design of information systems in which records are born and managed. The proactive approach has been derived from new archival theories suited for electronic recordkeeping, and implies that electronic records must, at the time of creation fulfil their current and future requirements. Information systems where records are born and managed should, based upon a proactive approach, meet recordkeeping requirements. This thesis is based upon a four-year research effort and consists of seven research articles that present the results of the research. The objective is to contribute to knowledge of design recommendations for information systems, in which records are born and managed. The main result of this thesis is identification of five areas that can affect and improve the design of information systems in which records are born and managed. First: A set of empirically and theoretical grounded characteristics of records are presented. Those characteristics have to be complemented with organization-defined characteristics. Second: this research has contributed a conceptualization of use of records and users of records. The notion of known use/user, and unknown use/user has been introduced. Design becomes difficult because requirements of unknown users are difficult to conceptualize. Third: The Recordkeeping Quality Assessment model (RQAM) is presented. The model implies a holistic quality approach to recordkeeping, and intends to be used as a basis for quality assessment, and as a reference model in design situations to achieve high recordkeeping quality. Fourth: Two dominant different views on records are presented. Private organizations appraise records principally upon business values, and public organisations base their appraisal criteria upon accountability and legislative values. The two views on records should be brought into one view and form a risk management-like appraisal. Fifth: Proactivity is a way of thinking and should be applied on several levels in the recordkeeping environment: to the electronic record, to the information system where the electronic record is born and managed, to the organization, and to the user.

Keywords: Design, Electronic records, Information systems, Proactivity, Recordkeeping

SAMMANDRAG

Denna avhandling handlar om hur informationssystem skall designas, i vilka arkivinformation skapas och hanteras över tid. Modern arkivteori förordar en proaktiv ansats vid hantering av elektronisk arkivinformation. Proaktiviteten innebär att arkivinformationen senast vid sin tillkomst måste uppfylla arkivvetenskapliga krav. Det medför att design av informationssystem, i vilka arkivinformation skapas och hanteras måste uppfylla arkivvetenskapliga krav och följa en proaktiv ansats. Denna avhandling är ett resultat av fyra års forskning och består av sju vetenskapliga artiklar, vilka utgör avhandlingens resultat. Syftet med avhandlingen har att bidra med ny kunskap till hur informationssystem, i vilka arkivinformation skapas och hanteras över tid, skall designas. Avhandlingens huvudsakliga resultat är fem områden som alla kan påverka och förbättra design av sådana informationssystem. 1. Ett antal karaktäriska egenskaper hos arkivinformation har identifierats utifrån både teori och empiri. Dessa har visats sig behöva kompletteras med organisationsspecifika karaktäristiska egenskaper. 2. Begreppen användare av arkivinformation och användning av arkivinformation har konceptualiserats. Begreppet känd och okänd användare/användning av arkivinformation har introducerats. Design för okända användare är en svår utmaning, bland annat då krav från okända användare är svåra att fånga. 3. En kvalitetsmodell (RQAM) är presenterad som anger att kvalitet kring hantering av arkivinformation måste ske med en holistisk ansats. Modellen skall kunna användas som en hjälp vid kvalitetsmätning, men även som en referensmodell vid design av informationssystem. 4. Två dominerade värderingsperspektiv har identifierats avseende arkivinformation. Privata organisationer värderar arkivinformation mestadels utifrån ett verksamhetsvärde, medan offentliga organisationer värderar arkivinformationen mestadels baserat på legala krav och ansvarsspårbarhet. 5. Den proaktiva ansatsen skall ses som ett strategiskt angreppssätt på hantering av elektronisk arkivinformation. Den skall användas i flera nivåer av hantering av arkivinformation, på arkivinformationsnivå, informationssystemsnivå, organisationsnivå och på användarnivå.

Nyckelord: Design, Electronic records, information systems, proactivity, recordkeeping

ACKNOWLEDGEMENTS

Writing this thesis has been like skiing a serious off-pist tour. There are hidden dangers, route finding problems, and the fear for Murphy's law. One difference is though that when you are skiing, you are on your own, but as a PhD student I have been helped by others to reach the end of my studies. There are many people and organizations that have made this work possible, and which I want to acknowledge.

The writing of this thesis had never been possible without the funding from Eurpean Union 'Objective 1 programme for the Södra Skogslän region' and all the member organizations in the two research projects where I have been involved. Thank you for giving me the opportunity to finish this work.

I want to acknowledge everyone who has been supporting me during the last four years. I first want to thank my two supervisors, Professor Viveca Asproth, and Associate Professor Anita Håkansson. Without your patience, support and guidance this thesis had been very difficult to finish. I want to acknowledge all my colleagues in Härnösand: Anders, Anneli, Göran, Håkan, Karen, Larsa, Martina, Patrik, and Sara. A special thank to Anneli, Göran, and Patrik who have guided me in the labyrinths of archival theory. I also want to thank all my informatics colleagues in Östersund for several fruitful seminars. I must also thank Professor Stig Holmberg for all your comments on my work during these four years. I am especially grateful to Lena-Maria Öberg, who have been my colleague, friend, co-author, and every day lifebuoy. The many phone calls have made my work less lonely, but foremost you have given me support in my work.

I would never have become a PhD student if I not have met Associate Professor Urban Nuldén at IT-university in Gothenburg. I must thank you, for acting as an extra supervisor and friend during these years. I also want to thank Jonas Landgren for many fruitful conversations.

Special thanks goes to everyone, organization, and individuals that have been involved in the studies.

I also want to thank my mother, father and brother for your encouragement, but foremost my family, who made this thesis possible. My beloved wife Marie, you have always encouraged me, even if I have been working too many late nights. Seth and Sarah my two wonderful children, you have reminded me that there is more than just writing a thesis, I love you all.

Posse Ante Factum Audere Cum Convenit

Härnösand April 2008
Erik Borglund

TABLE OF CONTENTS

COMPOSITION OF THIS THESIS

This thesis consists of two separate sections: first a dissertation summary in Part I, and then a collection of seven research articles in Part II. Part I of this thesis serves as an introduction, presenting the problem, research aim, theoretical background, research approach, and the common results from each of the seven research articles together with the overall findings of the thesis. The seven research articles are presented in Part II. All research articles are peer reviewed: Five are journal articles, of which four have been published and one is accepted for publication; and two conference articles. Two of the research articles (I and IV) have been co-authored with Lena-Maria Öberg, and research article VI has been co-authored with Anneli Sundqvist. In those research articles the authors have contributed equally. All research articles have been formatted to fit the thesis and they are listed below.

I. Öberg, L.-M., & Borglund, E. (2006). What are the characteristics of records? *International Journal of Public Information Systems, 2006*(1), 55-76.

II. Borglund, E. (2005). Operational use of electronic records in police work [Electronic Version]. *Information Research 10(4)*, paper 236 from http://Informationr.net/ir/10-4/paper236.html

III. Borglund, E. A. M. (2007). RQAM: A recordkeeping quality assessment model proposal. *International Journal of Information Quality (IJIQ), 1*(3), 326-344.

IV. Borglund, E. A. M., & Öberg, L.-M. (2008). How are records used by organizations? *Accepted for publication in Information Research.*

V. Borglund, E. A. M. (2008). Electronic records use changes through temporal rhythms. *Archival and Social Studies: A Journal of Interdisciplinary Research* 2(1), 103-134.

VI. Borglund, E. A. M., & Sundqvist, A. (2007). *The role of EDM in information management within SME's*. Paper presented at The Second International Conference on Digital Information Management (ICDIM'07).

VII. Borglund, E. A. M. (2007). *EDM business values in a SME environment in terms of knowledge management*. Paper presented at the European and Mediterranean Conference on Information Systems 2007 (EMCIS2007), Valencia, June 24-26

PART I

1. INTRODUCTION

Information technology has changed our society and many new scientific fields have been raised since information technology and computer based information systems have begun to be widely used in different societal contexts. This thesis is about problems related to electronic recordkeeping, a phenomena that was born due to information technology and information systems. Records and archives are the two concepts that constitute archival science.

> *Archival science is distinct from other sciences because of its aims, its object and its methodology. Its object is process-bound information, which is to say: both the information itself and the processes that have generated and structured that information. Its aims are the establishment and maintenance of archival quality, that is to say: of the optimal visibility and durability of the records, the generating work processes and their mutual bond. Its methodology is the analysis, recording and maintenance of the links between the function of the information recorded on the one hand and its form, structure and provenancial context on the other. (Thomassen, 2001, p. 382)*

The roots of the modern archival tradition date back to when nations began to build administrations (Schellenberg, 1956/1998). In Sweden modern archival practice can be tracked back to 1903, and the way archival records are managed has implicitly followed the same principles since then (N. Nilsson, 1983). Paper has traditionally been the most common form of records, which are stored in archives and in record repositories. This was the situation until computers began to support and replace manual administrative tasks. Since computers have been used in daily administrative tasks more and more records have been born digital, and are no longer created on paper. In the early 1990's the effect of computerization began to be debated in the archival community (see e.g. Bearman, 1993, 1994; Dollar, 1992; Livelton, 1996; Roberts, 1994). Techniques and methods available for management of records that were developed for an analogue environment and not for a computer-based environment were questioned. E.g. Swedish archival practice was almost 100 years old when the problem with electronic records was raised. One of the major problems identified early was about short-term and long-term preservation of electronic records, and the research efforts primarily focused upon this problem (see e.g. Bearman, 1994; Dollar, 1992, 2000; Duranti, 2000, 2001a, 2001b; Gilliand-Swetland & Eppard, 2000; Gilliland-Swetland, 2000; McInnes, 1998; Upward, 2004). Preservation of electronic records was so different from preservation of paper-based records that some researchers claimed that electronic records and management of those were the input for a new archival paradigm (Cook, 1997; Delmas, 2001; Gilliland-Swetland, 2000; Upward, 2000). Another raised problem was that information

technology gave birth to new forms of records, that were previously often in the form of a document.

For management of electronic records, with preservation capacity, a proactive approach is proposed (see e.g. Borglund, 2006a; Reed, 2005; Upward, 2000, 2004, 2005b; Öberg, 2007). With a proactive approach it is important to plan in advance so that all the requirements of an electronic record are identified and fulfilled no later than the birth of the electronic record. The proactive approach implies that one cannot exclude the information systems where the records are born. Electronic records are born in information systems, and some of them need to be preserved for long time, even longer than the life of the information system where they were born. If electronic records do not fulfil recordkeeping requirements at creation, there is a risk that the record cannot be preserved with the necessary and expected quality. It is therefore necessary to further study and investigate how such information systems should be designed, to ensure that electronic records fulfill stated requirements from creation. Therefore, design-oriented research about long-term preservation and management of electronic records is necessary.

Research on electronic records has recently been dominated by the archival community, which has almost totally ignored problems of how information systems should be designed to meet electronic records requirements. Unfortunately it is also difficult to find any widespread research effort from the information system research community about the problem with electronic records and their need for long-term preservation. However, there have been some good examples lasting recent years that address and debate the problem with electronic records preservation from an IS perspective (Asproth, 2005, 2007; Chen, 2001; Gladney, 2004; Karjalainen, Päivärinta, Tyräinen, & Rajala, 2000; J. Nilsson, 2006; Quisbert, 2006; Runardotter, 2007).

There is a need to build a common knowledge base about electronic records, to which both archival science and information systems should contribute. It is essential to increase knowledge about how electronic records affect information systems design, information systems in which electronic records are born.

2. BACKGROUND TO THE PROBLEM DOMAIN, AND RESEARCH OBJECTIVE

All records, in both electronic and traditional formats, are evidence of business in organizations (Duranti, 2001a; National Archives of Australia, 2004; Reed, 2005). To maintain the evidential value of a record it is necessary to preserve the content of the record, to preserve the context where the record was created, and to preserve the structure of the record (National Archives of Australia, 2004; Reed, 2005; Thomassen, 2001). Electronic records include both records that are born

electronic and records that have been set a side in electronic form (Duranti, 2001a; National Archives of Australia, 2004). Given the variety information technologies on offer today, electronic records may be born in a wide variety of systems. The National Archives of Australia has listed common places where records can be created (National Archives of Australia, 2004, p. 13): By using office applications records can be found in word processed documents, desktop processed documents, spreadsheets, and in presentations; Records can be born using different business information systems such as databases, geospatial information systems, human resource systems, financial systems, workflow systems, client management systems, and in customer relationship management systems; Records can also be born and generated in different web-based environments such as intranets, extranets, public websites, and in online transactions; Records can also be the result of different communication technologies such as email, SMS, MMS, electronic fax, voice mail, and instant messaging. This list made by the National Archives of Australia, of different information systems and different information technologies in which electronic records can be created does not, of course, cover the whole range of information technology that can give birth to electronic records. But not all business information systems manage or contain records. Figure 1 is a visualization of different business information systems. This list indicates that long-term preservation of electronic records can be very complicated if the content, context and structure must be kept intact, given the huge variation of possible file formats and storage media. Another problem is that electronic records might be very infrequently accessed, and be stored through several file format cycles, and media type cycles (Song & JaJa, 2007). Today it is difficult to find a computer with a floppy drive installed, and reading documents created in e.g. Office 3.0 is problematic. Formats and media evolution have been identified as an acute problem that must be solved. If an electronic record not can be read there is no use trying to preserve it.

Digital information in general can be very fragile and there are risks related to both software failure and hardware failure, which can make the information unusable (Song & JaJa, 2007). The fragility does not decrease over time. The fragility problem is devastating for electronic records that need to be preserved for the long-term. A paper is readable even if the reader not can understand what is written. Electronic records cannot be read at all if the proper technology is not available and working, to translate the bit stream of data into something that is understandable, or if the bit stream is corrupted. The problem domains of long-term preservation still debated in research, can be divided into: technical problems, legal issues, organizational problems, and problems concerning context and metadata (Asproth, 2007).

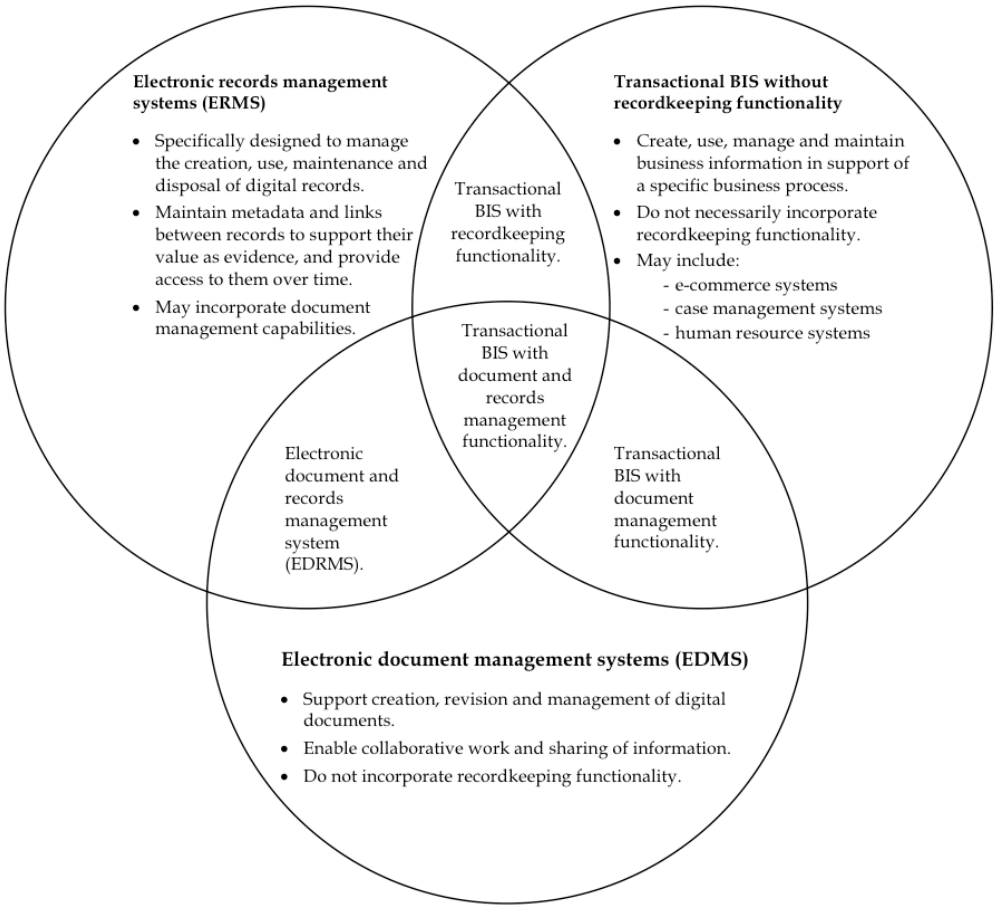

Figure 1. The relationship between different business information systems (National Archives of Australia, 2006b, p. 36)

2.1. Reactive focus of archival research to date

Consequently, in the light of the description above, the archival community's major research efforts can be defined as reactive and technical. The reactive research has focused on solving long-term preservation problems when the electronic records are already born, and quality must be guaranteed over time. The technical focus is about ensuring that electronic records today can be preserved for the long-term despite changes in formats and storage media (Lorie, 2001). Many archival research projects in the last 10 years have been both reactive and technical in their focus. InterPARES[1] is an international research

[1] http://www.interpares.org/

project at the University of British Columbia, that aims to develop both theoretical and methodological knowledge of how to preserve records in the long-term while keeping the authenticity of the record. LDB[1] (Long-Term digital preservation project) and their partners researched methods for long-term preservation and developed a working electronic archive environment. Within the LDB project three major research foci can be found. First: studies on how electronic records changed archivists' work practice (Runardotter, 2007); second: the development of a framework for archival systems (Quisbert, 2006); and third: metadata for the preservation of the structure of digital objects (J. Nilsson, 2006). The purpose of the David[2] project was to develop guidelines and manuals for electronic archives, resulting in hands-on manuals for preservation. Emulation was the technical solution used for long-term preservation of digital material in the CAMiLEON[3] project. In Europe the DLM[4] forum has served as a place where solutions and techniques to solve electronic record-related problems can be discussed and presented within the European Union. The DLM forum has still focused upon technical problems such as formats, and storage media.

This thesis adopts an informatics research perspective[5], which implies having an organizational research focus, with an intertwined mix of technologies, application areas, and stakeholders (Dahlbom, 1996). A study of the major scientific journals in the area of electronic recordkeeping, the Records Management Journal[6], and Archival Science[7], found no trend towards an organizational research perspective. Instead the research perspective was found to focus more on reactive problems, i.e. problems occurring after electronic records have already been created. One area of importance has been to present different proposals to solve the problem of non-readable formats, with for example emulation (Granger, 2000). Test and assessment of available standards has been proposed as important (Oliver, 2007), specifically the impact of ISO 15489 (Healy, 2001; McLeod, 2003), and the MoReq - Model Requirements for the Management of Electronic Records - (Cain, 2002). Efforts have also been put into assessment and validation of various recordkeeping toolkits (McLeod, Childs, & Heaford, 2007). Success stories about the positive impact organizations can gain by implementing electronic records management systems is another research area

[1] http://ldb.project.ltu.se/~Projekt_LDB

[2] http://www.antwerpen.be/davidproject/index.html

[3] http://www.si.umich.edu/CAMILEON/

[4] http://europa.eu.int/comm/secretariat_general/edoc_management/dlm_forum/

[5] For further description of this thesis research perspective see section 4.1

[6] http://www.emeraldinsight.com/info/journals/rmj/rmj.jsp

[7] http://www.springerlink.com/content/105703/

(Gregory, 2006; Maguire, 2005; Smyth, 2005; Williams, 2005). Archival description has a long archival tradition, which is also the case when dealing with electronic records (Schenkolewski-Kroll & Tractinsky, 2006; Yakel, 2003) Archival description is closely related to archival metadata efforts (Atkinson, 2002; Cunningham, 2001; Duff, 2001). Another rather important research effort has been to conceptualize electronic records. Early in the 1990's, research focusing on conceptualizing the new phenomena, and presenting proposals for methods to deal with electronic records can be found (Bearman, 1994; Dollar, 1992). The conceptualization of electronic records has been a continuing research focus of the research InterPARES project (Duranti, 2001a, 2001b; Duranti & Tibodeau, 2006).

2.2. Proactive recordkeeping systems design

Recordkeeping is "making and maintaining complete, accurate and reliable evidence of business transactions in the form of recorded information." (National Archives of Australia, 2004, p. 80) The definition of the term recordkeeping includes "the design, establishment and operation of recordkeeping systems" (National Archives of Australia, 2004, p. 80). In the introduction to this thesis the importance of the proactive approach was presented, which has its basis in the Records Continuum Model (Upward, 2000, 2004, 2005b). Proactivity in recordkeeping implies that information systems involved in recordkeeping should be designed to fulfill recordkeeping requirements. In MoReq2, the Model Requirements for the Management of Electronic Records (European Commission, 2008), the functional requirements of electronic record management systems are described. MoReq2 is an effort by the European Commission that was necessary to underpin transparent transnational e-services in Europe. In the United States of America the Department of Defense has a design criteria standard for electronic records management software(Department of Defense, 2007). Software vendors in the United States of America that have electronic records management software must be DoD-certified to be able to sell their software to public agency customers. In Norway they are working on an improved national standard for the Norwegian archive system, Noark 4. The new standard Noark 5 is inspired by the work the European Commission did to improve MoReq (Riksarkivet, 2007). The three contributions presented above deal with the requirements that electronic records management systems must fulfill. It has been impossible to find any methodological aid on how to actually work in the design process. In the DIRKS manual (National Archives of Australia, 2001a), design is mentioned. DIRKS is an 8-step process aimed to improve recordkeeping and information management in organizations. In DIRKS step F, a step by step guide to designing recordkeeping systems is presented (National Archives of Australia, 2001b). As a complement to the DIRKS manual the National Archives of Australia has also presented its own functional specification for electronic records management

systems (National Archives of Australia, 2006a), with similar content and purpose as both MoReq2, and Noark.

One area closely related to electronic recordkeeping is electronic document management and in this domain contributions from information systems research could be found. Sprague (1995) has developed fundamental components of functionality in the management of electronic documents, necessary for the design of electronic document management systems. According to Päivärinta (2001) Sprague has been one of few researchers who have adopted an organizational perspective on his research and not a technical perspective. Päivärinta (2001) uses a genre based approach to identify organizational requirements for electronic document management systems. Päivärinta represents the Scandinavian school of information systems research, and has, together with colleagues at Agder University college in Norway, continued to contribute to this research field. They have been one of the first information systems research groups that have focused on Enterprise Content Management (ECM). From their research, design implications can be derived, even if the research itself focused on management and implementation issues (see Munkvold, Päivärinta, Hodne, & Stangeland, 2006; Nordheim & Päivärinta, 2004, 2006; Päivärinta & Munkvold, 2005).

Despite those above mentioned standards and manuals it is possible to identify areas not covered. Firstly, the majority of research efforts have focused on reactive problem solving, i.e. problems related to recordkeeping after the electronic record has already been created. This research perspective is important, and is necessary for long-term preservation of electronic records. It is also very natural that this kind of reactive problem solving is very technically oriented. Secondly, the research projects that aimed to proactively solve problems focused only on limited types of information systems. The design-related guidelines and standards presented above are mainly made for electronic records management systems. As described above electronic records can be born in various information systems, and there is no guarantee that they are managed by an electronic record management system. Theoretically the above standards and manuals could be applied to other kinds of information systems, but there were no examples found in the literature. The standards and manuals mentioned above have a common purpose: they are aids for high quality recordkeeping that follows agreed and standardized requirements, as for example authenticity and reliability of electronic records (c.f. International Standards Organization, 2001; Reed, 2005). The standards and manuals do not deal with any issues of usefulness, user satisfaction, or usability. Implicitly this is a critique towards these manuals and standards. Usefulness, user satisfaction, and usability are issues that are very important issues in information systems design,.

2.3. Research objective

The previous sections aimed to present the problem domain and to describe an area where new knowledge is needed. There is a lack of knowledge about how to design information systems in which electronic records are born and managed. This is the knowledge gap where this thesis is positioned, in the area in between archival science and information systems research. It is a problem not knowing how to design information systems where the electronic records are born and managed, so that the electronic records can be preserved for the long-term with content, context, and structure intact. The problem needs to be solved in collaboration between archival science and information systems.

My research has emerged from the discussion above, and my starting point is the proactive approach. The objective of this research is to contribute to knowledge of design recommendations for information systems, in which records are born and managed. The objective will be achieved by identifying areas that affect and that can improve the design of information systems in which records are born and managed.

3. CONCEPTUAL FRAMEWORK

This research has been carried out in a problem domain that is principally defined by archival science, so it is important to present some of the central archival theories that have served as point of departure for this research. In this section those theories are presented.

3.1. Records

This thesis is about problems related to electronic records, and the concept of records is central to an understanding of the problems that must be solved. Records and archives are the two concepts that form archival science (Thomassen, 2001). The definition of a record is dependent on how it is created and on the content of the information. In this research a record is seen as a subset of information with unique requirements and characteristics.

From the Scandinavian IS research tradition data and information is crucial. Data are symbols that can be understood and interpreted as information (Langefors, 1978, 1995). On the other hand, information can, only be understood by humans, and never by a computer (Sundgren & Steneskog, 2003). In this thesis the term 'information' is used, even if 'data' would be the more correct usage. The subset of information, records, is results of human activities and therefore information is more suitable.

Records are evidence of actions and transactions (Reed, 2005; Thomassen, 2001) and the most widespread and accepted definition of records is found in the ISO 15489 definition:

> *"Information created, received, and maintained as evidence and information by an organization or person, in pursuance of legal obligations or in transaction of business."(International Standards Organization, 2001, p. 3)*

Another widespread and accepted definition is the International Council on Archives definition:

> *"Recorded information in any form or medium, created or received and maintained, by an organization or person in the transaction of business or the conduct of affairs."(International Council on Archives, 2000, p. 11)*

In this thesis the ISO definition is the one applied, because it has its base in the Australian archival tradition, which is adopted in this thesis (see section 3.2). The record definition above does not make any separation between electronic records or paper-based records. All records have content, structure/form and are created in a context (Hofman, 1998).

The evidential value of a record is central, and records are preserved for the evidence they represent (e.g. Saarinen & Sääksjärvi, 1990; Schellenberg, 1956/1998; Sprehe, 2000; Thomassen, 2001). According to Cox (2001) the evidential value of a record can only exist if the content, structure, and context are preserved. The context is the link between different records that belong together and also to the process where the record was created. The record's relationship to transactions is both what makes records different from information and enables the evidential functionality of records (Reed, 2005). In order to have evidential value, records must have two other criteria: Authenticity, and reliability. A record can never serve as evidence if it is not reliable and authentic (e.g. Duranti, 2001a; International Standards Organization, 2001; Reed, 2005).
ISO 15489-1 defines authenticity and reliability as: "

> *An authentic record is one that can be proven*
>
> *a) to be what it purports to be,*
>
> *b) to have been created or sent by the person purported to have created or sent it, and*
>
> *c) to have been created or sent at the time purported*
>
> *To ensure the authenticity of records, organizations should implement and document policies and procedures which control the creation, receipt, transmission, maintenance and disposition of records to ensure that records creators are authorized and identified and that records are protected against unauthorized addition, deletion, alteration, use and concealment.*
>
> */…/*
>
> *A reliable record is one whose content can be trusted as a full and accurate representation of the transactions, activities or facts to which they attest and can be dependent upon in the course of subsequent*

> *transactions or activities. Records should be created at the time of the transaction or incident to which they relate, or soon afterwards, by individuals who have direct knowledge of the facts or by instruments routinely used within the business to conduct the transaction" (International Standards Organization, 2001, p. 7)*

The evidential values of records are ensured if the authenticity and reliability of records are kept throughout preservation. Reliable and authentic records are a prerequisite for evidential values, which are necessary for accountability (Meijer, 2001a, 2001b).

3.1.1. Electronic records

Electronic records are records that are born digital (Duranti, 2001a, 2001b). The requirements of authenticity and reliability which are stated in ISO 15489 are also requirements for electronic records. Electronic records have changed the way in which one can interpret a record. The electronic record is not necessarily a physical entity, which in electronic form can be, for example, a Word document (e.g. Reed, 2005; Thomassen, 2001); it is possible that electronic records may be more of a logical entity. An electronic record can consist of several components that are managed in different databases, or information systems (Dollar, 1992). This duality makes it possible for the electronic record to both appear as 1) an entity; and 2) aggregated or composed by data from different sources.

Records that are transformed from analogue form into electronic form are also treated as electronic records. In this thesis the definition by Duranti "an electronic record is a record made or received and set aside in electronic form."(Duranti, 2001a, p. 272) is applied.

3.1.2. Local variations of records

In theory and practice many records are documents (see e.g. Hartland, McKemmish, & Upward, 2005; Reed, 2005). In the analogue management of records, the records were most frequently created on paper, which was interpreted as documents. In the Swedish translation of ISO 15489 (International Standards Organization, 2001), 'records management' is translated as 'document management' (in Swedish Dokumenthantering). The latter is explianed by the fact that the Swedish language does not have a translation for 'record'. This affects this research, which has been undertaken in Sweden in different Swedish organizations. In both public and private organizations they only talk about document management, which in Sweden covers both records management and document management. However, in public organizations they are aware of the concept of records, which could be a synonym for Swedish 'official documents' (in Swedish 'allmän handling').

In other Scandinavian countries where researchers have studied records the term 'documents' has also been used because of the non-existence of a translation of records (see e.g. Salminen, Kauppinen, & Lehtovaara, 1997; Tiitinen, 2003;

Tiitinen, Lyytikäinen, Päivärinta, & Salminen, 2000; Valtonen, 2007; Öberg, 2007). It is therefore difficult to make a clear distinction between documents and records in both research and in practice in a Scandinavian context.

In this thesis and in the articles that constitute the thesis, the term 'record' is used consequently except in the two articles (6 & 7) that present the results from research in two small and medium sized enterprises (SME). In Sweden there is no similar expression like 'official documents' for enterprises. The term 'documents' is used both for those that should be defined as records and for those that are only documents

3.2. The Australian archival tradition

In this thesis the Australian archival tradition is adopted. The Records Continuum Model developed foremost by Frank Upward (Upward, 2000, 2004, 2005a, 2005b; Upward & Stillman, 2006), is the basis for the Australian archival tradition.

The Records Continuum Model supports archivists in their concern with the relationship between recordkeeping and accountability (Upward, 2005b). The model views records as characteristically unstable (Upward, 2005b). A recordkeeping model should consider both an object-oriented approach and a system-based approach. There are no end products in an archival institution so there is a need for continuous addition of process metadata while records change through space-time. The model is four-dimensional and is presented in figure 2. According to Upward (2005b), traditional archival methods are creating one-dimensional documents and two-dimensional records, or three-dimensional archive but technologies enable a four-dimensional approach. Records can have multiple lives in space-time, and a record is never finished in its creation, it is continuously in change (Upward, 2000). McKemmish (2001, p. p.336) is of the opinion that use of the model will lead to "accessibility of meaningful records for as long as there are of value to people, organizations, and societies – whether that is for a nanosecond or millennia." The Records Continuum Model is the basis for the proactive approach proposed in this thesis. At creation the record should meet the requirements from all four dimensions.

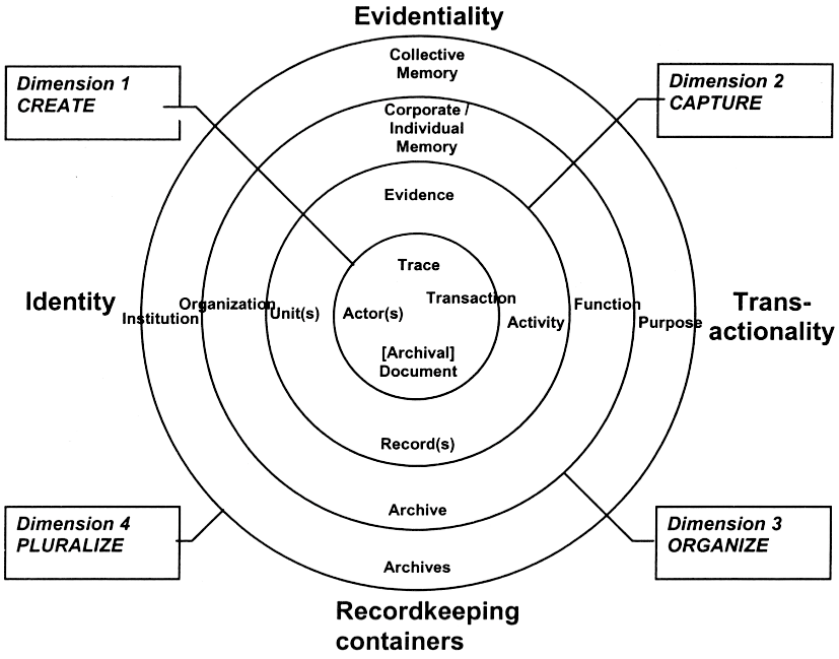

Figure 2. The Records Continuum model (Upward, 2005b, p. 203) © Frank Upward

3.2.1. Recordkeeping and recordkeeping systems

In this thesis the entire management of records goes under the term recordkeeping, which is a term associated with the Australian archival tradition. Recordkeeping is an organized and structured way of managing records from creation through their entire existence, and is defined as: "Making and maintaining complete, accurate and reliable evidence of business transactions in the form of recorded information." (National Archives of Australia, 2004, p. 80). A recordkeeping system should be seen as the entire systemic construct, which aims to capture, maintain and provide access to records over time including both software, hardware, and humans (National Archives of Australia, 2004).

Several types of systems that control and manage records exist in recordkeeping. In many organizations records are managed by electronic records management systems (ERMS). The definition of an ERMS is: "An automated system used to manage the creation, use, maintenance and disposal of electronically created records for the purposes of providing evidence of business activities./..." (National Archives of Australia, 2004, p. 78). A closely related system type is the electronic document management system (EDMS), which is defined as: "An automated system used to support the creation, use and maintenance of electronically created documents for the purposes of improving an organisation's workflow./..." (National Archives of Australia, 2004, p. 78). An

EDMS differs from ERMS in many ways. In an EDMS documents are managed, they can exist in many versions, be deleted and changed by their users, and the structure of the storage is optional. In an ERMS records are managed, only one final version can exist, deletion is very regulated, and the structure of storage is very strictly regulated (National Archives of Australia, 2006b).

In many situations records are born and managed outside an ERMS. Such systems can be described as business information systems, i.e. systems that support the business of an organization (National Archives of Australia, 2006b). Such systems do not necessary fulfill recordkeeping requirements (European Commission, 2002; National Archives of Australia, 2006a, 2006b).

3.3. Use and user of records

The objective of this thesis is to contribute to knowledge of design recommendations for information systems in which records are born and managed. This objective, together with the informatics perspective by Dahlbom (1996)[1], that is adopted in this thesis, implies that use and users are important concepts.

In this section some theoretical perspectives of use and users in archival science are presented. The perspectives are then put in relation to traditional information systems research perspectives of users and use.

In archival science limited research efforts have been put into studies about access, use, and users of records (Sundqvist, 2007). Sundqvist argues that studies on use and users are important in order to be able to conceptualize those concepts in the electronic records era. Without knowledge and conceptualization of use and users of records, design of electronic recordkeeping systems and archives system could be difficult (Sundqvist, 2007). A distinct difference is found in the literature between use and users of records. Different perspectives on use will be presented first.

In archival science a theoretical distinction between a record's primary and secondary value (Schellenberg, 1956/1998) has been basis for different views of use. The primary value of a record is its value to the organization in which the record is created, and its use is also found in this context. The secondary value for records is its evidential value and informational value suitable for future research, i.e. when records are no longer of operational value for the organization, they are valuable to researchers (Schellenberg, 1956/1998). Schellenberg represents a perspective on records and archives, where the record is primarily kept for evidential purposes, and preserved long-term for research purposes. Another contribution that makes distinctions between different use categories is presented by Shepherd & Yeo (2003). Shepherd & Yeo present three different purposes of using records: 1) Business purposes; 2) Accountability

[1] See section 4.1

purposes; and 3) Cultural purposes. According to Sundqvist (2007), this may be an attempt to bridge between the two values of records presented by Schellenberg (1956/1998). In the ISO 15489 (International Standards Organization, 2001) a set of different organizational benefits of records is presented, e.g:

- Conduct business in an orderly, efficient and accountable manner
- Support and document policy formation and managerial decision making
- Provide consistency, continuity and productivity in management and administration
- Facilitate the effective performance of activities throughout an organization
- Meet legislative and regulatory requirements including archival, audit and oversight activities

Pugh (1992) has yet another contribution to the definition of records use. She presents two categorizations of records use: direct use; and indirect use of records. Direct use is when someone is actually using a record by e.g. reading a record. The indirect use is when someone is affected by someone else's direct use of records.

Sometimes users want to use records for specific purposes but they can not, because of the quality of the records. Valtonen (2007) presents a study where she wanted to understand from the archives how police officers used records during a pre-trial investigation. The preserved records gave no information about how the pre-trial investigation was done. In the archive only the end product was preserved. This implicitly relates use of records with appraisal of records. If a future user cannot find the information he/she wanted in the archive, dependent upon destruction of records, the kept records do not fulfill the future user's needs.

According to Sundqvist (2007) there are extensive research efforts on user studies in archival science. However, the research is limited to user behavior in archival institutions. Research about records users in organizations seems to have been given lower priority.

There are some small differences between the way use and users have been applied in information systems research compared to the archival perspective presented above. The IS research tradition usually interprets users as those individuals that are physically going to use or interact with the information system. It is also possible to find this perspective in IS educational literature (e.g. Pressman & Ince, 2000). Studies of the use of information technology constitutes one part of the field of research called the *new informatics* (Dahlbom, 1996), and social informatics (Kling, 2000b, p. 245). Another user perspective is the involvement of users in systems development (see e.g. Bjerknes & Bratteteig,

1995; Nielsen & Relsted, 1994; Saarinen & Sääksjärvi, 1990). In information systems quality research the quality of an information system can be measured by user satisfaction when using an information system (Bailey & Pearson, 1983; DeLone & McLean, 1992, 2003; Doll & Torkzadeh, 1988; Ives, Olson, & Baroudi, 1983). Satisfied users have been used as the easiest way to assess whether or not an information system has fulfilled its stated and implied needs (Dahlbom & Mathiassen, 1993).

In archival science interest in the use of information technology has been of secondary value. In archival science the user uses records, i.e. a subset of information. If the record is electronic the user must use information technology to access the record, but only because the use of information technology is necessary in order to use the records. In comparison, IS research focuses on users that use information technology, and not mainly on users that use information. The border between use of information technology and use of information does not have a sharp edge. Although the concept of the user is very widely used in various information systems research contexts, there is some criticism of the concept. The term' user' is imprecise: Is everyone interacting with an information system a user or are they something else? According to Lamb & Kling (2003) the term 'user' can be someone using an information technology artefact (information system) on a daily basis. Modern information technology opens up the prospect of a different type of user, a user that is not a primary user of information technology. This kind of user is better described as a social actor (Lamb, 2006; Lamb & Kling, 2003).

In this thesis a user of records is an individual that uses records as subset of information. Access to records could be given by use of different information technology artefacts such as e.g. information systems, but the use of information systems is only a necessary step to access the record.

4. RESEARCH APPROACH

This section covers a description of the overall research approach used, followed by a discussion about my role as researcher. This section ends with a discussion about the quality in this research.

4.1. Research perspective

The IS research tradition in Scandinavia has focused on system development (see e.g. Bansler, 1989; Iivari & Lyytinen, 1998). In this thesis the overall research perspective is design oriented, and adopts the definition of informatics as:

> *"…a theory and design oriented study of information technology use, an artificial science with the interwined complex of people and information technology as its subject matter" (Dahlbom, 1996, p. 29)*

In a broader sense my research and this thesis conforms to a socio-technical perspective and is best positioned in the domain of social informatics (Kling, 1999, 2000a, 2000b; Kling & Hert, 1998). In this thesis information technology is assumed to be a social construct and understanding of social constructs cannot be gained without including humans and social contexts. Vehovar (2006) places the definition above by Dahlbom into the research field of social informatics. As the adopted research approach implies, this thesis is design oriented, which also is stated in the thesis objective. Design in this thesis should be seen as a process where the existing situation is changed towards a desired situation (Simon, 1981). A desired situation can be anything from a small artifact as a model or framework to a large information system. Design is about a goal to improve information technology and its use (Dahlbom, 1996) and in this research the goal is to improve to the way information systems in which records are born and managed are designed. The research follows a proactive approach and aims to enable long-term preservation of electronic records. The findings presented in this thesis should be seen as possible tools that assist the process of change from an existing situation to a desired situation.

In the Scandinavian school of IS research interpretative field studies of various kinds are the dominant research method. Interpretative field studies have also been a fully accepted research method in IS outside Scandinavia (Klein & Myers, 1999). The interpretative perspective has been applied because this research aims to increase knowledge about the boundary object (electronic records) between two research traditions, to result in a knowledge bridge between the archival community, and the IS community. An interpretative IS research approach implies that knowledge is gained through studies of the contextual setting in which the information system is situated. An interpretative research approach is also appropriate given that this thesis is positioned under the social informatics umbrella. Since the underlying theoretical assumption is that information technology and information systems are social constructs, then the studies of them should take place in the social contexts where they exist. This is how the "new informatics" differs from computer science (Dahlbom, 1996). Thus the dominant applied research method used in this thesis is the interpretative case study, which follows an interpretative IS research tradition (c.f. M. Myers, 1997; M. D. Myers & Avison, 2002). Electronic records and design for digital recordkeeping is a rather new field of research and its boundaries are not yet fully defined. From the beginning of this project it was quite clear that the research should be explorative and that each research study should contribute new knowledge that would provide input for the next study. It was for this reason that the case study methodology was chosen (c.f. M. D. Myers & Avison, 2002; Yin, 2003). I also decided that I needed to collect data from different settings,

which for example made ethnography unsuitable for this research purpose. In the six studies that have been the basis for the empirical data collection in this research a variety of data collection methods have been used. They are summarized in Table 1, and are fully described in each of the seven research articles. In all six studies different types of observation have been used, which is an established data collection technique if work-practice related use of information technology and information systems is to be understood (see e.g. Button & Harper, 1996).

This research is founded upon the IS research tradition, even though the research problem has been identified by archival science. In archival science there do not exist a research tradition similar to the found in IS research. However, in the last couple of years a debate has been begun which proposes using research methods from e.g. social science, and use of qualitative research methods have been proposes (see e.g. Gilliland & McKemmish, 2004; Gracy, 2004).

4.2. Research process

This research for this thesis has been carried out within two research projects. It is a challenge to be a researcher with an overall research question and fit this into two different research projects. The purpose of the research does not necessarily correspond with the purposes of the research projects. In this section the research process is described in chronological order. The purpose is not only to describe the process but also how each part of the research relates to the other parts and how each part contributes to the final result. The section begins by describing the two research projects from which this research has been funded. This is necessary to understand how the projects have influenced the research.

The research process began in 2004 in the project: *Archives of the Future – Electronic Information and Records Management in Swedish Agencies and Companies*[1]. The purpose of the project was, from an archival perspective, to systematically study electronic records management in a number of Swedish governmental and business organizations. The project focused on the complexity of digital records creation, records use and information search processes in different kinds of organizations and data were collected by empirical studies. The project aimed to study organizational and methodological aspects of long-term preservation of electronic records. The project, which ran for three years, was a collaboration between archives and information science and information systems research.

In 2006 the *Archives of the Future – Electronic Information and Records Management in Swedish Agencies and Companies*, ended and the *SMEdoc*[2] project

[1] A three year EU-funded research project at Mid Sweden University

[2] A 1 ½ year EU-funded research project at Mid Sweden University

began. *SMEdoc* was a research project with a totally different perspective to the first project. The focus of the *SMEdoc* project was to study the effect that efficient document and recordkeeping has on small and medium sized (SME) businesses. In the SME context the concept of records is not widespread, nor commonly used. Instead, the research implicitly focused on electronic documents. From a theoretical perspective the documents that were studied in the *SMEdoc* project could be defined as records, when they are created in the business process.

A detailed presentation of the research process will now follow. Figure 4 is a visualization of the process and the activities within the process. Figure 3 describes the symbols used in figure 4. The concepts used are adopted from the thesis by Danielsson (2007).

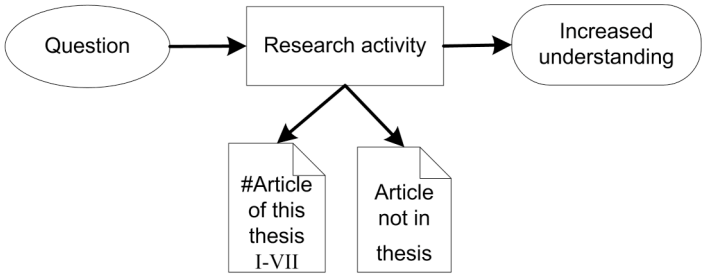

Figure 3. Symbols used in figure 4 to describe research process adopted from (Danielsson, 2007)

This research began with limited knowledge about the problem domain. One of the purposes of the project *Archives of the Future – Electronic Information and Records Management in Swedish Agencies and Companies,* was to form the area of research about long-term preservation of electronic records. The project gave me an opportunity to be very explorative as a researcher.

The first identified important issue was to increase the awareness of what an electronic record is, i.e. to identify the characteristics of electronic records. This was fulfilled in study 1, together with an extensive literature review. Study one resulted in article I. From study 1 the empirical data gave new knowledge that indicated a more widespread use of electronic records than was found in literature. In the literature very little was found about positive outcomes of electronic records use, which became the basis for **the second** question in this process, and served as the basis for study 2. In study 2 the aim was to study how records were used in operational work. Empirical data from previous research were complemented with new empirical data, and were analyzed according to the new research purpose of study 2. Study 2 ended in article II, and contributed to knowledge about use of electronic records.

If electronic records are to be used as evidence, the electronic records must be of high quality. My research focus within the project *Archives of the Future –*

Electronic Information and Records Management in Swedish Agencies and Companies now changed to focus on electronic record quality. **The third** question in this research was related to quality and the way high electronic record quality could be received and assessed. This was carried out in study 3 & 4. From study 3 & 4 three research articles were produced, which not are part of this thesis (Borglund, 2005a, 2005b, 2006b). Study 1-4 ended with a licentiate thesis (Borglund, 2006a). The licentiate thesis was further developed based on the studies 1-4, and resulted in article III. Article III presents a recordkeeping quality assessment model proposal. With the fourth study, the activities within the project *Archives of the Future – Electronic Information and Records Management in Swedish Agencies and Companies* ended. From that project new knowledge was created that served as a basis for **the fourth** question in this research. In the proposed electronic record quality assessment model from article III, and the licentiate thesis, the notion of the known and unknown user was presented. It was obvious that the user had a high impact on how recordkeeping was managed, and thus had an effect on the recordkeeping quality. Therefore the use and user of records needed to be conceptualized further. In recordkeeping, time is a natural component, due to the need for preservation, among many things. In two research articles (article IV & V) time was added in two different ways to increase knowledge about use and user. In article IV the empirical material was based on data collected in study 1-4 together with empirical data collected by Lena-Maria Öberg. The article added a linear temporal structure in the analysis of the use and user of records. The known and unknown use/user was further conceptualized. Article IV gave input for **the fifth** question, which was whether the use of records could also vary dependent on different temporal rhythms within an organization. Article V was based upon a longer field study named study 5. In article V the temporal structure was based on temporal rhythms in an organization and not a linear temporal structure.

At this stage I became involved in the *SMEdoc* project, and the project focus was SMEs. The project purpose was to increase knowledge about document and record management in SMEs. The *SMEdoc* project gave input for **the sixth** question in this research process: what role does records management, document management and information management play in SMEs? Study 6 resulted in articles VI & VII. Although the project forced me to change focus from records to documents, and from mainly public organizations to private, it was possible to compare the results from study 6 with the other studies. Study 6 gave new knowledge about similarities and difference between SMEs and public organizations in the way they deal with problems related to electronic records specifically, and digital information in general.

In figure 4, the research process is visualized in chronological order.

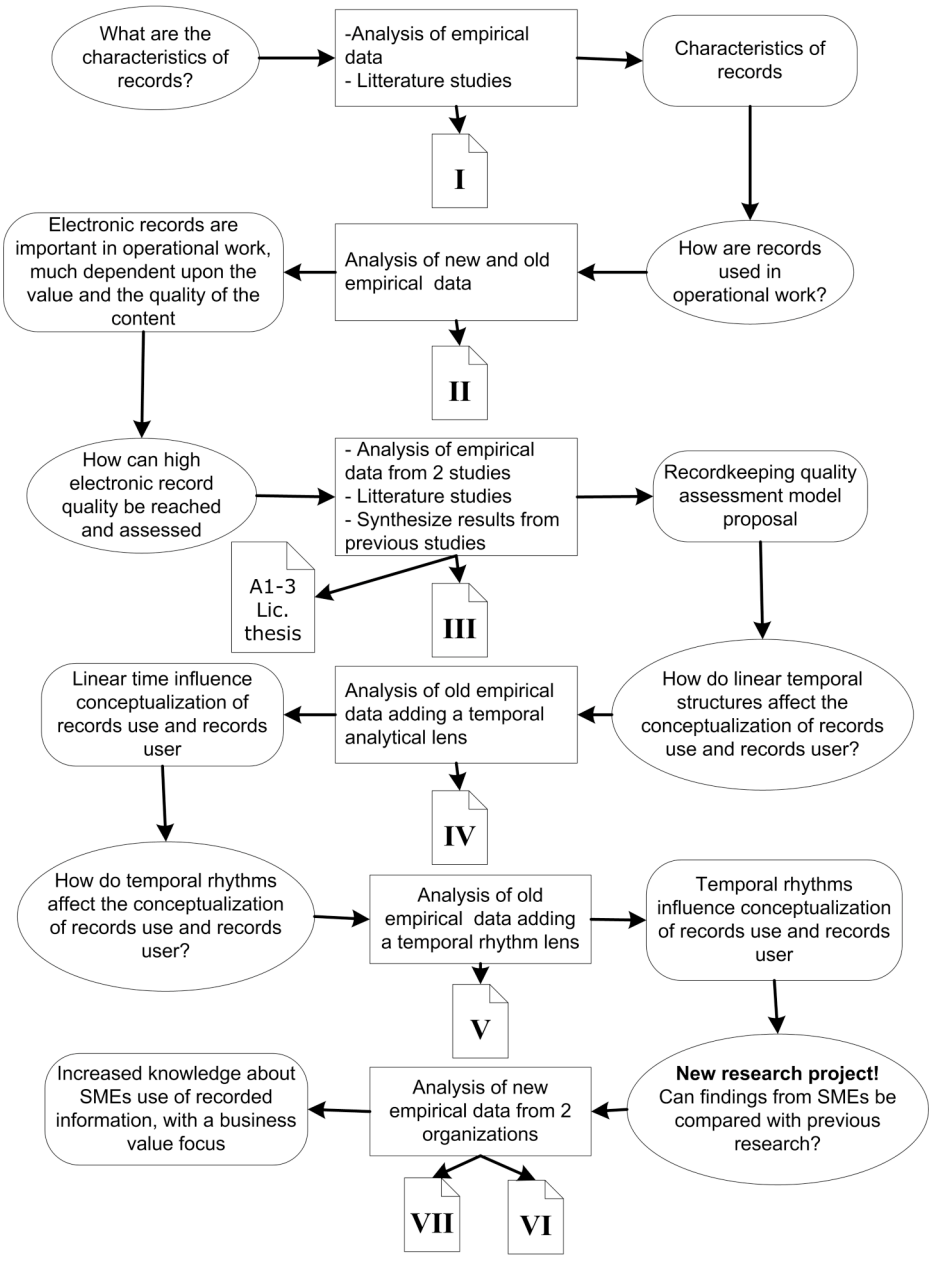

Figure 4, the research process in chronological order

Table 1, summarizes the key dimensions of every research study in this thesis, and their relationship to the research articles.

Table 1. Key dimensions of each study, and their relation to research articles

Study	*Data collection*	*Research setting*	*Purpose of study*	*Empirical data used in article:*
1	*10 interviews 1 Group interview Participatory observations Internal Documents*	*1 Municipality 1 Enterprise 1 Public company 1 Police authority*	*To identify the characteristics of records based on empirical data and archival theory.*	*I, III, IV*
2	*29 semi-structured interviews 50 hours participatory observations Internal documents*	*1 Police authority*	*To increase knowledge of the way electronic records are used within operational work, and how the use of electronic records affect that operational work*	*II, III*
3	*6 interviews 4 full days of participatory observations Internal documents*	*1 Public organization*	*To identify what electronic record quality is needed to maintain trustworthiness in electronic records.*	*III, IV*
4	*12 interviews 4 days of participatory observations Internal documents*	*2 Public organizations*	*To identify a set of "good practice" for achieving reliable and authentic records in recordkeeping systems.*	*III, IV*
5	*Participatory observation 3 years, ca 300 hours*	*1 Police authority*	*To contribute with knowledge of use, and adoption of IT in police work, with the goal of identifying design implications for IT in police work*	*V*
6	*13 interviews 2 group interviews 2 questionnaires Observations Internal documents*	*2 SMEs*	*To contribute to knowledge of electronic document management and electronic recordkeeping in SMEs*	*VI, VII*

4.3. My Role as researcher

This research has, apart from the briefly described research projects above, been a process in which my role as a researcher has been challenged. When entering this new field of research with my roots in the Scandinavian IS research community, I was not accepted as a researcher in the archival community. I did not have enough theoretical knowledge, and I had problems in expressing myself. The archival community was almost acting suspiciously: that I was only yet another IT-person who thought technology could solve the problem the archival community faced. However, during the process I became more and more accepted in the archival community and was transformed into an accepted member of that community. But when I returned to the IS research community, I have become an outsider, with new knowledge that no one wanted, or thought was necessary. Suddenly it was like I had lost my roots. In the later part of this research process

I have put huge efforts into becoming accepted in the information system research community again.

The role I have taken in this research process implicitly makes me definable as a broker, i.e. a person with knowledge from two communities and competence to communicate knowledge about the boundary object electronic records in an understandable way for both the archival science community, and the information systems research community. A broker is a person who can move between two communities (Wenger, 1998).

4.3.1. My pre-understanding

In this thesis empirical data have been collected in many organizations. One of those organizations is the Swedish Police Service. As a former police officer I have therefore performed research in a setting that is familiar to me. The Swedish Police Service is an organization that can be difficult to access as researcher. With a police background, this has never been a problem for me. For the last four years as a practitioner I have been doing full time research and only minor police work, and during that period police practice has been observed both from a practitioner's perspective and from a researcher's perspective. Being a sworn officer returning to practice as a full participant and observer has not introduced any problems or doubts for my colleagues. The dual role, officer and researcher, has been that of a reflective practitioner (Schön, 1983). Research notes have been taken parallel to police notes during the shifts. Reflective informal minutes have been compiled after most of the shifts. It is not without complications and risk of criticism to do research within a context that is well known to the researcher (Repstad & Nilsson, 1999; Svensson & Starrin, 1994). From anthropology the term "going native" has been borrowed to describe data collection in an environment that can be the researcher's back yard (Kanuha, 2000). Research within one's own practice have been performed in various areas, for example: in teaching (Richardson, 1994), in social work (Kanuha, 2000; Monti, 1993), and in police work practice (Ekman, 1999; Holgersson, 2001, 2005). In this research the benefits of being able to access data from the police has been valued more highly than the risk that "going native" brings. Following the principles of a sound hermeneutic approach, it is important to be honest about the pre-understanding the researcher has (Wallén, 1996), which is the purpose of this section. In articles (I, II, & V) where empirical data from the police have been used, the data and the analysis of the data have been discussed with, and read by different research colleagues, with the goal of minimizing bias.

In the other research settings that served as basis for this research I have not had any detailed pre-understanding. I had only the general pre-understanding gained from 17 years of work at a government agency. However, this has given me useful general knowledge about public organizations and their management.

4.4. Research quality

In this thesis qualitative research methods have been used. These are well-suited to studying and increasing knowledge about electronic records and their management. This research has also been explorative, which is natural when a new research field is entered. The qualitative approach has been useful in creating an understanding of the research field, and about electronic records and their use. The risk in taking an explorative approach is that I, the researcher, have had difficulty knowing where my research will take me. Each study gives input for new questions and new identified sub-problem areas. This approach has similarities to the Grounded theory method presented by Strauss & Corbin (1998), where the theory building is intended to be iterative, and continuously analyzed. However, the aim of the research for this thesis has not been to develop a theory: it is only the research process that has similarities to the process described by Strauss & Corbin.

Criticisms put forward against qualitative research methods centre around those methodologies' lack of validity and reliability. Validity and reliability are applicable when doing quantitative research where the results are often intended to be generalized. The results of this research are not claimed to be generalizable, because the data have been collected in a limited number of organizations in relation to the full population.

In quantitative research with a positivist approach, three quality terms are often used: external validity, reliability, and objectivity; and these are described by many (see e.g. Bell, 2000; Guba & Lincoln, 1989; Wallén, 1996). In qualitative research those terms are not appropriate and the quality of research must be described in other ways. Guba & Lincoln (1989) have introduced an alternative way to ensure high quality in qualitative research without using external validity, reliability, and objectivity. Transferability is the alternative to external validity or generalizability. Transferability is about the possibility of using some or all of the results of qualitative research in another setting, and is achieved by a detailed description of the research settings to ensure others understand context, culture and other factors, which either affected the research or were found in the research setting. Dependability is Guba & Lincoln's response to reliability. Here a rich description of the research process is needed, so that a reader can understand every step in the process and follow changes in the original research method. Conformability is the last alternative dimension, which is a substitute for objectivity. In qualitative research it is important that the results are grounded in the data and that this relationship is possible to track back to its source. The whole idea with these three alternative dimensions is to ensure that an outsider should be able to find the source of the data and judge the results accordingly.

In this research transformability of the results and dependability of the method, i.e. appropriateness of the method for the purpose of the research, are the two dimensions that have been used as a guide to increase the quality of this research. Every research article has aimed to describe the research settings and research context as descriptively as possible in order to make the results transferable to other organizations and settings. Another aim has been to describe the research process clearly in each research article. However, this thesis consists of different research articles and full descriptions of research settings and the research process can be difficult to achieve because of limitations on the length of each research article.

5. RESEARCH CONTRIBUTIONS

In this section each articles is summarized and described under the following headings:

- Problem definition and purpose of the article
- Summary of the results

5.1. Summary of article I

Öberg, L.-M., & Borglund, E. (2006). What are the characteristics of records? *International Journal of Public Information Systems, 2006*(1), 55-76.

Problem definition and purpose of the article

Electronic records have become more and more common in organizations as the majority of organizations have computerized their administration. Electronic records as well as paper-based records must be reliable and authentic to be able to serve as evidence. The issue of preservation is not trivial. In theory, records are a subset of information and the definitions of records available are rather abstract and difficult to use for help in identification of records. The descriptions of records often consist of the functionality records must achieve. Identification of the characteristics of records is necessary if one aims to formalize records, which is in turn necessary to enable processing in a computer-based information system. In this article the aim was to describe the characteristics of records based on both archival theory and empirical data. In the article three research questions were used:

- What is defined as a record in organizations?
- What are the characteristics of these records?
- Are there any differences between the empirically grounded characteristics of records and the characteristics described by recordkeeping and archival theory?

Summary of the results

The article presents a list of several different characteristics found in four organizations. There is a large variety in what organizations define as records. The article also presents context, type of content, organizing, structure and version/copy as characteristics of records. Based on an extensive literature study, all characteristics other than type of content are found in archival science and recordkeeping literature. The article shows the existence of some discrepancies between theories and empirically identified records, when penetrating each characteristic in detail. Legislation, other organization-dependent regulations, archival tradition, and different recordkeeping traditions between countries are possible reasons for these discrepancies. This article also presents examples of a large variation in recordkeeping maturity between organizations, which greatly affects what an organization defines as records. There are examples of good correspondence to standards and recommendations of recordkeeping and also the opposite.

The main contribution of this article is the identification of characteristics of records and that the organizations where records are born and used must declare the organizational specific characteristics for those records. This knowledge can be applied in the design of information systems in which records are born and managed. Electronic records should be formalized to some extent before it is possible to manage and process them in computer-based information systems. The variety of identified records in organizations should, together with the widespread unawareness of what a record is, motivate a proactive approach when dealing with electronic records. Before an information system is designed organizations should carefully identify both the general and the organization-specific electronic records.

5.2. Summary of article II

Borglund, E. (2005). Operational use of electronic records in police work [Electronic Version]. *Information Research 10(4)*.

Problem definition and purpose of the article

When electronic records became more commonly used in organizations, the archival science community became almost desperate to find a solution to solve problems related to preservation of electronic records. The majority of the research on electronic records has focused on how to solve problems and less has focused on the possible benefits electronic records can give an organization. The first step to identify benefits is to study how electronic records are used in organizations. The purpose of this article was to study use of electronic records in operational situations, and has been guided by the following research question:

- How are electronic records used within operational work, and how does the use of electronic records affect that work?

Summary of the results

In the operational environment of the Swedish police, where the study was conducted, electronic records were a widespread type of information. Several information systems consisted of records and five information systems containing electronic records were identified, all of which were obliged to preserve their content forever.

The article presented various situations where records were used in operational work:

- Information retrieval processes
- Information communication processes
- Decision making
- Valuation of information
- More accessibility

Police officers were found to be using electronic records on a daily basis and electronic records were identified as an important source of trustworthy information, i.e. reliable and authentic information.

The operational use of electronic records could be summarized in two dimensions: 1. Decision making for situated action; and 2. Decision making for planned action. Police officers used electronic records either to plan some action or they used them once in an operational situation. In the latter, they could either retrieve information derived from electronic records by using the dispatch central, or they could already have gathered the information they used previously. Use of electronic records was also identified as a natural component in police officers' ability to increase their police knowledge by easy access and searchability in the information systems containing electronic records. The possibilities for police officers to search and access reliable and authentic information, for the purposes of both tactical and legal decisions, increased the officers' ability to make correct decisions within operational work. Police officers could be better prepared for the unexpected when working. If searchability and access to information systems containing electronic records became more mobile, the role electronic records play in operational police work would increase.

The main contribution of this article is the description of the operational value electronic records can play in a time-critical work. Electronic records were used for different kinds of decision-making, which is a purpose other than the original purpose of the records, to serve as evidence over actions and activities. This knowledge is part of the conceptualization of use and user of records.

5.3. Summary of article III

Borglund, E. A. M. (2007). RQAM: A recordkeeping quality assessment model proposal. *International Journal of Information Quality (IJIQ), 1*(3), 326-344.

Problem definition and purpose of the article

Electronic recordkeeping is an area with many identified problems. One major problem is related to long-term preservation. Nevertheless, long-term preservation can not just be seen as a problem that is possible to solve on its own. Long-term preservation of electronic records requires a proactive approach, which guarantees that electronic records are authentic and reliable through out time. The proactive approach implies that electronic records and electronic recordkeeping systems have certain quality. Quality in the electronic records domain is not an area that has attracted many researchers, which motivates a knowledge contribution in that area.

Summary of the results

This article represents the essence of a two-year research project. It presents the synthesized results from four research studies, with the purpose of increasing knowledge about how recordkeeping quality assessment can be understood based on empirical data together with the theory of information quality, information system quality, and information system quality assessment models. In this article, which is based on the author's licentiate thesis (Borglund, 2006a), the results are presented as a recordkeeping quality assessment model (RQAM) proposal.

The RQAM proposal consists of four major sub-results (assertions) which, together with theory, constitute the components in RQAM.

Electronic records exist with unique characteristics

Although general definitions of what defines a record exist, a record must be seen and understood by the organization which manages them. A large variety of electronic record types, all with unique characteristics, were found. The organizations responsible for management of those records do not fully maintain these characteristics and implicitly recordkeeping requirements are not fulfilled.

Electronic records are used, with partial unknown future uses

Electronic records must often be preserved for the long-term, which results in the possibility of their being used many times in various situations after their creation. Thus electronic records are used for purposes not known in advance when they were created. When designing information systems, the intended uses of the system form the system requirements, together with user needs. For electronic recordkeeping systems, the intended future use can be partially unknown when an electronic recordkeeping system is designed and developed. It is essential to ensure that records cannot be changed after they are born, so the authenticity and reliability should be maintained.

Electronic records have unique quality dimensions

Information and data quality dimensions have been identified as also being usable and applicable on electronic records. Those quality dimensions were: Accessibility, Appropriate amount of data, Believability, Completeness, Free-of-error, Interpretability, Relevancy, Representational consistency, Security, Timeliness. Some information and data quality dimension was not found in the empirical material: Understandability, Objectivity, Reputation, Value Added, Concise representation. The information and data quality dimension 'Ease of Manipulation' was not found, but this dimension is not wanted. A set of quality dimensions unique for electronic records was found and identified: Accuracy, Movability, Original look, Portability, Searchability, and Traceability.

Assignment free Recordkeeping should be considered at three levels

Recordkeeping quality cannot be seen in a one-level approach. A holistic view must be applied to understand quality in recordkeeping. The three levels where quality in recordkeeping should be understood are:

1. Strategic level
2. Computer-based Information System Level
3. Entity level (record level)

The main contribution of this article is the RQAM proposal which is of predictive nature and should be used to support development and assessment of information systems in which records are born and managed, as a reference model.

5.4. Summary of article IV

Borglund, E. A. M., & Öberg, L.-M. (2008). How are records used by organizations? *Accepted for publication in Information Research.*

Problem definition and purpose of the article

In archival science two predominant models of describing recordkeeping exist: the life cycle model, and the records continuum model. These two models differ in how appraisal is managed. In the life cycle model, the appraisal takes place when a record is inactive and no longer used. In the records continuum model the basis is that appraisal should be done proactively, and at least no later than the point at which a record is born. Both proactive appraisal and macro appraisal demand knowledge about how records are used. The design of electronic recordkeeping systems are also affected by the way records are used, which forms the user requirements of the system. In recordkeeping research studies of how records are used is an emerging research topic.

The aim of this article was to investigate how records are used in organizations, and who uses them, with the purpose of studying whether the use of records addresses certain needs in the development of electronic recordkeeping systems. In the article a temporal lens was applied to the use and users of records, by using the notion of temporal structures.

Summary of the results

This article has applied a temporal lens, based on the taxonomy of distinction between records' primary and secondary value. Within each of those two temporal structures, three different purposes for using records have been identified to further divide the results. Within the temporal structure of primary value, the users and uses are most often known in advance. It is also possible to summarize the users as traditional users, according to the terminology used in information systems literature, i.e. a user interacting with the system in some sense. In the other temporal structure, secondary purpose, the use and user are very difficult to identify in advance, because the use of records is very situation-dependent. The characteristics of the use and user in the second temporal structure are best described as partially unknown. The latter situation is a result that affects the design of information systems involved in recordkeeping. In traditional information system development methods, use is known in advance, and how to handle the uncertainty of use is not dealt with by predominant development methods. A similar result is found in the applied categorization of the different purposes for use of records, within the two temporal structures. Within the first temporal structure the purpose for use of a record is known in advance. In the second temporal structure, there is a huge uncertainty about the purpose for which records may be used. In the second temporal structure it was also found that the purpose for using some records had nothing to do with the records' original purpose.

The value a record has for a user is one basis for the appraisal process. The uncertainty identified in this study about user and use of records makes it difficult to follow the proactive appraisal approach imposed by the records continuum model. When it comes to electronic recordkeeping, at creation the electronic record must meet stated and implied needs of its users, which includes both known and partially unknown. In this study several examples were found where a user wanted to use a record, but was not able to find the record. Often the reason was that the record had not been constructed to be searchable to support such use. This is a strong argument that uncertainty about future use is a problem that needs to be minimized if high quality electronic recordkeeping systems should exist. The problem of management of this uncertainty is crucial in the design of recordkeeping systems, which should fulfill both user needs and stated record requirements. Another finding in this study was that the notion of social actor has eligibility in understanding and describing some users of records in the second temporal structure.

The main contribution of this article is the conceptualization of use of records and the user of records. Knowledge about use of records and the user of records are implicitly necessary when using predominant information system design

methods, which are currently used when designing information systems involved in recordkeeping.

5.5. Summary of article V

Borglund, E. A. M. (2008). Electronic records use changes through temporal rhythms. *Archival and Social Studies: A Journal of Interdisciplinary Research* 2(1), 103-134.

Problem definition and purpose of the article

Electronic records cannot be changed or manipulated, if the evidential value, authenticity, and reliability should be maintained throughout preservation. Therefore records must meet the stated and implied needs of their users at the time of creation. When electronic records are born and managed within information systems, both the system and the record itself must meet stated and implied user needs. Altogether this provides motivation for increased knowledge about uses of records.

The purpose of this article was to increase knowledge about how electronic records are used in knowledge-intensive and time-critical work practice. The article is a contribution to the research field on electronic records use, and the results will be usable in the design of information systems managing electronic records. The article has been guided by the following research question:

- How do different temporal rhythms in operational police work affect the use of electronic records?

Summary of the results

This article presents the temporal structures that are embedded in operational police practice as forming the basis of different types of electronic records use. Four temporal structures were used in this study, and each had a characteristic use of records.

Assignment free

Police officers use information systems to search, and retrieve electronic records and information found in electronic records for a business purpose. They want to be informed and keep up to date about police-related activities, and they use records to increase their knowledge in order to be able to perform better in their work.

Preparing/mobilization

Police officers that are physically outside the police station cannot search, retrieve, or use electronic records as primary users can. They have to be assisted by others, and they retrieve and use bits and pieces of electronic records, i.e. information fragments that can assist them in different tactical decisions.

Intervention/engaging

Here the police work is time-critical. The police officers have to rely on their experience and information already gathered; there is limited time to ask

someone else to search for specific information. They use information already derived from electronic records in their action, if necessary. Their actions are the starting points for a new record of their activities.

Debriefing/documentation

Police officers use information systems to create electronic records when they debrief and document their work. All these documents are records and managed electronically. Electronic records created in this process can be useful for and used by other police officers. Often existing electronic records serve as a source of information in the debriefing situation.

From the temporal structures presented above and different uses of records, a conceptualization of user was compiled.

In the temporal structure ***assignment free,*** the police officers can be conceptualized as traditional users, interacting with different information systems to access, to search, to retrieve, and to use electronic records. They use electronic records foremost to be informed and to gain knowledge, very dependent on the embedded evidential value in electronic records. In ***preparing/mobilization*** police officers can no longer actively use information systems directly. They are dependent on others, who assist them to access, to search, to retrieve electronic records. They are more like mediated users, who use electronic records indirectly. ***Intervention/engaging*** is the most time-critical temporal structure in police work practice described in this article. Here the police officers act in a situation, and decisions must normally be taken upon knowledge already gained. They are more like a bricoleur, i.e. a person that needs to solve the situation with available tools at hand. Such tools include information and knowledge derived from electronic records. In ***debriefing/documentation*** the police officers are conceptualized foremost as producers of electronic records. After a police assignment the police officers need to document their action, which results in new records.

In this article the principal result is the continuation of work to conceptualize use of records and user of records. Temporal structures in organizations can have an impact on electronic records use. If electronic records are used in different ways in different temporal structures in an organization, information systems involved in recordkeeping should be designed to meet these different uses.

5.6. Summary of article VI

Borglund, E. A. M., & Sundqvist, A. (2007). *The role of EDM in information management within SME's*. Paper presented at The Second International Conference on Digital Information Management (ICDIM'07).

Problem definition and purpose of the article

Documents are sometimes described as sources of knowledge. When documents today are born digital they are managed electronically. Capturing, storing,

sharing and disseminating knowledge can give organizations advantages. Research on electronic document management (EDM) has had a mostly technical focus, and far fewer research contributions that have taken an organizational perspective. In this article the problem of interest is whether EDM in a small and medium sized enterprise (SME) environment supports the need for management of the corporate memory, i.e. the organization's corporate knowledge. The purpose of the article was to increase knowledge about the relation between the business values of EDM and the business needs of SMEs, and was guided by the following research questions:

- How are electronic documents used in the SMEs?
- What are the business needs of the SMEs, and how do they correspond with stated EDM business values?

Summary of the results

Document use is widespread in the SME that was studied. Documents are important in communication, and as sources of information. The unstructured management of electronic documents makes it difficult to find the documents that are wanted, which results in waste of time. The employees know that it is easier to ask a colleague instead of searching for the document.

Both tacit and explicit knowledge are needed. AN EDM can be suitable for managing explicit knowledge, which it is often possible to codify or formalize.. On the other hand there was also a need to manage tacit knowledge, which is a kind of knowledge that is difficult to formalize, and therefore it is not possible to manage it through documents. Tacit knowledge can for example be experience as well as knowledge that an individual has, without knowing it. In the company that was studied, younger employees mostly ask older colleagues instead of trying to find the information they are looking for. This is dependent both on the fact that the younger employees are looking for knowledge that is definable as tacit, and on the fact that the documents are not managed in a such a way that they can be found.

Knowledge cannot be managed without a proper and working electronic document management system. In electronic document management there is no tradition of preserving the context for every document. Documents with rich contextual description can be used to derive experience. Context is one of the things that separates information from knowledge (Blair, 2002). When a document is nothing more than information, the context is necessary.

The main contribution of this article is that recorded information in the form of electronic documents is an important business asset in the organizations studied, and that internal stove-pipes in the organization negatively affect the possibility to fully exploit the business value found in recorded information.

5.7. Summary of article VII

Borglund, E. A. M. (2007). *EDM business values in a SME environment in terms of knowledge management.* Paper presented at the European and Mediterranean Conference on Information Systems 2007 (EMCIS2007).

Problem definition and purpose of the article

Electronic document management (EDM) is an emerging technique in many types of organizations. There are many organizations that have implemented electronic document management systems (EDMS) to support their business. There are several stated business values that organizations can receive from EDM, but these business values seem to be more applicable to larger organizations. In major scientific databases there no research was found that focused on small and medium sized enterprises (SMEs). SMEs are important to economic growth, but to be competitive SMEs need to adopt new technologies. Given the limited attention researchers have paid SMEs and their use of EDM, there is motivation to increase the knowledge about business values SMEs can gain from EDM.

The research question that has guided this article was:

- How can electronic document management support the stated and implied needs for management and utilization of the corporate memory in an SME type of organization?

Summary of the results

Electronic documents are important part of the business in the two SMEs studied. Almost all employees produce electronic documents by using a variety of information systems. It is almost impossible to work without creating electronic documents. But this ease of production also has a negative effect. It is so easy to create documents and the preservation of documents, especially those created by MS office suite, is too dependent on personal action. People store and preserve documents following their own built up structure, and strategy. There is a need to have a strategy for the entire organization-wide management of documents. It is also found that the management of electronic documents is very difficult. The widespread uses of electronic documents are so complex that no single system can manage all the electronic documents that a business needs. The use of electronic documents has made it easy to create documents, but difficult to manage them. Different versions of digital documents should be managed and tracked, which empirically seems more difficult than analogue document management. In the organizations studied there was a need to manage knowledge in an organized way. In the majority of the created documents the content was information that was part of the organizational corporate knowledge. Without a working system for management of electronic documents it is difficult to use knowledge bound in the documents. Frequently it is the lack of contextual relationship between different documents that disables the possibility of retrieval and use of

document-bound knowledge. The complexity of electronic documents found in the two companies studied signaled a need for a common classification or taxonomy within organizations. If an organization has a defined classification, they can also develop an internal metadata schema that can be used in all the systems that created documents in some way. The classification opens up the possibility for information sharing between systems.

The main contribution of this article describes how electronic documents play an important role in modern SME business. Electronic documents are very easy to create but less easy to manage. In the companies studied there was a need to improve communication, to improve information sharing, support business processes, and to manage knowledge and experience. This need is in accordance to the business values addressed by EDM.

6. MAIN RESULTS

The research results and details of the research contribution are documented in the collection of articles. This section aims to present a comprehensive overview of the main results. The implications of the results, and the sources from which the results have been drawn are discussed in the following subsections. The main results that contribute to knowledge of design recommendations for information systems in which records are born and managed, are the following areas that all affect and can improve design of such information systems:

- This thesis has presented empirically and theoretically grounded **characteristics of records.** A set of common characteristics of records exists, but the organizations in which the records are born, and/or are used add a set of organizational characteristics.
- This thesis has contributed by **conceptualization of use of records and user of records**. The notion of known use/user, and unknown use/user has been introduced. Temporal structures have also been used as an analytical lens to further conceptualize use and user of records.
- A **Recordkeeping quality assessment model (RQAM)** was developed to serve as the basis for quality assessment in recordkeeping. The model as it is presented can preferably be seen as a reference model to increase understanding about how recordkeeping quality should be achieved and interpreted.
- **Different views of records** based upon the difference between both public and private organizations have been studied in this research. In public organizations appraisal of records is principally based upon accountability values and legislative values. In private companies the

appraisal of records is principally based upon the business values of records.

- The **proactive approach** is proposed as necessary in order to capture and manage evidential, authentic, reliable and accountable electronic records. The proactive approach has been proven to include more than was at first proposed.

6.1. Discussion of the results

6.1.1. The characteristics of records

From article I a set of characteristics was presented. One of the ideas behind information systems is automation. To process information in information systems, information has to be formalized, which is the theoretical starting point for article I. Neither the identified characteristics in this research nor the characteristics stated in ISO 15489[1] (for example) are so constructed that records can be detected automatically. The characteristics should rather be seen as requirements on a record level. This implies that the organization where records are born and managed must also define the unique characteristics of their records. In article II, IV, and V several examples of records are found whose characteristics have been defined by the organizations where they are born and managed. From article VI, and VII examples of rather ad-hoc definition of digital documents are presented, which made the management of the documents difficult.

As a result of the above, the organization in which electronic records are managed must define their electronic records and make sure that they can also be managed by the information system aimed for management. The organizations have the knowledge to define what are records in their organizational context, and what are the characteristics of those records. It is important that organizations continuously and proactively identify the records that exist in their business. It is also important when new information systems are being designed to identify whether the information system itself results in new kinds of records. The latter was a result that has also been confirmed by the InterPARES[2] project, which also identified that organizations have a large responsibility for definition of records (for details see Duranti & Tibodeau, 2006). Even in the best of worlds it is not possible to believe that new types of records will never be born in an organization. Organizations change, and new business processes occur resulting in new kinds of records. They must also be identified and it must be possible to manage them in an information system. Thus the work of finding and

[1] see section 3.1

[2] http://www.interpares.org

identifying records is an iterative process, which must be performed regularly. This also results in a requirement for the information system managing the records. When new types of records arise, it must be possible to manage them in an information system without too much adjustment to the system. The fact that many organizations developed their own kind of recordkeeping practice distanced from archival standards might make it more difficult to fulfill the needs presented in this section.

6.1.2. Conceptualization of records use and records user

The conceptualization of records use and records user is mainly drawn from articles II, IV, and V. In article III, the need for further conceptualization of use and user was identified.

In the design of information systems, use and user are core elements in capturing system requirements. The uncertainty about the use and user of records makes it very complicated to capture requirements and to identify the needs of future users. In modern information systems development methods, it is the current or present user and their use that is of interest. How something may be used in the future is of less interest. In recordkeeping the proactive approach is proposed and it is essential that the requirements be captured no later than the point at which the information system is developed and designed. Therefore the unknown use and unknown user of records is a huge challenge, and a real problem. In this research several examples of use have been found that were not identified when the record was born. By using a temporal lens in this research (Article IV & V) an even more complex picture of the user was discovered. For example in a linear temporal structure (article IV) the user was conceptualized as both user and social actor. The social actor's need can differ from a traditional user's need. In the linear temporal structure the use was also shifting, from known towards unknown. Users of records also shift and vary, dependent upon temporal rhythms. The conceptualization of use and user of records in this research shows a rather complex picture of the variation use of records can have, which is a great challenge, for example in the process of collecting and identifying requirements.

The conceptualization of use and user of records also produced new knowledge: that records are used more actively in organizations than they appear to be in the literature. The uses characterized as secondary use of records, (see article IV), have been more easily performed through the use of information technology. The conceptualization of records use and records user gave new knowledge of benefits that organizations and individuals can gain by using records. Information systems make electronic records easier to access, and the evidential value and the true source of knowledge records represent can increase in information systems.

In traditional information systems development the users are the source of system requirements. With records it is important to realize that the users are

mainly using a system as a tool to access records, but they might also use the system to capture and manage records. Therefore the capturing of requirements must also cover these aspects.

In designing information systems involved in recordkeeping it is recommended that the designer must realize that the use of records and users of records be treated with caution. Negligence in use and user identification can result in recordkeeping that does not fulfill stated and implied requirements, i.e. recordkeeping quality will be low.

6.1.3. Recordkeeping Quality Assessment Model (RQAM)

The Recordkeeping Quality Assessment Model (RQAM) proposal is presented in article III, but is constituted from knowledge gained from articles I and II. High quality can implicitly be seen as a goal from the adopted definition of recordkeeping[1] used in this thesis. Preservation of records should be of high archival quality, i.e. the general requirements found in standards should be fulfilled. The RQAM proposal shows that quality must be seen holistically, and that there are many factors influencing the overall quality. The recordkeeping quality assessment model also relates the user to record quality. The model can be used as a reference model to understand the complexity of recordkeeping quality.

The model implicitly proposes that when designing information systems involved in recordkeeping, one can not focus solely on the quality of the system, one must also take into consideration other quality dimensions, which are presented in the model. The model is also a first step towards the possibility of assessing recordkeeping quality.

6.1.4. Different views on records

In this thesis two types of organizations have been involved: private organizations and public organizations. In general these two organization types treat and manage their electronic records and electronic documents with caution if and when the organization's business is dependent upon the records or documents. But there are some obvious differences between the two types of organizations. is Knowledge of this difference was gained mainly from articles I, VI, and VII but also from papers IV, and V.

In articles VI and VII the importance of management of business knowledge was presented. Management of organizational knowledge was seen as important for increasing the revenue of the business. Articles VI and VII also showed that the un-documented criteria for the appraisal of documents were based upon the business value of different document types. In the organizations presented in articles IV and V, the appraisal of records was primarily based upon legislative and accountability values. If appraisal is based upon business values only, there

[1] see section 3.2.1

is a risk that both legislative values and accountability values are neglected. Neither is the appraisal performed in public organizations ideal. The appraisal of records is important when designing information systems involved in recordkeeping, because appraisal identifies those records that are important for the organization and will be preserved for the long term. In a proactive approach appraisal becomes more important than ever. In an electronic environment, records become more accessible, and in this research use of records has been addressed as important, for example in the capture of requirements. Implicitly, the possibility of widened records use can result in new, but not yet known values of records. If the combination of appraisal techniques from both private and public organizations is used, the business values, legislative values, and accountability values can give broader knowledge about the use of records, and implicitly the identification of requirements that corresponds with the organization's true needs.

Appraisal is a task that needs to be done early in an information systems development process. Appraisal is the method that defines what records are necessary for the organization and why. The identification of the appropriate length of preservation is a task that is embedded in appraisal. Appraisal can be seen as risk management for the way records should be managed to support business values, legislative values and accountability values in an organization.

6.1.5. Proactive electronic recordkeeping

The main results presented above are drawn from the seven articles that constitute this thesis. They all strengthen the argument for a proactive approach which was the theoretical starting point for this thesis. Articles I-VII show that proactivity is necessary when designing information systems in which records are born and managed.

This research had the proactive approach as one important theoretical starting point. This research and the main results presented above contribute by widening the view of the proactive concept, to include more than ensuring that records requirements are fulfilled at the time of records creation.

To achieve high quality electronic recordkeeping, the proactivity must be holistic. Based principally upon the findings presented in article III, the proactive approach should be applied on several levels in the recordkeeping environment: the electronic record, the information system in which the electronic record is born and managed, the organization, and the user.

The identification and definition of organizational records and their organization-specific characteristics must be done proactively. First the proactive concept has implications for electronic record characteristics. The organization should also proactively develop strategies that enable detection of new types of records that are created. The proactive approach also implies that

the requirements of records users are captured in advance. Electronic records must meet current and future user requirements at birth if the quality of the records is to be maintained during long-term preservation. The records' user requirements should not be confused with user requirements for an information system, even if the requirements are sometimes interwoven. From the point of view of the records continuum model, it has been proposed that appraisal of electronic records must be done proactively. The importance of this has been strengthened by this research.

Information technology has given new forms of records and made possible new types of records that not were possible in an analogue environment. For example electronic records can be born in information systems in fully automated processes, and some electronic records can never be transformed into a single file entity as for example a picture, or a PDF document. Without a proactive approach there is a risk that many records will be lost in the long term, because it is not possible to preserve them outside the information systems. Organizations may change their processes which result in new records. Old information systems can acquire new functionality that gives birth to new kinds of records. All this together implies that proactivity is something that is not only necessary when designing information systems where records are born and managed. Proactivity is a continuous approach from design, management and disposal of information systems where records are born and managed. Proactivity is an approach that must be the basis for the way organizations develop their recordkeeping strategy.

7. CLOSING REMARKS

The objective of this thesis was to contribute to knowledge of design recommendations for information systems, in which records are born and managed. In such design processes it is important to realize that all of the characteristics of records cannot only be found in standards and in literature. The characteristics are something that must be identified in the organizational setting, where the records are created and are intended to be used. Even though various standards define records and state their characteristics, it is within the organizations that the records must be defined and their characteristics identified. It is also important that use of records and the user of records cannot be seen as fully comparable to the conceptualization of use and user in the way they are described in information systems design literature. In this research use and user of records have been conceptualized, but there is still work to be done. The information systems design methods currently available are not optimized for the design of information systems with unknown users. It is probably risky to develop information systems involved in recordkeeping without at least trying to

minimize the uncertainty about future users. In integrated e-services, for example, this might be a problem. It is possible that some e-services produce records that will not be usable in the future.

The idea of high quality is embedded in recordkeeping. If recordkeeping implicitly aims towards high quality, the information system alone cannot guarantee that. There is an interwoven complexity between records, information system, organization, and use/user, which must be taken into consideration when information systems involved in recordkeeping are being designed.

Records exist in both public and private organizations. When designing information systems for recordkeeping purposes appraisal is essential for identifying what records should be preserved and what records are of high value to the organization. Appraisal of records is proposed to have its base upon a mix of business values, accountability values, and legislative values. Studies about the way risk assessment could be used in appraisal might strengthen understanding of the value of different records.

The key to success is proactivity. Without a proactive approach there is a risk that information systems in which records are born and managed may be designed without enabling sound recordkeeping of high quality.

This research should be followed by complementary studies with the aim of further conceptualizing use of records and users of records. Further, it is important to develop methods for the design of information systems in which the users are partially unknown. That is, the challenge is in the area of capturing user needs from users who are not yet known. The last area where further research is needed is to continue development of the RQAM, which should include a real life test of the model.

The main contribution of this thesis is in the design of information systems in which records are born and managed. Information systems that manage electronic records are information systems that must fulfill requirements, which, up to this point, have not been known in the information system research community. Another area whereby this thesis contributes to information system research is the notion of the unknown user. Information systems in which not all of the users are known in advance have been presented in this thesis as something that is more common than the literature leads us to believe, and that the uncertainty about the user implies the need for new design methods.

As a researcher I have previously presented my role as a broker, a person building a knowledge-bridge between two scientific fields. In this thesis the two fields are information systems and archival science. I have presented an information systems perspective to a problem which has its roots in archival science. It is therefore also possible to interpret this research as a contribution to

the goal of building a knowledge-bridge between different scientific fields that share an interest in increasing their knowledge about electronic recordkeeping.

A PhD thesis is not the final goal in a research career, it is just a pit stop where you refuel, take a breath, and get new coordinates for your future research efforts (Stenmark, 2002). This thesis has introduced new problem areas that are waiting to be further investigated and understood, which will be my goal, when I leave this pit stop.

8. REFERENCES PART I

Asproth, V. (2005). Information technology challenges for long-term preservation of electronic information. *International Journal of Public Information Systems, 2005:1*, 27-37.

Asproth, V. (2007). Integrated information systems - a challenge for long-term digital preservation. *Interdisciplinary Journal of Information, Knowledge, and Management, 2*, 89-98.

Atkinson, E. (2002). Much ado about metadata. *Records Management Journal, 12*(1), 19-23.

Bailey, J. E., & Pearson, S. W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. *Management Science, 29*(5), 530-545.

Bansler, J. (1989). Systems development research in Scandinavia: Three theoretical schools. *Scandinavian Journal of Information Systems, 1*(1), 3-20.

Bearman, D. (1993). Record-keeping systems. *Archivaria* (36), 16-36.

Bearman, D. (1994). Electronic evidence : Strategies for managing records in contemporary organizations. Pittsburgh: Archives and Museum Informatics.

Bell, J. (2000). *Introduktion till forskningsmetodik* (3., rev. uppl. ed.). Lund: Studentlitteratur.

Bjerknes, G., & Bratteteig, T. (1995). User participation and democracy: A discussion of scandinavian research. *Scandinavian Journal of Information Systems, 7*(1), 73-98.

Blair, D. C. (2002). Knowledge management: Hype, hope, or help? *Journal of the American Society for Information Science and Technology, 53*(12), 1019-1028.

Borglund, E. (2005a). *A first step towards general quality requirements for e-records.* Paper presented at the Fourteenth International Conference on Information Systems Development - ISD´2005 Karlstad, pp. 745-756.

Borglund, E. (2005b). Electronic record quality, necessary inter alia for trustworthy e-government services. In K. S. Soliman (Ed.), *Information management in modern enterprise: Issues & solutions. Proceedings of the 2005 international business information management conference July 5 - 7, 2005 Lisbon, Portugal* (pp. 334-341): IBIMA.

Borglund, E. (2006a). A predictive model for attaining quality in recordkeeping. Sundsvall: Mittuniversitetet.

Borglund, E. (2006b). *Fulfilling electronic record requirements: Good practice from two Swedish organizations.* Paper presented at the Archiving 2006, May 23-26, Ottawa, Canada

Button, G., & Harper, R. (1996). The relevance of 'work-practice' for design. *Computer Supported Cooperative Work (CSCW), 4*(4), 263-280.

Cain, P. (2002). Model requirements for the management of electronic records (moreq): A critical evaluation. *Records Management Journal, 12*(1), 14-18.

Chen, S.-S. (2001). The paradox of digital preservation. *IEEE Computer, 34*(3), 24-29.

Cook, T. (1997). What is past is prologue: A history of archival ideas since 1898, and the future paradigm shift. *Archivaria, 43*, 17-63.

Cox, R. J. (2001). *Managing records as evidence and information*. Westport, Conn.; London: Quorum Books.

Cunningham, A. (2001). Six degrees of separation: Australian metadata initiatives and their relationships with international standards *Archival Science, 1*(3), 271-283.

Dahlbom, B. (1996). The new informatics. *Scandinavian Journal of Information Systems, 8*(2), 29-48.

Dahlbom, B., & Mathiassen, L. (1993). *Computers in context: The philosophy and practice of systems design*. Cambridge, Mass.: Blackwell.

Danielsson, U. (2007). Relationships between information communication technology and psychosocial life environment: Students and young urban knowledge workers in the ict-era. Sundsvall: Mittuniversitetet.

Delmas, B. (2001). Archival science facing the information society. *Archival Science, 1*, 25-37.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research, 3*(1), 60-95.

DeLone, W. H., & McLean, E. R. (2003). The Delone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems, 19*(4), 9-30.

Department of Defense. (2007). *Electronic records management software applications design criteria standard: Dod 5015.02-std*. Retrieved 12 November 2007. from http://www.dtic.mil/whs/directives/corres/pdf/501502std.pdf.

Doll, W. J., & Torkzadeh, G. (1988). The measurement of end-user computing satisfaction. *MIS Quarterly, 12*(2), 259-274.

Dollar, C. M. (1992). Archival theory and information technologies: The impact of information technologies in archival principles and methods. Macerata: Univ. of Macerata.

Dollar, C. M. (2000). *Authentic electronic records: Strategies for long-term access*. Chicago, Ill.: Cohasset Associates Inc.

Duff, W. M. (2001). Evaluating metadata on a metalevel. *Archival Science, 1*(3), 285-294.

Duranti, L. (2000). *The impact of technological change on archival theory*. Paper presented at the International Council on Archives Conference, September 16, 2000, Seville, Spain.

Duranti, L. (2001a). Concepts, principles, and methods for the management of electronic records. *The Information Society, 17*, 271-279.

Duranti, L. (2001b). The impact of digital technology on archival science. *Archival Science, 1*(1), 39-55.

Duranti, L., & Tibodeau, K. (2006). The concept of record in interactive, experiential and dynamic environments: The view of interpares. *Archival Science, 6*(1), 13-68.

Ekman, G. (1999). *Från text till batong: Om poliser, busar och svennar*. Stockholm: Ekonomiska forskningsinstitutet vid Handelshögsk. (EFI).

European Commission. (2002). *Model requirements for the management of electronic records*. Luxembourg: Office for Official Publications of the European Communities.

European Commission. (2008). *Moreq2: Model requirements for the management of electronic records*. Luxembourg: Office for Official Publications of the European Communities.

Gilliand-Swetland, A. J., & Eppard, P. B. (2000). Preserving the authenticity of contingent digital objects [Electronic Version]. *D-Lib Magazine*, *6(7/8)*. Retrieved June 11 2004 from http://www.dlib.org.

Gilliland, A., & McKemmish, S. (2004). Building an infrastructure for archival research. *Archival Science, 4*(3-4), 149–197.

Gilliland-Swetland, A. J. (2000). Enduring paradigm, new opportunities: The value of the archival perspective in the digital environment. Washington, D.C.: Council on Library and Information Resources.

Gladney, H. M. (2004). Trustworthy 100-year digital objects: Evidence after every witness is dead. *ACM Transactions on Information Systems, 22*(3), 406-436.

Gracy, K. F. (2004). Documenting communities of practice: Making the case for archival ethnography. *Archival Science, 4*(3-4), 335-365.

Granger, S. (2000). Emulation as a digital preservation strategy [Electronic Version]. *D-Lib Magazine*, *6(10)*. Retrieved 28 November 2007 from http://www.dlib.org/dlib/october00/granger/10granger.html.

Gregory, K. (2006). Implementing an electronic records management system: A public sector case study. *Records Management Journal, 15*(2), 80-85.

Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Newbury Park, Calif: Sage.

Hartland, R., McKemmish, S., & Upward, F. (2005). Documents. In S. McKemmish, M. Piggott, B. Reed & F. Upward (Eds.), *Archives: Recordkeeping in society* (pp. 348p). Wagga Wagga: Charles Sturt University, Centre for Information Studies.

Healy, S. (2001). Iso 15489 records management – its development and significance. *Records Management Journal, 11*(3), 133-142.

Hofman, H. (1998). Lost in cyberspace : Where is the record? In K. Abukhanfusa (Ed.), The concept of record: Report from the second Stockholm conference on archival science and the concept of record, 30-31 may 1996 (pp. 115-129). Stockholm: Swedish National Archives.

Holgersson, S. (2001). It-system och filtrering av verksamhetskunskap : Kvalitetsproblem vid analyser och beslutsfattande som bygger på uppgifter hämtade från polisens it-system. Linköping: Univ., Institutionen för datavetenskap.

Holgersson, S. (2005). *Yrke: Polis : Yrkeskunskap, motivation, it-system och andra förutsättningar för polisarbete*. Linköping: Institutionen för datavetenskap Linköpings universitet.

Iivari, J., & Lyytinen, K. (1998). Research on information systems development in Scandinavia-unity in plurality. *Scandinavian Journal of Information Systems, 10*(1&2), 135-186.

International Council on Archives. (2000). ISAD(G) : General international standard archival description : Adopted by the committee on descriptive standards, Stockholm, Sweden, 19-22 September 1999 (2. ed.). Madrid: Subdirección General de Archivos Estatales.

International Standards Organization. (2001). *ISO 15489-1. Information and documentation and records management part 1: General.* Geneva: International Standards Organization.

Ives, B., Olson, M. H., & Baroudi, J. J. (1983). The measurment of user information satisfaction. *Communications of the ACM, 26*(10), 785-793.

Kanuha, V. K. (2000). "Being" Native versus "Going native": Conducting social work research as an inside. *Social Work, 45*(5), 439-447.

Karjalainen, A., Päivärinta, T., Tyräinen, P., & Rajala, J. (2000). *Genre-based metadata for enterprise document management.* Paper presented at the HICSS '00 the 38th Annual Hawaii International Conference on System Science, 4-7 Jan, Hawaii.

Klein, H. K., & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretative field studies in information systems. *MIS Quarterly, 23*(1), 67-94.

Kling, R. (1999). What is social informatics and why does it matter. *D-Lib Magazine, 5*(1), [Available at http://www.dlib.org]

Kling, R. (2000a). Learning about information technologies and social change. *The Information Society, 16*(3), 217-232.

Kling, R. (2000b). Social informatics: A new perspective on social research about information and communication technologies. *Prometheus, 18*(3), 245-264.

Kling, R., & Hert, C. (1998). Social informatics in information science: An introduction *Journal of The American Society for Information Science, 49*(12), 1047-1052.

Lamb, R. (2006). *Alternative paths towards a social actor concept*. Paper presented at the Twelfth Americas Conference on Information Systems, Acapulco, Mexico, August 4-6.

Lamb, R., & Kling, R. (2003). Reconceptualizing users as social actors in information systems research. *MIS Quarterly, 27*(2), 197-235.

Langefors, B. (1978). *Theoretical analysis of information systems* (4. ed.). Lund: Studentlitt.

Langefors, B. (1995). Essays on infology: Summing up and planning for the future. In (Dahlbom, Bo ed., pp. 180 ;). Lund: Studentlitteratur.

Livelton, T. (1996). *Archival theory, records, and the public*. Lanham, Md. ; London: The Society of American Archivists and Scarecrow Press Inc.

Lorie, R. A. (2001). *Long term preservation of digital information*. Paper presented at the JCDL '01: Proceedings of the 1st ACM/IEEE-CS joint conference on Digital libraries.

Maguire, R. (2005). Lessons learned from implementing an electronic records management system. *Records Management Journal, 15*(3), 150-157.

McInnes, S. (1998). Electronic records: The new archival frontier. *Journal of the Society of Archivists, 19*(2), 211-220.

McKemmish, S. (2001). Placing records continuum theory and practice. *Archival Science, 1*(4), 333-359.

McLeod, J. (2003). Assessing the impact of ISO 15489 – a preliminary investigation *Records Management Journal, 13*(2), 70 - 82

McLeod, J., Childs, S., & Heaford, S. (2007). Records management capacity and compliance toolkits: A critical assessment. *Records Management Journal, 17*(3), 216-232.

Meijer, A. (2001a). Accountability in an information age: Opportunities and risks for records management. *Archival Science, 1*(4), 361-372.

Meijer, A. (2001b). Electronic records management and public accountability: Beyond an instrumental approach. *The Information Society, 17*(4), 259-270.

Monti, D. J. (1993). On the risks and rewards of "going native". *Qualitative Sociology, 15*(3), 325-332.

Munkvold, B. E., Päivärinta, T., Hodne, A. K., & Stangeland, E. (2006). Contemporary issues of enterprise content management: The case of Statoil. *Scandinavian Journal of Information Systems, 18*(2), 69-100.

Myers, M. (1997). Interpretative research in information systems. In F. A. Stowell & J. Mingers (Eds.), *Information systems: An emerging discipline?* (pp. 239-266). London: McGraw-Hill.

Myers, M. D., & Avison, D. E. (2002). *Qualitative research in information systems: A reader*. London: Sage.

National Archives of Australia. (2001a). *Part 1-the DIRKS methodology: A users guide*. Retrieved 12 November 2007. from http://www.naa.gov.au/Images/dirks_part1_tcm2-935.pdf.

National Archives of Australia. (2001b). *Step f – design of a recordkeeping system* Retrieved 12 November 2007. from http://www.naa.gov.au/Images/dirks_stepF_tcm2-963.pdf.

National Archives of Australia. (2004). *Digital recordkeeping: Guidelines for creating, managing and preserving digital records,*. Retrieved 8 Jan 2008. from http://www.naa.gov.au/Images/Digital-recordkeeping-guidelines_tcm2-920.pdf.

National Archives of Australia. (2006a). *Functional specifications for electronic records management systems software*. Retrieved Jan 2, 2008. from http://www.naa.gov.au/Images/ERMSspecifications_tcm2-1007.pdf.

National Archives of Australia. (2006b). *Guidelines for implementing the functional specifications for electronic records management systems software*. Retrieved Jan 2, 2008. from http://www.naa.gov.au/Images/ERMSguidelines_tcm2-1018.pdf.

Nielsen, J. F., & Relsted, N. J. (1994). A new agenda for user participation: Reconsidering the old Scandinavian prescription *Scandinavian Journal of Information Systems, 6*(2), 3-20.

Nilsson, J. (2006). Preserving physical structure of digital objects through metadata. Luleå: Luleå University of Technology.

Nilsson, N. (1983). Arkiv i förvandling: Studier i arkivens teori och tillgänglighet. Solna: Nordiska bokh. (distr.).

Nordheim, S., & Päivärinta, T. (2004). *Customization of enterprise content management systems: An exploratory case study*. Paper presented at the 37th Hawaii International Conference on System Sciences, Jan 5-8, Hawaii.

Nordheim, S., & Päivärinta, T. (2006). Implementing enterprise content management: From evolution through strategy to contractions out-of-the-box. *European Journal of Information Systems, 15*(6), 648-662.

Oliver, G. (2007). Implementing international standards: First, know your organization. *Records Management Journal, 17*(2), 82-93.

Pressman, R. S., & Ince, D. (2000). *Software engineering: A practitioner's approach* (5. ed.). London: McGraw-Hill.

Pugh, M. J. (1992). *Providing reference services for archives & manuscripts*. Chicago: Society of American Archivists.

Päivärinta, T. (2001). A genre-based approach to developing electronic document management in the organizations. University of Jyväskylä, Jyväskylä.

Päivärinta, T., & Munkvold, B. E. (2005). *Enterprise content management: An integrated perspective on information management.* Paper presented at the 38th Hawaii International Conference on System Sciences, Jan 3-6, Hawaii.

Quisbert, H. (2006). A framework for the development of archival information systems. Luleå: Luleå University of Technology.

Reed, B. (2005). Records. In S. McKemmish, M. Piggott, B. Reed & F. Upward (Eds.), *Archives: Recordkeeping in society* (pp. 101-130). Wagga Wagga: Charles Sturt University, Centre for Information Studies.

Repstad, P. l., & Nilsson, B. r. (1999). *Närhet och distans: Kvalitativa metoder i samhällsvetenskap* (3., [rev.] uppl. ed.). Lund: Studentlitteratur.

Richardson, V. (1994). Conducting research on practice. *Educational Researcher, 23*(5), 5-10.

Riksarkivet. (2007). *Noark-5 norsk arkivsystem*. Retrieved 13 November 2007. from http://www.riksarkivet.no/arkivverket/lover/elarkiv/noark-5.html.

Roberts, D. (1994). Defining electronic records, documents and data. *Archives and Manuscripts, 22*(1), 14-26.

Runardotter, M. (2007). Information technology, archives and archivists: An interacting trinity for long-term digital preservation. Luleå: Luleå University of Technology.

Saarinen, T., & Sääksjärvi, M. (1990). The missing concepts of user participation - an empirical assessment of user participation and information system success. *Scandinavian Journal of Information Systems, 2*, 25-42.

Salminen, A., Kauppinen, K., & Lehtovaara, M. (1997). Towards a methodology for document analysis. *Journal of American Society for Information Science, 48*(7), 644-655.

Schellenberg, T. R. (1956/1998). *Modern archives: Principles and techniques* (Repr. ed.). Chicago: SAA. (Original work published 1956).

Schenkolewski-Kroll, S., & Tractinsky, A. (2006). Archival description, information retrieval, and the construction of thesauri in israeli archives *Archival Science, 6*(1), 69-107.

Schön, D. A. (1983). The reflective practitioner : How professionals think in action. New York: Basic Books.

Shepherd, E., & Yeo, G. (2003). *Managing records a handbook of principles and practice*. London: Facet Publishing.

Simon, H. A. (1981). *The sciences of the artificial* (2. ed.). Cambridge, Mass.: MIT P.

Smyth, Z. A. (2005). Implementing EDRM: Has it provided the benefits expected? *Records Management Journal, 15*(3), 141-149.

Song, S., & JaJa, J. (2007). *New techniques for ensuring the long term integrity of digital archives*. Paper presented at the dg.o '07: Proceedings of the 8th annual international conference on Digital government research: bridging disciplines & domains.

Sprague, R. H. (1995). Electronic document management: Challenges and opportunities for information systems managers. *MIS Quarterly, 19*(1), 29-49.

Sprehe, T. J. (2000). Integrating records management into information resources management in U.S. Government agencies. *Government Information Quarterly, 17*(1), 13-26.

Stenmark, D. (2002). *Designing the new intranet*. Göteborg: Göteborgs universitet.

Strauss, A. L., & Corbin, J. M. (1998). Basics of qualitative research : Techniques and procedures for developing grounded theory (2. ed.). Thousand Oaks, Calif.: SAGE.

Sundgren, B., & Steneskog, G. (2003). Information systems for concerted action. In B. Sundgren, P. Mårtensson, M. Mähring & K. Nilsson (Eds.), *Exploring patterns in information management: Concepts and perspectives for understanding it-related change* (pp. 11-38). Stockholm: Economic Research Institute, Stockholm School of Economics

Sundqvist, A. (2007). The use of records – a literature review. *Archives & Social Studies: A Journal of Interdisciplinary Research 1*(1), 623-653.

Svensson, P.-G., & Starrin, B. (Eds.). (1994). *Kvalitativ metod och vetenskapsteori*. Lund: Studentlitteratur.

Thomassen, T. (2001). A first introduction to archival science. *Archival Science, 1*(4), 373-385.

Tiitinen, P. (2003). *User roles in document analysis.* Paper presented at the CAiSE'03, Klagenfurt/Velden, Austria, 16-20 June.

Tiitinen, P., Lyytikäinen, V., Päivärinta, T., & Salminen, A. (2000). *User needs for electronic document management in public administration: A study of two cases*. Paper presented at the ECIS 2000, Vienna, Austria.

Upward, F. (2000). Modeling the continuum as paradigm shift in recordkeeping and archiving processes, and beyond - a personal reflection. *Records Management Journal, 10*(3), 115-139.

Upward, F. (2004). The records continuum and the concept of an end product. *Archives and Manuscripts, 32*(1), 40-62.

Upward, F. (2005a). Continuum mechanics and memory banks: (1) multi-polarity. *Archives and Manuscripts, 33*(1), 84-109.

Upward, F. (2005b). The records continuum. In S. McKemmish, M. Piggott, R. Barbara & F. Upward (Eds.), *Archives: Recordkeeping in society* (pp. 197-222). Wagga Wagga: Charles Sturt University, Centre for Information Studies

Upward, F., & Stillman, L. (2006, 9-11 October). *Community informatics and the information processing continuum.* Paper presented at the Constructing and Sharing Memory: Community informatics, Identity and Empoverment, Prato 9-11 October.

Wallén, G. (1996). *Vetenskapsteori och forskningsmetodik* (2. uppl. ed.). Lund: Studentlitteratur.

Valtonen, M. R. (2007). Documentation in pre-trial investigation: A study of using the records continuum model as a record management tool. *Records Management Journal, 17*(3), 179-185.

Vehovar, V. (2006). Social informatics: An emerging discipline? In J. Berleur, M. I. Nurminen & J. Impagliazzo (Eds.), Social informatics: An information society for all?: In remembrance of Rob Kling: Proceedings of the seventh international conference on human choice and computers (hcc7), ifip tc 9, maribor, slovenia, september 21-23, 2006 (pp. 73-85). New York: Springer.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press.

Williams, D. J. (2005). EDRM implementation at the national weights and measures laboratory *Records Management Journal, 15*(3), 158-166.

Yakel, E. (2003). Archival representation *Archival Science, 3*(1), 1-25.

Yin, R. K. (2003). *Case study research: Design and methods* (3. ed.). Thousand Oaks, Calif.: Sage Publications.

Öberg, L.-M. (2007). Traceable information systems: Factors that improve traceability between information and processes over time. Sundsvall: Mittuniversitetet.

Web pages

http://www.interpares.org/ Retrieved 16 April, 2008

http://ldb.project.ltu.se/~Projekt_LDB Retrieved 16 April, 2008

http://www.antwerpen.be/davidproject/index.html Retrieved 16 April, 2008

http://www.si.umich.edu/CAMILEON/ Retrieved 16 April, 2008

http://europa.eu.int/comm/secretariat_general/edoc_management/dlm_forum/ Retrieved 16 April, 20, 2008