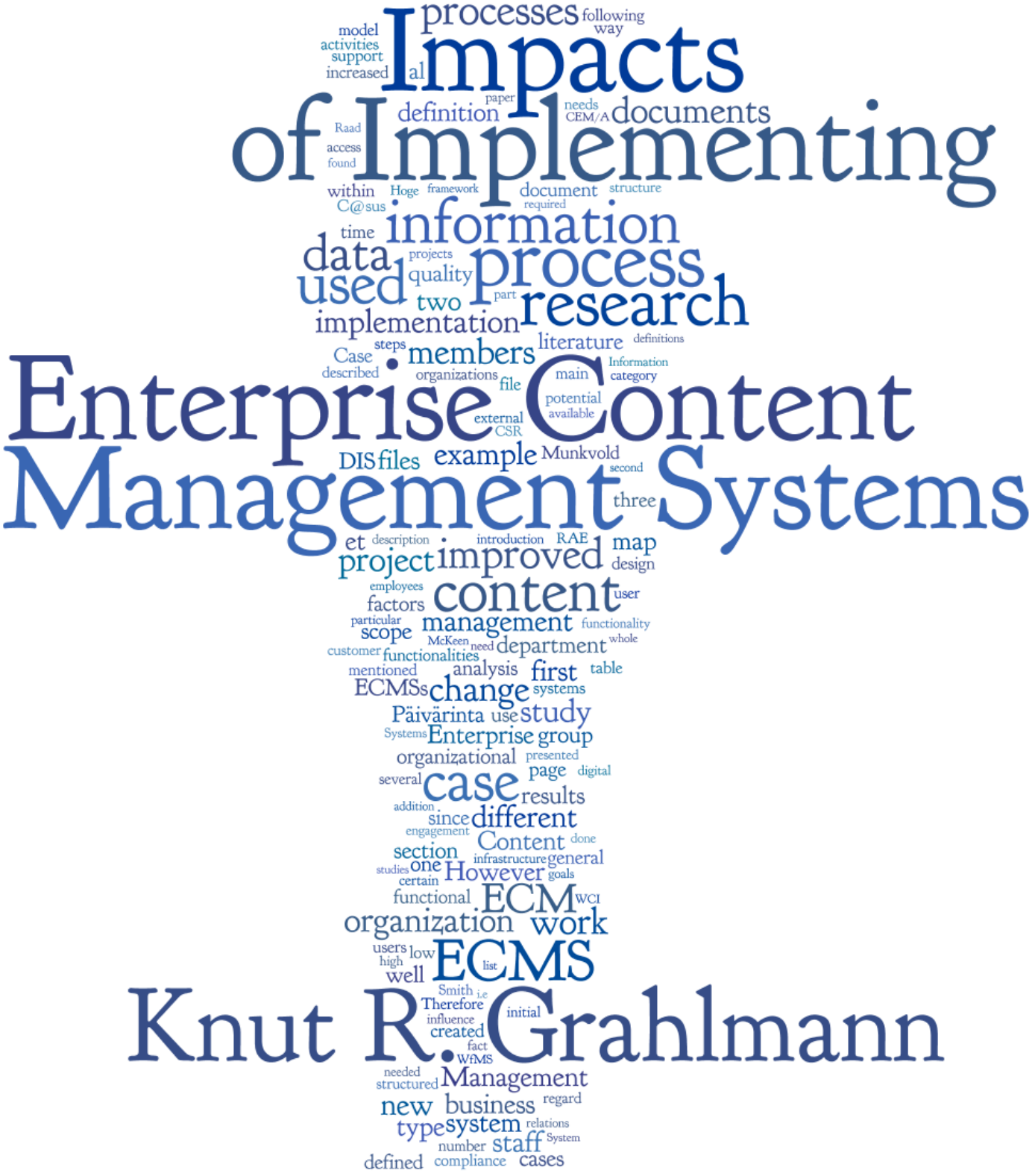
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Universiteit Utrecht

Impacts of Implementing Enterprise Content Management Systems

Thesis submitted for the degree of Master of Science

author:
Knut R. Grahlmann (3102114)

thesis committee:
dr. ir. Remko Helms
prof. dr. Sjaak Brinkkemper

supervisors from
PricewaterhouseCoopers Advisory N.V.:
dr. Cokky Hilhorst
drs. Sander van Amerongen

thesis registration number:
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master program Business Informatics
Department of Information and Computing Sciences
Faculty of Science
Utrecht University

Abstract

During the last decades, the amount of content — in short, digital data and information — produced in organizations has grown substantially. Next to the growth of the amount of transaction data for example caused by e-commerce, the amount of textual or multimedia information captured in documents, e-mails, or organizational websites has increased. This information often represents the explicit knowledge of organizations and its holistic management can provide strategic advantages. Yet, these digital objects are often scattered over different systems throughout the organization so that they are hard to be located and retrieved. Lacking an integrated approach to manage content also conflicts with both new legal conditions which require that organizations keep records of their communications and societal trends such as higher demands from customers or telework which requires that project files can be accessed from a distance. As a response, Enterprise Content Management (ECM) as an approach to the organization-wide management of content has been becoming popular. However, research on this topic is scarce.

In this thesis, the impacts of implementing Enterprise Content Management Systems (ECMSs) and influencing factors are explored from both an explanatory and an exploratory perspective. In addition, improved definitions of the basic terms content and ECM are provided and a Reference Architecture for ECM (RAE) is designed which gives an overview of the potential functionalities provided by ECMSs. After an extensive literature study, an ECMS impact model has been validated in a case study research conducted at three organizations.
The results from the explanatory part of the case study demonstrate that the impacts of implementing ECMSs can mainly be found in the five categories employees, operational processes, managerial processes, horizontal coordination, and vertical control. The functional scope of the particular ECMS (i.e. the range of offered functionalities) and the type of the ECMS-supported processes have been determined as influencing factors. Other than expected from the initial literature study, it has also been shown that these two factors can influence each other. The exploratory part of the case study has resulted in a recapitulatory overview of the potential impacts of implementing ECMSs. In addition, other potential influencing factors have been identified, as for example the implementation approach.

The results of this research have a number of practical implications. By also including structured data, the new definition of content presents a new direction for the development of future ECMSs. Practitioners can also profit from the case study results because they highlight important topics for ECMS implementation projects and illustrate the opportunities of implementing ECMSs, such as streamlining processes with regard to governance and compliance. On the other hand, the results help organizations to realize that ECMSs can also have negative impacts. Further research should focus on the validation of the results for different factor constellations. In addition, a comprehensive research agenda taking into account the exploratory results is presented.

Preface

17,5 in 12, oder: Ein Rückblick

Wasser, wohin das Auge reicht.
Runde für Runde, immer nur Wasser. Und Noten.
„Was ist Wahrheit?“
Dann, eine Insel! Auf! Dahin!

Endlich Kraft zum Schwimmen,
aber doch nur eine Holzplanke.
Neuer Kurs!
Wieder schwimmen.

Watt, immerhin.
Weiter, mal stockend, mal stürmisch.
„Schon seh’ ich das Land!“
Endlich! Gratias, euch allen.

My thanks go out to the many people who helped me along my way towards finishing this thesis. First of all, I would like to thank all the respondents from the three cases. Them taking the time to being interviewed and to review the case study reports next to busy schedules made this research possible and is highly appreciated. Secondly, I would like to draw the attention to all the great people from the ITE group at PricewaterhouseCoopers Advisory of whom some are to be particularly mentioned. Cokky Hilhorst and Sander van Amerongen were my daily supervisors and they invested a lot of time into this project. I am deeply indebted to them for showing me the way, sparring about ideas, being patient with me, and for giving constructive feedback when I needed it. By being truly knowledgeable experts on the field of ECM, Fred van Roijen and Melior Hoekstra provided a lot of valuable insights. Neal Muusze was a fine co-interviewer for the second case and Paul Gabriels made it possible to conduct the case study at the Hoge Raad. Last but not least, Adri de Bruijn provided the means to do the internship in the first place. The other colleagues are too many to mention all of them, but I have truly appreciated the excellent atmosphere at the office and the elaborated discussions about polar bears, walls, and sand castles; I have already started missing them.
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Contents

List of Figures I

List of Tables III

List of Acronyms V

1 Introduction 1
1.1 Sub-questions . . . 3
1.2 Social and scientific relevance . . . 4
1.3 Document structure . . . 4

2 Research approach 5
2.1 Research methods . . . 5
2.1.1 Case study research . . . 5
2.1.1.1 Types of validity . . . 6
2.1.1.2 Attributes of rigorous positivist case study research . . . 6
2.1.2 Design research . . . 8
2.2 Research Plan . . . 10

3 Conceptual foundation 13
3.1 Defining content . . . 13
3.1.1 Definition by examples . . . 13
3.1.2 First definition: structuredness of data . . . 15
3.1.3 Second definition: structuredness of information . . . 16
3.1.4 Third definition: information and metadata . . . 16
3.1.5 Literal perception . . . 16
3.1.6 Proposed definition . . . 17
3.2 Defining Enterprise Content Management . . . 17
3.2.1 Enterprise information systems . . . 18
3.2.2 Content Management . . . 18
3.2.3 Evolution of the term Enterprise Content Management . . . 19
3.2.4 ECM as a field of IS research . . . 22
3.2.5 Proposed new definition . . . 22

4 Designing the Reference Architecture for ECM 25
4.1 Scientific need . . . 25
4.2 Design research process . . . 25
4.2.1 Design requirements . . . 26
4.2.2 Design approach . . . 26
4.3 Components and functionalities from scientific literature . . . 26
4.3.1 Electronic Document Management Systems . . . 27
4.3.2 Electronic Record Management Systems . . . 28
4.3.3 Workflow Management Systems . . . 29

4.3.4 Website Content Management . . . 30
4.4 Components and functionalities from practitioners literature . . . 31
4.5 The Reference Architecture for ECM . . . 32
4.6 Additional observations . . . 34
4.6.1 ECMSs as middleware . . . 34
4.6.2 Management of structured data . . . 34
4.6.3 ECMSs as multi-product software . . . 34

5 Defining the ECMS impact model 37
5.1 Designing the impact framework . . . 37
5.1.1 Potential impacts of implementing ECMSs . . . 37
5.1.2 Design research process . . . 38
5.1.2.1 Frameworks from previous IS research . . . 39
5.1.2.2 Enhanced impact framework . . . 41
5.2 Determining potential influencing factors . . . 43
5.2.1 Previous IS research . . . 43
5.2.2 Factor operationalizations . . . 44
5.2.2.1 Functional scope . . . 44
5.2.2.2 Process type . . . 44
5.3 Initial version of the ECMS impact model . . . 45

6 Case studies 47
6.1 Design and preparation . . . 47
6.1.1 Research design . . . 47
6.1.1.1 Unit of Analysis and set-up . . . 47
6.1.1.2 Guidelines for data analysis . . . 48
6.1.2 Case study protocol . . . 49
6.1.3 Case selection . . . 50
6.2 First case: Organization A . . . 51
6.2.1 Background and project goals . . . 51
6.2.2 Process type . . . 52
6.2.3 Implementation . . . 53
6.2.4 Description of the ECMS . . . 53
6.2.5 Impacts . . . 56
6.2.6 Preliminary analysis and implications for remaining research process . . . 58
6.3 Second case: department WCI . . . 60
6.3.1 Background and project goals . . . 60
6.3.2 Process type . . . 60
6.3.3 Implementation . . . 61
6.3.4 Description of the ECMS . . . 62
6.3.5 Impacts . . . 62
6.3.6 Preliminary analysis and implications for remaining research process . . . 66
6.4 Third case: Supreme Court of the Netherlands . . . 70
6.4.1 Background and project goals . . . 70
6.4.2 Process type . . . 71
6.4.3 Implementation . . . 72
6.4.4 Description of the ECMS . . . 73
6.4.5 Impacts . . . 75
6.4.6 Preliminary analysis . . . 78

7 Analysis and results 79
7.1 Cross-case analysis . . . 79
7.1.1 Comparison of the functional scopes . . . 79
7.1.2 Comparison of the process types . . . 79

7.1.3 Comparison of the impacts . . . 80
7.1.4 Inter-factor comparison . . . 82
7.1.4.1 Influence of the functional scope on impacts . . . 82
7.1.4.2 Influence of the process type on the impacts . . . 82
7.1.4.3 Influence of the process type on the functional scope . . . 83
7.1.4.4 Influence of the functional scope on the process type . . . 84
7.2 Results from case study research . . . 84
7.2.1 Explanatory results . . . 84
7.2.2 Exploratory results . . . 87
7.2.2.1 Updated list of impacts . . . 87
7.2.2.2 Implementation approach . . . 87
7.2.2.3 Soft factors . . . 88
7.2.2.4 Goals . . . 89
7.2.2.5 Sequential dependencies . . . 90
7.2.3 Validity . . . 91
7.3 Results from design research . . . 91
7.3.1 Reference Architecture for ECM . . . 92
7.3.2 Impact framework and impact table . . . 92
7.4 Limitations of research . . . 94

8 Conclusions **95**
8.1 Answers to research questions . . . 95
8.2 Implications for practice . . . 97
8.3 Further research . . . 97

References **VII**

A Additions to Conceptual foundation **XVII**
A.1 ECM definitions . . . XVII
A.2 Definitions of RAE components and functionalities . . . XIX
A.2.1 presentation layer . . . XIX
A.2.2 process layer . . . XX
A.2.3 services layer . . . XX
A.2.4 infrastructure layer . . . XXI
A.3 Definitions of potential impacts of implementing ECMSs . . . XXII

B Interview questions **XXIX**

C Case study evidence **XXXI**
C.1 Case study database . . . XXXI
C.2 Case: Organization A . . . XXXII
C.2.1 First interview with product champion . . . XXXII
C.2.2 Second interview with project leader . . . XXXIV
C.2.3 Third interview with partner . . . XXXVII
C.2.4 Field note of informal discussion . . . XXXIX
C.3 Case: department WCI . . . XLI
C.3.1 First interview . . . XLI
C.3.2 Second interview with consultant . . . XLV
C.4 Case: Hoge Raad . . . XLVII

D Potential notation for displaying dependencies among impacts **LIII**

E Overviews for cross-case analysis **LV**
E.1 Functional scopes . . . LV
E.2 Impact tables . . . LVII

List of Figures

2.1 General method for conducting design research 9
2.2 Visualization of research plan 11

3.1 Fields of ECM research 22

4.1 Classification of systems to support work processes 30
4.2 Reference Architecture for ECM 33

5.1 Effects of ICT in organizations 40
5.2 Enhanced impact Framework 41
5.3 Categorization of the factor process type 45
5.4 Initial research model 45

6.1 Functional scope of CEM/A&C and map 54
6.2 Functional scope of DIS and GWS4all 63
6.3 Functional scope of C@sus 74

7.1 Main impact categories of ECMSs matched on an organizational chart 80
7.2 Extended ECMS impact model 85
7.3 Extended ECMS impact model including explanatory results 86

8.1 Draft research model for further research 98

E.1 Functional scope of CEM/A&C and map LVI
E.2 Functional scope of DIS and GWS4all LVI
E.3 Functional scope of C@sus LVI

List of Tables

2.1 Attributes of rigorous positivist case study research 7
2.2 Research deliverables and approaches 10

3.1 Definition hierarchies of data, information, and knowledge 14
3.2 Major functionalities of a CMS 19
3.3 List of scientific literature on ECM 20

4.1 Groups of sources from practitioners' literature used for designing the Reference Architecture for ECM 31

5.1 Sources of impacts and respective research foci 38
5.2 Categorized potential impacts of implementing ECMSs 42

6.1 Coding scheme for process type 48
6.2 Coding scheme for impact intensity 49
6.3 Preliminary screening of the process types at the three organizations 50
6.4 Coded impacts of CEM/A&C and map 56
6.5 Updated definition of impact 13 after first case 59
6.6 Coded impacts of DIS and GWS4all 67
6.7 Updated and added impacts after second case 69
6.8 Coded impacts of C@sus 77
6.9 Updated impacts after third case 78

7.1 Comparison of the process types of the cases 80
7.2 Influence of the process type on the EDM and WfM components 85
7.4 Final impact table 93

A.1 Previous definitions of ECM XIX
A.2 Potential impacts of implementing ECMSs XXVIII

C.1 Case study database XXXII

D.1 Coded impacts of DIS and GWS4all including dependencies LIV

E.1 Coded impacts of CEM/A&C and map LVIII
E.2 Coded impacts of DIS and GWS4all LVIII
E.3 Coded impacts of C@sus LVIII
E.4 Coded impacts of CEM/A&C LIX
E.5 Coded impacts of DIS and GWS4all LIX
E.6 Coded impacts of map LIX

List of Acronyms

AIIM	Association for Information and Image Management
BAM	Business Activity Monitoring
BI	Business Intelligence
BPR	Business Process Reengineering
CCM	Component Content Management
CEM/A&C	Client & Engagement Management, Acceptance & Continuance
CM	Content Management
CMS	Content Management System
CRMS	Customer Relationship Management System
CSR	case study research
DAM	Digital Asset Management
DBMS	Database Management System
DIS	Document Informatie Systeem
DIV	documentaire informatie voorziening (engl. documental information provision)
DSP	Documentary Structure Plan
EAI	Enterprise Application Integration
ECM	Enterprise Content Management
ECMS	Enterprise Content Management System
EDM	Electronic Document Management
EDMS	Electronic Document Management System
ERM	Electronic Records Management
ERMS	Electronic Records Management System
ERP	Enterprise Resource Planning
ERPS	Enterprise Resource Planning System
ES	Enterprise System
FTE	full-time equivalent
GWS4all	Geintegreerd Welzijn Systeem (engl. Integrated Welfare System)
IS	Information System
IT	Information Technology
KM	Knowledge Management
MRPS	Material Requirements Planning System
OMD	Operational Management Division
Org. A	Organization A
RAE	Reference Architecture for ECM
RHCA	Regionaal Historisch Centrum Anoniemstad
SBC	Server Based Computing
WBS	Work Breakdown Structure
WCI	Work, Care, and Income
WCM	Web Content Management
WCMS	Web Content Management System
WfM	Workflow Management
WfMS	Workflow Management System

In the beginning the Universe was created. This has made a lot of people very angry and has been widely regarded as a bad move.

Douglas Adams

1 Introduction

The last decades have seen several prominent changes in the environment of both private and public organizations. Organizations operate under permanent cost pressure and growing global competition, so that increasing operational efficiency has become a focus of many management teams (Bakos and Treacy, 1986; Meyer, Nakane, Miller, and Ferdows, 1989). Another change is that the demands of customers (i.e. (potential) clients of companies and citizens) have grown: they expect a higher quality of the delivered products and services (which can for example also be a parking permit in case of a municipality) in a shorter period of time and would like to be able to easily gain insight in the current status of their case (Parasuraman, Berry, and Zeithaml, 1991). New legal conditions form a third major change. For example, the Sarbanes-Oxley Act requires that all relevant business communication is archived (Engel, Hayes, and Wang, 2007; Gundling, 2006), companies in Germany have to adhere to standards regarding the storage of digital financial documentation (Bundesministerium der Finanzen, 2001), and public organizations in the Netherlands are required to maintain an ordered and accessible archive, including their digital documents (n.a., 1995). The last external change mentioned here is the trend towards an improved work-life balance which manifests itself, amongst others, in the fact that telework is becoming more wide-spread (Bailey and Kurland, 2002). A consequence of this trend is that employees need to be able to digitally access files so that they are able to completely work from a distance (Bentley and Yoong, 2000; Tung and Turban, 1996).

Considerable changes have occurred inside organizations as well. During the last decades, numerous programs and information systems have been introduced in organizations with the goal of reducing the workload of humans (Aalst and Hee, 2004). In turn, working without word processors, spreadsheet calculators, and e-mail has become almost unimaginable (Beckman and Hirsch, 2001; Minsky and Marin, 1999). These applications are used for various activities within organizations, including not only primary ones as for example in sales, but also for supportive ones such as technology development or human resource management (Porter and Millar, 1985). An important side effect is that a large share of organizations' explicit knowledge is captured digitally nowadays, for example in the form of process descriptions and manuals (Alavi and Leidner, 2001). In addition to these files, scanners are broadly available and can be used for digitizing incoming and outgoing documents of an organization (Sprague, 1995). In total, the so-called 'unstructured data' created by these applications has been estimated to account for 53 to 85 percent of organizations' digital resources (Robb, 2004; Swoyer, 2007). However, the respective files are often just stored on file servers or on local hard drives, so that locating and accessing necessary files has become exceedingly difficult (Dourish et al., 2000).
Furthermore, the recent two decennia have also witnessed the rise of online presences on the Internet and of organizational intranets, both of which can also contain enormous amounts of organizational information (O'Leary, 1997). A related problem is that already as early as in the mid 1980s, the massive increase in available data and information (Leidner and Elam, 1995; Zantout and Marir, 1999) has resulted in the so-called information overload (Hiltz and Turoff, 1985) and the rise of the Internet has only intensified this problem (Berghel, 1997). Another internal change is the introduction of virtual teams, which "are an ad hoc collection of geographically dispersed individuals from different functions, specialties, or even organizations [...] constituted to complete a specific, complex task" (Suchan and Hayzak, 2001, p.175). Just as teleworking, this

kind of organizational co-operation also requires that as much information from a project as possible is digitally accessible (Strader, Lin, and Shaw, 1998). However, the increase in the amount of content to be managed and its scatteredness throughout organizations have resulted in the situation that the professional management of content has become almost impossible, even though organizations are highly dependent on it (Grudin, 2006). As a response to this situation, Enterprise Content Management Systems (ECMSs) have become popular during recent years (Tyrväinen, Päivärinta, Salminen, and Iivari, 2006) since they are positioned as technical solutions for the organization-wide management of all types of content.

Although Enterprise Content Management (ECM) has been considered to be "the latest buzzword" (Mescan, 2004, p.55), others consider ECMSs as a new class of Information Systems (ISs) and have therefore positioned them as a new field of IS research (Tyrväinen et al., 2006). Since it is a major goal of IS research to "further knowledge that aids in the productive application of information technology to human organizations and their management" (Hevner, March, Park, and Ram, 2004, p.76), researchers are supposed to analyze any class of ISs. This also holds for ECMSs, but despite their large potential benefits, surprisingly little research has been conducted on this subject (Nordheim and Päivärinta, 2006; Päivärinta and Munkvold, 2005). The current situation of ECM research seems to be comparable to the status of research on Enterprise Resource Planning Systems (ERPSs) in the late 1990s (Mabert, Soni, and Venkataramanan, 2003): "Whereas practitioners are already facing [...] challenges, researchers still have provided few aids to manage them from the viewpoint of the enterprise. Research on ECM experiences remains scarce as well" (Päivärinta and Munkvold, 2005, p.9). To add to the problem of scarce scientific research, Andersen (2008), a technical communicator, has observed that the discourse about ECM mainly occurs in practitioners' literature such as for example KMWorld. She further argues that practitioners reporting there usually view technology "as having an inevitably positive impact on an environment" and that they "tend not to think about the bias of their own inventions or the possible societal consequences of adopting them" (Andersen, 2008, p.69).

Consequences have also been identified by Päivärinta and Munkvold (2005) as an important topic of ECM research because "unless we would assume that ECM brings up only positive consequences, there remains thus a challenge to complement the success stories with in-depth studies on all possible impacts, including negative ones" (Päivärinta and Munkvold, 2005, p.3). In the same article, they have identified a number of topics needing further research, including "[p]ractical means for evaluating the main impacts sought by ECM investments beyond plain cost savings in information processing operations and facilities; including also experiences from unwanted impacts and realized risks of ECM development projects" (Päivärinta and Munkvold, 2005, p.9). This view is concurred in the field of IS evaluation, where it has been observed that the implementation of new ISs often leads to unforeseen impacts (Smithson and Hirschheim, 1998). However, the outcomes of implementing ISs are not an independent entity, but are rather influenced by a wide variety of factors (Cooper and Zmud, 1990). This became particularly apparent during early ERPS implementations when projects at different organization led to diametrically opposed results what resulted in extended research on fathoming these factors for the Enterprise Resource Planning (ERP) domain (Karimi, Somers, and Bhattacherjee, 2007). This thesis follows this stream of research and therefore seeks to determine the relevant factors influencing the impacts of implementing ECMSs in order to create a more profound understanding of this subject. Hence, the research question for this thesis has been defined as:

What are the impacts of implementing Enterprise Content Management Systems in organizations and what are the relevant influencing factors?

1.1 Sub-questions

For being feasible during the process of this research, the research question has been detailed by eight sub-questions. First of all, the basic terms used in this document need to be defined in order to create a common understanding of the topic.

Sub-question 1 *How can content be defined?*

Sub-question 2 *What is Enterprise Content Management?*

Sub-question 3 *What are the potential functionalities offered by Enterprise Content Management Systems?*

The following step is to also split up the research question into its parts. First of all, the dependent variable of this research — the impacts which can occur when an ECMS is implemented — are to be further fathomed.

Sub-question 4 *Which impacts can occur when an Enterprise Content Management System is implemented in an organization?*

This sub-question results in a list of potential impacts. However, a simple list is likely to be only usable as a checklist and does not deliver insights into the nature of the impacts. Therefore, a framework is needed which allows to categorize impacts according to their nature.

Sub-question 5 *How can the impacts of implementing Enterprise Content Management Systems be categorized and operationalized?*

The factors that influence the impacts — the independent variables of this research — are the focus of the second part of the research question.

Sub-question 6 *Which factors influence the impacts of implementing an Enterprise Content Management System?*

Since different ECMS implementations should also be comparable with each other, the factors need to be operationalized.

Sub-question 7 *How can the influencing factors be operationalized?*

After having determined both the impacts and the influencing factors, relationships among the major elements of this research are to be determined. The resulting, more detailed understanding will not only add to the body of scientific knowledge on ECMS, but is also likely to deliver some practical guidelines for ECMS projects.

Sub-question 8 *How are the influencing factors related to the impacts?*

These sub-questions demonstrate that this research contains both an exploratory (sub-questions 3, 4, and 6) and an explanatory (sub-question 8) component. However, the main deliverable that is called for by the research question is an explicitly described model of the relations between the influencing factors and the impacts. Therefore, the exploratory component about inventorying functionalities, factors, and impacts is subordinate to the explanatory one.

1.2 Social and scientific relevance

The introduction has already stated several societal problems to which ECM can provide solutions and therefore, research which advances the understanding and development of ECM is in general socially relevant. This particular research is expected to be relevant because it is supposed to provide practitioners and organizations which are about to implement an ECMS with a structured summary and understanding of the functionalities that can be offered by an ECMS. It is also supposed to improve the success rate of implementation projects by presenting an overview of potential impacts and of factors which should to be taken into account by organizations when they embark upon ECMS implementation projects.

This research is also expected to be scientifically relevant because it is supposed to summarize the current state of research on ECM. First of all, definitions of fundamental terms as well as an inventory of potential functionalities and impacts would provide a common conceptual foundation and a common understanding for future research in this field. The operationalizations that are to be developed for the case study research can be a practical, novel way of studying the impacts of implementing ECMSs and might also be adaptable to other types of ISs. Finally, the establishing of influencing factors, of relations among them, and of other potential factors should set a first step towards the quantitative study of these elements.

1.3 Document structure

After the introduction to this research in this chapter, chapter 2 describes the two research methods used in this thesis and presents the research plan. In chapter 3, the first literature study is presented which has been conducted for defining the terms content and ECM as the two underlying concepts of this research. The following chapter 4 presents a Reference Architecture for ECM and the design research process that has been taken for constructing it. Afterwards, the ECMS impact model is defined in chapter 5 which guides the multiple-case study being described and preliminarily analyzed in chapter 6. The final analysis of all three case studies is performed in chapter 7 which also presents the final results of this research. This document concludes with a summary of the obtained results, some comments on the practical implications, and several suggestions for further research in chapter 8.

Though this be madness, yet there is method in 't.

William Shakespeare

2 Research approach

This chapter first presents some general theoretical and methodological background information of the research approach and the two main research methods applied in this research. Next to guiding the following steps of this research, this information is also applied during the construction of the research plan which is introduced and explained afterwards.

2.1 Research methods

The two main research methods used in this research, case study research and design research, are briefly depicted here, including descriptions of the research processes and practical remarks.

2.1.1 Case study research

A case study is defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p.13). As such, case study research (CSR) is very suitable for studying ISs since they usually involve "complex and ubiquitous interactions" (Dubé and Paré, 2003, p.598) with their environment which can hardly be studied in an experimental setting (Darke, Shanks, and Broadbent, 1998). CSR is suitable for investigating both exploratory and explanatory research questions (Yin, 2003, p.3 et sqq.) and Benbasat, Goldstein, and Mead (1987) concur by positioning CSR as being particularly appropriate for problems "in which research and theory are at their early, formative stages" (Benbasat et al., 1987, p.369).

In several publications about CSR, the difference between an interpretivist and positivist approach to CSR is made (Cavaye, 1996; Darke et al., 1998; Dubé and Paré, 2003). In the interpretivist approach, "research does not enter a social setting with *a priori* constructs, but allows constructs to emerge" (Cavaye, 1996, p.232) during the process. Understanding the meaning which the research subjects assign to phenomena of the specific environment under study is the main focus of this approach (Darke et al., 1998). Positivist CSR on the other hand "is concerned with the empirical testability of theories or laws" (Darke et al., 1998, p.276) "by identifying individual components of a phenomenon and explains the phenomenon in terms of constructs and relationships between constructs" (Cavaye, 1996, p.233). It should be noted though that both approaches to CSR are valid and that the choice between the two should be determined by the goal of the research (Gregor, 2006). Having a mainly explanatory nature, this research needs to follow the positivist approach which is described in the remainder of this subsection.

The general approach of (positivist) CSR has four phases: designing & preparing, conducting, analyzing, and reporting. After providing a general overview, detailed descriptions of the first three phases are provided. In the first phase, the research question to be answered by the study is defined. It determines the unit of analysis — "the fundamental problem of defining what the 'case' is" (Yin, 2003, p.22) — and it also largely influences the overall structure of the research which can in essence vary between a single or multiple-case design. The scope of the literature

study carried out next depends on the nature of the research question. Whereas exploratory questions usually require little previous study, the literature study for explanatory studies often results in propositions which are tested during the course of the research (e.g. in the form of an initial research model). The propositions also guide the subsequent selection of cases and the development of the case study protocol (see attribute 19 below), the strategy for analyzing the data (e.g. how the data is to be linked to the propositions), and the structure of the case study report. The optional last activity of this phase is conducting a pilot case in which the data collection instruments are refined and in which the researcher(s) can get a more detailed impression of the topic (Yin, 2003, p.19 et sqq.). It should be noted that CSR with a multiple-case design can be of iterative nature. Based on an important discovery during one of the cases, the initial propositions, the case selection, or the case study protocol may need to be adapted. CSR ends with the creation of a case study report which not only clearly describes the conclusions and the data, but also includes descriptions of the procedures used during collection and analysis (Yin, 2003).

2.1.1.1 Types of validity

Due to its very nature, qualitative research cannot use the same methods for determining the validity of its conclusions as quantitative research, such as statistical tests. However, social science has developed four constructs for assessing the quality of qualitative research which Yin (2003) describes as follows. *Construct validity* describes the fact that the concepts to be evaluated need to be correctly operationalized which means that the chosen measures really need to capture the phenomenon studied. The requirement for *internal validity* is the existence of clear argumentative chains from evidence to conclusion(s) which demonstrate that indeed a certain set of conditions was the cause of an observed effect and not "spurious relationships" (Yin, 2003, p.34). In contrast, *external validity* establishes whether the findings can be generalized to the general domain of the specific study, for example if the results of a study of a single or a few ERPSs are applicable to all ERPSs. The fourth construct is *reliability* which is an indication of the probability that the repetition (where applicable by a different researcher) of a specific case study would deliver the same results with regard to collected data and obtained conclusions. The goal is to reduce the amount of errors and bias (Yin, 2003, p.33 et sqq.).

2.1.1.2 Attributes of rigorous positivist case study research

Based on previous works, Dubé and Paré (2003) have developed the non-exclusive list of attributes characterizing rigorous positivist CSR presented in table 2.1 on the facing page. The three areas *research design*, *data collection*, and *data analysis* are shortly presented in the following. As these attributes are largely based on Yin (1994) (the previous edition of Yin (2003) which has been used in this research), some repetition of points already mentioned in the general description of the CSR method is unavoidable.

Research design

After the research questions have been clearly defined (attribute 1), existing theory needs to be evaluated so that some initial concepts or propositions (where applicable based on rival theories) can be defined (2, 4, 5, 6). However, researchers in exploratory case studies should only carry out a minimal literature study, "because preordained theoretical perspectives or propositions may bias and limit the findings" (Eisenhardt, 1989, p.536) (3). Before the study can be further designed, the unit of analysis needs to be defined (10). A case study can evaluate a single case when this case is exceptional and can deliver unique insights (8). A multiple-case design is considered to be more sound and should be pursued when enough resources are available (Yin, 2003, p.46 et sqq.). The cases to be studied should be selected in such a way that literal ("predicts similar results" (Yin, 2003, p.47)) or theoretical ("predicts contrasting results but for predictable reasons" (ibid)) replications are possible (7, 9). When selecting cases, attention should also be

#	attribute	author(s)	exploratory	explanatory
area 1: research design				
1	Clear research questions	1, 2, 3	X	X
2	A priori specification of constructs	3	X	
3	Clean theoretical slate	3	X	
4	Theory of interest	2, 4		X
5	Predictions from the theory	2, 4		X
6	Rival theories	2, 4		X
7	Multiple-case design	2, 3, 4	X	X
8	Nature of single-case design	2	X	X
9	Replication logic in multiple-case design	3, 4	X	X
10	Unit of analysis	1, 2	X	X
11	Pilot case	2	X	X
12	Context of the case study	1, 2	X	X
13	Team-based research	1, 3	X	X
14	Different roles for multiple investigators	1, 3	X	X
area 2: data collection				
15	Elucidation of the data collection process	1	X	X
16	Multiple data collection methods	1, 2, 3, 4	X	X
17	Mix of qualitative and quantitative data	1, 3	X	X
18	Data triangulation	1, 2, 3, 4	X	X
19	Case study protocol	1, 2	X	X
20	Case study database	1, 2	X	X
area 3: data analysis				
21	Elucidation of the data analysis process	1, 2, 3	X	X
22	Field notes	2, 3	X	X
23	Coding and reliability check	2	X	X
24	Data displays	2	X	X
25	Flexible & opportunistic process	1, 2, 3	X	X
26	Logical chain of evidence	1, 2	X	X
27	Empirical testing	2, 4		X
28	Explanation building	2	X	
29	Time series analysis	2		X
30	Searching for cross-case patterns	3, 4	X	X
31	Use of natural controls	4		X
32	Quotes (evidence)	1,2	X	X
33	Project reviews	2	X	X
34	Comparison with extant literature	3	X	

Table 2.1: Attributes of rigorous positivist case study research (Dubé and Paré, 2003, p.606).

The numbers in the column *author(s)* refer to the following publications:

1: Benbasat et al. (1987)
2: Yin (1994)
3: Eisenhardt (1989)
4: Lee (1989)

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paid to so-called natural controls, which is an attempt to mimic experiments from other research domains where as many potentially influencing factors as possible are eliminated or controlled for. The selected cases should capture situations in which only one or a few factors change so that the influence of other factors is naturally controlled for (Lee, 1989) (31). Therefore, the specific

context of a case study is relevant for the credibility and generalizability of the results and needs to be included in the case study report (12). The overall quality of the research can be enhanced by carrying it out in a team of researchers (13, 14). Finally, the research procedure should if possible also include a pilot case (11) (Dubé and Paré, 2003).

Data collection

Before the data is collected, a case study protocol (19) is to be developed including an overview of the project, the field procedures, the case study questions, and a guide for the case study report (Yin, 2003, p.67 et sqq.). The case study report needs to describe how the data of the case(s) has been collected, as this is important for judging its reliability and construct validity (15). The latter can be increased by using different data collection methods, by triangulating data (i.e. combining multiple data sources for deriving conclusions), and, when applicable, by evaluating both qualitative and quantitative data (16-18). CSR can for example also include informal discussions with respondents which are to be captured in field notes (22). All collected evidence from the study sites and from the analysis process should be registered and managed in a case study database, so that for example raw material is available for independent inspection (20).

Data analysis

In CSR, a preliminary analysis of the data can already be performed after every case. If necessary, the results from this analysis should be used for adapting the data collection procedures (25). As with the data collection, the process taken for analyzing data needs to be described in the case study report (21). The data needs to be prepared for analysis. This can be done by visualizing it for example in tables (24) or by coding it according to a scheme being defined in the case study protocol. The reliability of the latter method can be enhanced through coding the same data by different researchers (23). These two preparation methods can simplify searching for patterns occurring in several cases (30) which can deliver important insights for the analysis. Three other methods are also considered to be good practice. Prepositions previously derived from theory (predicted patterns) are compared with the findings from the case research (empirical patterns) as part of empirical testing (27). This method should use the rival explanations developed in (6) and should also evaluate whether the results are in line with the prearranged replications from (9). Explanation building (28) is a less formalized version of pattern matching where an initial theory about the phenomenon studied is postulated. In the remainder of the case research, this statement is iteratively compared and adapted to the findings of the studies. Finally, time series plot a large number of observations over time and allow to identify evolving patters (29) (Dubé and Paré, 2003; Yin, 2003). Also during data analysis, particular attention needs to be paid to reliability and the following measures are proposed for increasing it. A logical chain of evidence allows "an external reviewer or observer to follow the derivation of any evidence from initial research questions to ultimate case study conclusions [...] in either direction" (Dubé and Paré, 2003, p.618) (26). The use of quotes in the case study report can help to support the conclusions (32) and the review of the report by participants serves as a double-check of the findings and their interpretation (33). Finally, comparing the results of exploratory case research to existing literature (both conflicting and confirming) is likely to enhance internal validity and to widen the generalizability (34) (Dubé and Paré, 2003).

2.1.2 Design research

Design research (or design science) "involves the analysis of the use and performance of designed artifacts to understand, explain and very frequently to improve on the behavior of aspects of Information Systems" (Vaishnavi and Kuechler, 2007). These artifacts can take various forms, namely constructs, models, methods, instantiations, and better theories (Vaishnavi and Kuechler, 2007). For this research, only *constructs* which "define the terms used when describing and thinking about tasks" (March and Smith, 1995, p.256) and *models* — "set[s] of propositions or statements expressing relationships among constructs" (March and Smith, 1995, p.256) — are

relevant since the other three forms are not asked for by the sub-questions. Several frameworks for conducting design research have been proposed in literature which have been summarized by Vaishnavi and Kuechler (2007) as depicted in figure 2.1.

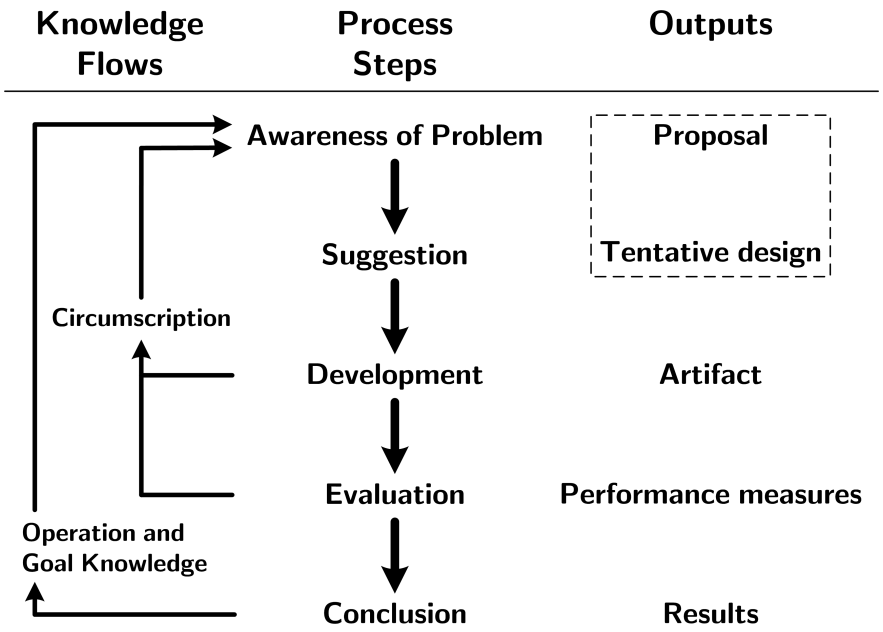

Figure 2.1: General method for conducting design research (Vaishnavi and Kuechler, 2007).

The first step in design research is to become aware of a problem on which research is necessary because it is required by scientific or business needs. This phase results in a (formal or informal) proposal describing the problem which also contains evaluation criteria for and a tentative design of the artifact. This design is created during the suggestion phase which in its essence is a "creative step wherein new functionality is envisioned" (Vaishnavi and Kuechler, 2007). This initial idea of the final artifact is further detailed in the development phase. During this phase, researchers are expected to incorporate findings from previous IS research which can be found in the so-called knowledge base. In the following phase, the artifact is evaluated with regard to the previously mentioned criteria what results in measures of its performance. The method used for the evaluation can take various forms, for example an experimental approach such as a simulation or an observational approach as for example CSR. At this point, it is important to notice that design research usually is an iterative search process. The arrows in figure 2.1 labeled circumscription describe a feedback loop through which the comprehension of the initial problem (domain) continuously grows based on the findings and events of the design and evaluation phase. This comprehension influences in turn the results of these two phases as well. This loop continues until the artifact is "good enough" (Vaishnavi and Kuechler, 2007) so that the overall results of the research can be summarized in the last phase: either as confirmed knowledge or as triggers for further research, creating awareness of a new problem. In both cases, the results need to be communicated in a way that clearly contributes to the knowledge base. In fact, the continued abstraction of the results can lead to a more general understanding of or to emergent theory about the problem domain (Hevner et al., 2004; Vaishnavi and Kuechler, 2007).

The just mentioned goal of communication about design research artifacts can be obtained by including six components formulated by Jones and Gregor (2008). The first one is the definition of the artifact's *purpose and scope*. Secondly and similar to the first type of artifact formulated by March and Smith (1995), *constructs* are to be provided which means that the elements being used within the artifact are to be named and defined. In addition, the *principle of form and function* which forms the architecture of the artifact is to be explicated. The fourth component *artifact mutability* requires that the description also comments on future changes to the artifact. *Testable*

propositions about the artifact help to evaluate it. Finally, it needs to be stated on which *justificatory knowledge*, i.e. which findings from previous research, the artifact is based on.

2.2 Research Plan

Taking into account the steps to be performed for each research method described in the previous section, this research will follow the research plan depicted in figure 2.2 on the facing page. The deliverables created during the various steps are related to the research question and its sub-questions in table 2.2. In the remainder of this research, the practical guidelines for the two research methods are taken into account during the individual steps as it is described in the respective sections as well as in sections 7.2.3 and 7.3.

	research question	**designated deliverable**	**research method**
	What are the impacts of implementing Enterprise Content Management Systems in organizations and what are the relevant influencing factors?	explicated and validated model relating influencing factors to impacts (ECMS IMPACT MODEL)	exploratory and explanatory CSR
	sub-question	**designated deliverable**	**research approach**
1	How can content be defined?	DEFINITION CONTENT	literature study
2	What is Enterprise Content Management?	DEFINITION ECM	literature study
3	What are the potential functionalities offered by Enterprise Content Management Systems?	REFERENCE ARCHITECTURE FOR ECM	design research
4	Which impacts can occur when an Enterprise Content Management System is implemented in an organization?	LIST OF POTENTIAL IMPACTS	exploratory CSR
5	How can the impacts of implementing Enterprise Content Management Systems be categorized and operationalized?	IMPACT FRAMEWORK & IMPACT TABLE	design research
6	Which factors influence the impacts of implementing an Enterprise Content Management System?	LIST OF INFLUENCING FACTORS	exploratory CSR
7	How can the influencing factors be operationalized?	LIST OF OPERATIONALIZED INFLUENCING FACTORS	literature study
8	How are the influencing factors related to the impacts?	explication of ECMS IMPACT MODEL	explanatory CSR

Table 2.2: Research deliverables and approaches.

The first step is to perform a literature study for defining the terms content and ECM so that a precise conceptual foundation for this research is created. Afterwards, a CSR is conducted. The reason for choosing this as the main research method lies in the exploratory and explanatory nature of the research question as well as in the embryonic state of ECM research. The embryonic state also was the reason for not including quantitative research components as the exact constructs to be studied are not known yet. The CSR starts with a literature study on factors that potentially

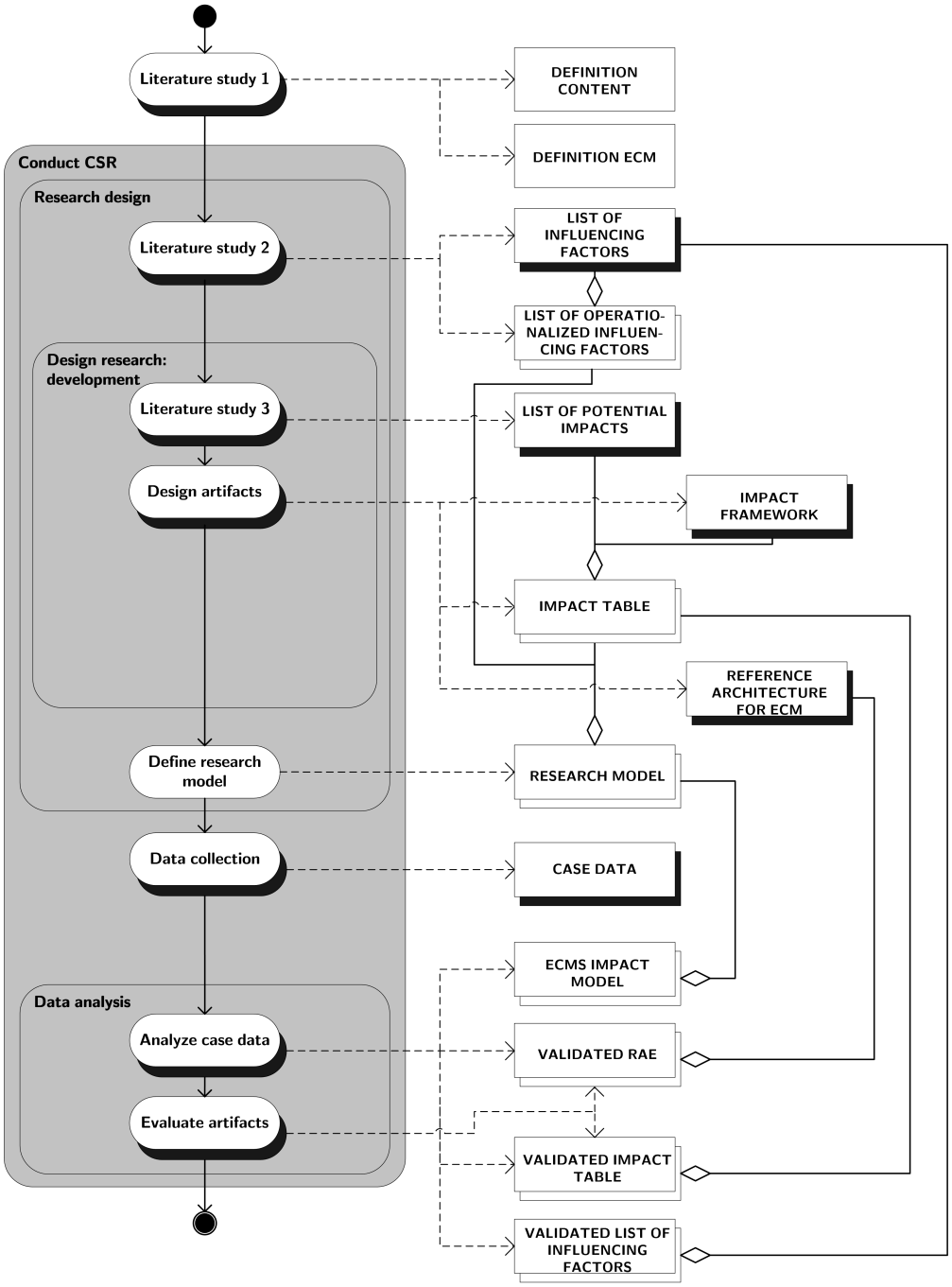

Figure 2.2: Visualization of research plan.

influence the impacts of implementing ECMSs and their particular operationalizations since these factors are needed as the independent variables of the initial research model.
During the design phase of the CSR, three design research artifacts are to be constructed. The usage of design research is justified since the artifacts are necessary for being able to define the initial research model, therefore presenting a scientific need. The design research includes a third literature study both for listing potential impacts of implementing ECMSs and for extracting relevant existing theories for designing the artifacts. The initial research model constructed afterwards guides the following data collection phase of the CSR. Finally, the case data is analyzed with regard to sub-questions 3, 6, 4, and 8 what results in 'empirically validated' answers to these sub-questions. In addition, the analysis serves as the evaluation phase for the designed artifacts. In the following chapter, the first four steps of this research plan and their results are described.

The loftier the building, the deeper must the foundation be laid.

Thomas van Kempen

3 Conceptual foundation

This chapter first defines the term content as the rhetorical basis of ECM. It then continues by deriving a synthesizing definition of the term ECM itself.

3.1 Defining content

"Something contained" (Merriam-Webster Online Dictionary, 2008a) — this definition of content raises the questions 'What is the something? And in what is it contained?' and therefore only provides preliminary understanding. The latter is deepened by several examples of content which are exhibited first. Theoretical approaches to the term content are given by three more elaborate definitions that have been found in ECM (related) literature. Finally, a more literal perception of content is presented. However, it is demonstrated that all five groups are not complete and partly contradict each other. This shows that there is the need for an improved concise definition of content which is proposed at the end of this subsection.
Since the definitions include the terms data or information, these two concepts are described first. Alavi and Leidner (2001) have presented two different hierarchies of definitions which are depicted in table 3.1 on the following page.[1] The first one is the 'classical' bottom-up hierarchy which is for example used by Davenport and Prusak (2000). It asserts that data exists first, is used for creating information which again forms the basis for knowledge to emerge. The second, iconoclastic definition hierarchy has been proposed by Tuomi (1999), who defines the term in a top-down approach. In his opinion, knowledge exists first and becomes information once it is articulated. Finally, certain information can become data.
Another term used in the first three definitions of content is metadata. Information is often exchanged digitally, in particular within organizations. Other than humans, ISs can however not understand the message information transfers; they lack the very capability to independently interpret information and therefore can only process *data* (Alavi and Leidner, 2001; Boiko, 2005; Tuomi, 1999). Still, ISs should be usable for supporting humans in their work with information. In order to do so, 'electronic resources' (also called 'digitized objects' (Vellucci, 1998, p.187)) are accompanied by metadata, i.e. "data that describe the attributes of a resource; characterize its relationships; support its discovery, management, and effective use; and exist in an electronic environment" (Vellucci, 2000, p.34).

3.1.1 Definition by examples

Within ECM literature, two different groups of examples of content have been found. The first group characterizes content as "everything from well-structured transaction data, via more or less structured XML-tagged content, e-mails and discussion forums, to voluminous digital files still often stored as 'one chunk' of data" (Munkvold, Päivärinta, Hodne, and Stangeland, 2006, p.70). This perception is shared by Nordheim and Päivärinta (2006), Tyrväinen, Salminen, and Päivärinta

[1] The definitions of the term knowledge are only included for reasons of understandability but are not used in the remainder of this particular discussion.

bottom-up hierarchy	concept	top-down hierarchy
"information possessed in the mind of individuals: it is personalized information (which may or may not be new, unique, useful, or accurate) related to facts, procedures, concepts, interpretations, ideas, observations, and judgments" (Alavi and Leidner, 2001, p.109)	knowledge	"the result of cognitive processing triggered by the inflow of new stimuli" (Alavi and Leidner, 2001, p.109)
data that has been interpreted and shaped (Awad and Ghaziri, 2004; Benevolo and Negri, 2007) so that it presents relations among facts and "arrive[s] at a meaning in the eyes of the perceiver" (Awad and Ghaziri, 2004, p.36); The shape of information can be very diverse and includes all "forms of recorded communication" (Boiko, 2005, p.7): text, sound, images, motion, and their digital representations (i.e. files or e-mails[2]). It is important to notice that information is not the medium itself, but the message which is contained (Awad and Ghaziri, 2004; Davenport and Prusak, 2000).	information	(digital) representation of a mental image of a concept (e.g. knowledge) which someone considered important to communicate (Boiko, 2005); "information is created from knowledge through a process of articulation. When knowledge is given structure and when it is embedded in artifacts it can become a physical information object that can be shared. In some cases this articulation happens through language, in other cases it may happen through creation of designs, images, and tools" (Tuomi, 1999, p.6).
"the quantities, characters, or symbols on which operations are performed by a computer" (Oxford University Press, 2008) and represents "a set of discrete facts about events" (Davenport and Prusak, 2000, p.2)	data	"is created from information by putting information into a predefined data structure that completely defines its meaning. [...] [D]ata emerges as a result of adding value to information by putting it into a form that can be automatically processed" (Tuomi, 1999, p.5).
data is used to create information which in turn is interpreted to form knowledge (Alavi and Leidner, 2001)	**summary**	"Data can emerge only if a meaning structure, or semantics, is first fixed and then used to represent information" (Tuomi, 1999, p.4).

Table 3.1: Definition hierarchies of data, information, and knowledge.

(2003), Bandorf, Yoshizawa, Takada, and Merbeth (2004), and H. A. Smith and McKeen (2003). The perception of the second group is that content is an "organisation's unstructured information [which] means letters, emails, reports etc as opposed to databases or accounting systems which contain 'structured' information" (AIIM Europe, n.d.). Vitari and Ravarini (2009)'s definition of content is similar: content is something contained and "can embrace a wide range of types of information, from simple ASCII format texts to multimedia objects, regardless of how and where they are published" (Vitari and Ravarini, 2009, p.250). For their specific research, they further limit content to information contained in websites. Next to Forrester Research, Inc. (2007), the Association for Information and Image Management (AIIM)'s perception is shared in scientific sources such as Andersen (2008) and Reimer (2002). The difference between these two groups is that the second group does not consider structured data in databases to be content.

[2] For the sake of simplicity, the remainder of this section only uses the term files.

3.1.2 First definition: structuredness of data

The notion of structuredness has already been mentioned by both groups above and is further refined by the first definition which is based on the various degrees of structuredness of data. On the one side of the spectrum of structuredness is structured data, which is "very regular, i.e. it fits well with a predefined schema" (Magnami and Montesi, 2004, p.2), can be broken down into tables, and is usually managed in a database. An example are employee records (Magnami and Montesi, 2004; Vidgen, Goodwin, and Barnes, 2001). It is commonly agreed on that files belong to the category unstructured data and in consequence form the other side of the spectrum. However, the definitions vary with regard to the type of the files. According to Vidgen et al. (2001), a video file has low structure, but manuals or magazines display a higher degree of structure and therefore are to be placed between the two ends. Yet other authors place "documents, images, and rich media" (Somani, Choy, and Kleewein, 2002, p.686) into the category unstructured data. Taking into account that structured data is defined to be manipulable in a database, the second perception seems to be more applicable and hence is used in the remainder of this document. Both groups agree on the fact that unstructured data should be accompanied by metadata (Somani et al., 2002; Vidgen et al., 2001). In literature, semi-structured data is often mentioned as a third category and HTML- and (mainly) XML-files are given as examples (Chawathe, Abiteboul, and Widom, 1998; Magnami and Montesi, 2004). The "distinguishing feature [of semi-structured data] is that the schema is embedded with the data" (Suciu, 2002, p.744). XML-files being associated with an external XML-schema (e.g. a Document Type Definition) have been characterized as highly structured documents (cf. e.g. Meziane and Rezgui, 2004) and since the schema is external in this case, it could be argued that these files are indeed structured. However, Suciu (2002) argues that even in that case, the data contained in the file "remains self-describing and the schema is only used for validation purposes" (Suciu, 2002, p.744). This argumentation is agreed with by the author and is therefore followed in this document. Finally, these three categories of 'data-structuredness' are used for the first definition of content: everything besides structured data is content (Somani et al., 2002).

None of the mentioned publications specifies which definition hierarchy of data and information they apply which leads to the first point of criticism. The first hierarchy is not applicable because of the following counter evidence. A file containing a text for example about knowledge is considered to belong to the category unstructured data. However, it contains information and therefore, the limitation to data of this definition of content is not precise. The same reasoning applies even more to a spreadsheet file containing structured data which at the same time also transfers a message and therefore is considered to be information. To further complicate the situation, even a spreadsheet file which only contains structured data may need to be managed as content, e.g. by storing it under version management or archiving it. However, this definition of content excludes it from being content. The second hierarchy is also not applicable because of the following consideration. The particular definition of data prescribes that only information which can be placed into a "predefined structure that completely defines its meaning" (Tuomi, 1999, p.5) can become data. However, the previously mentioned text file about knowledge is very unlikely to be transferable into a database so that it can be automatically processed. Since the definition only considers several forms of data to be content, text files containing information would be excluded from qualifying as content when the second hierarchy is followed. In addition, this hierarchy defines that information can only become data when it can be structured (in a database), turning the term 'unstructured data' into an oxymoron from the viewpoint of this hierarchy.
The second point of criticism concerns the notion of structuredness. For example, text files or images of invoices are considered to be unstructured data. However, this perception is only true with regard to the degree that the messages contained in these files are automatically interpretable by an IS, but it is not true for human perceivers who are the final addressees of content. In addition, referring to information contained in files as unstructured data does not seem to be appropriate from an application point of view. Though the mental concept transported in a file may not be 'very regular' in terms of being manageable in a database, the file itself follows a certain structure

because it can be processed by an application. The term (un)structured can also not be replaced with for example (non-)machine-interpretable. Adapting the above definition, everything besides machine-interpretable data would be content. Certain XML-files are machine-interpretable (as for example files containing process descriptions in the Business Process Execution Language) and therefore would not be content. However, they may also be considered as records which need to be managed. This would turn them into a resource that is subject to Enterprise *Content* Management (cf. section 4.3.2), contradicting the substitute definition.

3.1.3 Second definition: structuredness of information

The second definition stems from ECM literature and defines content as "structured, semi-structured, and unstructured information, software code embedded in content presentations, and metadata" (Päivärinta and Munkvold, 2005, p.1). Apart from the fact that this definition is partly iterative (content includes content presentations), it also not complete. First of all, as the authors have not further defined structuredness, it needs to be assumed that they handle a similar definition of structuredness as given above. Transferring it to structured information would mean that the latter is 'very regular' and can be processed in databases without additional metadata. However, this leads to the contradiction that in both definition hierarchies, information is a message for human perceivers, but cannot be interpreted by ISs. In particular within the second definition hierarchy, the concept of semi-structured information results in a problem as well. XML-files with their predefined data structures defining meaning fulfill all requirements for qualifying as data. Even if they need to be managed as content, they are not included in this definition of content because it excludes data. Finally, a similar train of thought also applies to spreadsheet files only containing data (according to the first definition hierarchy) as these are not included in the definition.

3.1.4 Third definition: information and metadata

Information is also the central element of the third definition which defines content as the combination of information and its metadata (Boiko, 2005). A more figurative description is to see information as the essence in a shell of descriptive data (Kleinberger and Müller, 2000). Looking at the two definitions of data, it becomes apparent that both definition hierarchies can be employed in the definition of metadata. Therefore, the validity of this definition of content is not influenced by the validity of the definition hierarchies. However, as this definition also includes information only, the two last points of criticism from the previous definition (XML- and spreadsheet-files containing data) also apply to this definition and demonstrate that it is not complete.

3.1.5 Literal perception

A different perception of content is expressed by associating content with the notion of a container as in the introductory definition: "We talk about the content of a document [etc., ed.]. Content is often opposed to some other aspect of the container, for example, structure or form or representation" (Tyrväinen et al., 2006, p.628). In turn, ECM is for example meant for managing "the content of assets like documents, web sites, intranets, and extranets" (Tyrväinen et al., 2006, p.627). Differing from their previous definitions presented above, Tyrväinen et al. now separate the 'essence' of a data or information container from the object it is contained in. This perception can also be found in literature on Content Management (CM) which is presented in section 3.2.2.

This perception of content seems questionable for two reasons. First of all, there are containers which almost inseparably combine their 'essence' with its format, for example scanned diagrams and manuscripts or other multimedia files. As demonstrated in the following section, ECMSs can

also contain a component for managing electronic records of which the very goal is to manage containers as an entity, neither altering the substance nor its form (National Archives of Australia, 2006). Yet, these two types of 'containers' are excluded from being content by the literal perception. The second point of criticism resolves around the question whether ISs are indeed able to manage the content of for example a document as this kind of activity requires understanding. However, ISs are not capable of performing this kind of cognitive actions and instead have to rely on metadata for managing.

3.1.6 Proposed definition

In order to unify the diverging streams of definition within ECM literature, the following definition is proposed:

Content is the aggregation of digital data and/or information objects, and the corresponding metadata.

Instead of the term "digitized objects" proposed by Vellucci (1998), this definition uses the word digital. This is because the word digitized implies a conversion from analog to digital form, but data and information can also be originally created in a digital environment. Secondly, the two possible types of objects are specified by including both data and information objects. Therefore, this definition follows the line of argumentation of Munkvold et al. (2006) because the underlying assumption of Information Resource Management (IRM) is shared that the holistic management of all of an organization's data and information "can be used as a strategic weapon" (Trauth, 1989, p.264) to gain competitive advantage.

The new definition has various advantages. First of all, it highlights the importance of metadata for the management of both data and information. Two of the previous definitions were not explicit about this function, but this definition explicitly states that data and information have to be accompanied by metadata in order to qualify as content. The second advantage is that the new definition is not dependent on the auxiliary construct structuredness what makes it simpler and in turn easier to understand. This definition also has the advantage that it is better aligned with the definitions of its components since it is usable with both definition hierarchies of data and information. Finally, this definition clarifies that within the context of ECM, content also includes the so-called structured data. This new perception of content seems to mainly have value for scientific discourses. However, the fact that the practitioners' literature studied has not yet paid much attention to this type of content shows that the new definition can guide the further development of actual ECMSs.

3.2 Defining Enterprise Content Management

ECM is a relatively new concept within the field of information science. The existing body of literature on this topic is scarce (Nordheim and Päivärinta, 2006; Päivärinta and Munkvold, 2005) and a common understanding has not yet evolved (H. A. Smith and McKeen, 2003). Therefore, this section first comments on the word Enterprise in ECM and then describes the closely related term Content Management. Afterwards, the evolution of the term ECM is discussed. Finally, a synthesizing definition is proposed.

3.2.1 Enterprise information systems

The software market consists of software with different purposes, ranging from function Information Technology (IT) which is designed for supporting users with discrete tasks (e.g. spreadsheet software), over network IT (e.g. e-mail) to enterprise IT (McAfee, 2006). The latter — also known as Enterprise Systems (ESs) (Shang and Seddon, 2007) or Enterprise Information Systems (Yusuf, Gunasekaran, and Abthorpe, 2004) — is often used across an entire organization or even between several organizations and supports the real-time execution of business processes from beginning to end (McAfee, 2006; Shang and Seddon, 2002). In general, this kind of ISs is introduced in a top-down way by senior management and their implementation can entail massive changes in the structure of the organization such as new processes and dependencies (McAfee, 2006). ESs are usually comprised of packaged and integrated standard software (Shang and Seddon, 2007).
The word enterprise can imply that this technology is only used in large (potentially multinational) companies. However, enterprise IT is also used within public (cf. e.g. Bannister, 2001) or non-governmental (cf. e.g. Araujo and Araujo, 2006) organizations. Therefore, the broader term *organizations* is used when referring to companies, public administrations, non-governmental organizations etc. which use an ECMS.

3.2.2 Content Management

Content Management (CM) is a term broadly used in both the scientific literature and in the IT domain in general[3]. However, few definitions can be found in literature and instead, the term is just used without defining it (cf. e.g. Nakatsuka and Ishida, 2006). One source being commonly quoted also in scientific literature is Boiko (2005), a practitioner book, which gives the following definition: "[a]t the highest level, content management is the process behind matching what *you* have to what *they* want. You're an organization with information and functionality of value. They're a set of definable audiences who want that value. Content management consists of the processes and tools behind the distribution of that value" (Boiko, 2005, p.67). Using this definition as a basis, Benevolo and Negri (2007) further rationalize it by defining CM "as a system of methods and techniques to automate the processes of content collection, management and publishing using information technologies. CM bases its logic on the separation of content and its format" (Benevolo and Negri, 2007, p.10). Clark (2008) concurs by stating that a Content Management System (CMS) should use "markup, metadata, and tools to break documents into component parts, to a level of granularity (e.g., paragraph level, sentence level, word level) set by organizationally defined information models, and labeling each part with metadata that describe its meaning and relationships to other content" (Clark, 2008, p.38). A similar definition is given by Vitari and Ravarini (2009) who define CM "as the process of capturing, codifying, storing, and sharing information that is vital to an organization" (Vitari and Ravarini, 2009, p.250).
Often when the term CM is used, one should be speaking more precisely about Web Content Management (WCM) which is explained in more detail below (Benevolo and Negri, 2007; Vitari and Ravarini, 2009). However, CM also includes publishing to both electronic and print media, as for example catalogs, e-mails, or CD-ROMs (Benevolo and Negri, 2007; Boiko, 2005; Clark, 2008). The reasons for this multitude of publication channels come from a business perspective. Producing different texts about the same topic for different publications results in higher efforts and costs. Consequently, translation costs can raise as well, also in case that there is no overview of already translated texts. Finally, discrepancies between different sources of information could result in a decrease in customer satisfaction (Boiko, 2005; Mescan, 2004).

CM is technically supported by CMSs, which are mainly structured around the three main concepts of CM: collection, management, and publishing. Although these concepts do not necessarily translate directly into components, they can be used for grouping and understanding the functionalities offered by a CMS (Benevolo and Negri, 2007; Boiko, 2005), which are shortly

[3] A search at Google Scholar delivers about 38,700 results and at Google more than 40 million results.

major functionalities		definition
collection	authoring	supports the ”process of creating content from scratch”, which stays a manual activity after all. However, it can be supported by the CMS, e.g. by integrating the system with a word processor.
	acquisition	“process of gathering information that wasn’t originally created for [the] CMS”, from sources such as CD-ROM with photographs etc. and syndicated sources which have been designed for reuse, such as a news agency’s server (usually bulk import)
	conversion	changing the format or structure of content to meet the requirements of the CMS
	aggregation	“process of bringing disparate information sources into one overall structure”, e.g. through editorial processing, dividing it into components, or by adding metadata
management	repository	“the set of databases, file directories, and other systems structures (for example, custom settings for the CMS) that store the content of the system as well as any other data associated with the CMS”
	administration	for configuring the parameters and the structure of all parts of the whole system
	workflow	“responsible for coordinating, scheduling, and enforcing schedules and staff tasks” across all the whole CMS
publication	template system	templates are programs which convert the neutral content from the repository into the format and structure needed by a specific type of publication
	connections	“tools and methods used to include data from other (non-CMS) systems in finished publications”
	media support	provision of publication-specific services such as the generation of web pages, the generation of files for print publications, or a module for creating XML files

Table 3.2: Major functionalities of a CMS (Table adapted from Benevolo and Negri (2007), p.13; definitions from Boiko (2005), p.88 et sqq.).

described in table 3.2. It should also be noted that these three concepts can overlap and are interrelated in actual CMS (Benevolo and Negri, 2007).

As already mentioned, the perception of content handled in the CM domain closely resembles the literal perception of content presented in section 3.1.5. The strict separation of content and format limits CMSs to managing only a subset of organizational content since certain digital objects inseparably combine content and its format and are, according to this perception, not managed by a ‘pure’ CMS. This observation aligns with the fact that CMSs are originally rooted in Web Content Management Systems (WCMSs) which in general separate content and format (Benevolo and Negri, 2007; Boiko, 2005). Therefore, these definitions create the impression that CM is not different from ECM, but rather a part of it.

3.2.3 Evolution of the term Enterprise Content Management

In the remainder, the evolution of the term ECM is described by presenting and discussing several key definitions from the complete list of definitions presented in table A.1 which has been derived from studying the (to the author’s knowledge) currently available scientific literature on ECM listed in table 3.3 on the following page.

year	author(s)	title
2002	McNay	Enterprise content management: an overview
2002	Reimer	Enterprise Content Management
2003	H. A. Smith and McKeen	Developments in Practice VIII: Enterprise Content Management
2005	Sprehe	The positive benefits of electronic records management in the context of enterprise content management
2006	Dilnutt	Enterprise Content Management - Supporting Knowledge Management Capability
2007	Böhm	ECM-Markt - ein Strukturierungsansatz
2007	Reich and Behrendt	Technologien und Trends für Wissensarbeit und Wissensmanagement
2007	Rückel, Steininger, Riedl, and Roithmayr	Fallstudie: Einführung eines Enterprise-Content-Management-Systems
2008	Andersen	The Rhetoric of Enterprise Content Management (ECM): Confronting the Assumptions Driving ECM Adoption and Transforming Technical Communication
Characteristics of Financial Enterprise Content Management:		
2004	Kwok and Chiu	A Web Services Implementation Framework for Financial Enterprise Content Management
2005	Chiu and Hung	Privacy and Access Control Issues in Financial Enterprise Content Management
ECMS implementation, largely based on an ECMS project at Statoil:		
2003	Munkvold, Päivärinta, Hodne, and Stangeland	Contemporary Issues of Enterprise Content Management: The Case of Statoil
2004	Nordheim and Päivärinta	Customization of Enterprise Content Management Systems: An Exploratory Case Study
2006	Munkvold, Päivärinta, Hodne, and Stangeland	Contemporary Issues of Enterprise Content Management: The Case of Statoil
2006	Nordheim and Päivärinta	Implementing enterprise content management: from evolution through strategy to contradictions out-of-the-box
Additional publications from Munkvold, Nordheim, Päivärinta, and/or Tyrväinen:		
2003	Tyrväinen, Salminen, and Päivärinta	Introduction to the Enterprise Content Management Minitrack at the 36th Hawaii International Conference on System Sciences
2005	Päivärinta and Munkvold	Enterprise Content Management: An Integrated Perspective on Information Management
2005	Salminen, Tyrväinen, and Päivärinta	Introduction to the Enterprise Content Management and XML Minitrack the 38th Annual Hawaii International Conference on System Sciences
2006	Tyrväinen, Päivärinta, Salminen, and Iivari	Characterizing the evolving research on enterprise content management

Table 3.3: List of scientific literature on ECM.

For as far as it can be traced, the term ECM was mentioned for the first time in scientific literature in September 2002, however McNay (2002) used it in fact to only refer to 'Enterprise Web Content Management': "Enterprise Content Management is key in creating a dynamic, useful website. It ensures that you have your data organized in a logical structure and that the content is updated frequently by the owners of that information" (McNay, 2002, p.401). In the remaining literature, several definitions of the contemporary perception of the term can be found. Based on their particular definition of content, they can be broadly divided into two different groups.

The definition of the first group appears for the first time in an article published in November 2002 in which ECM is positioned as a technical concept centering "on the premise that all forms of content or unstructured data should be managed in a repository, independent of the applications utilizing the information. These concepts parallel first principals of structured data management and data base systems" (Reimer, 2002, p.18). In the remainder, the author describes several general functional requirements and the technologies needed for integrating content from already existing "[d]isjoint Content Management Systems" (ibid) which have been created for specific types of content. During these considerations, he clearly distinguishes ECMSs from structured data management systems such as relational databases (Reimer, 2002).

The AIIM, an international industry association focusing on ECM, follows its previously mentioned definition of content and also limits ECM to the management of 'unstructured information'. However, they perceive ECM as a broader concept as they do not limit it to being a technical concept but also include related methods and a strategic notion: ECM is "the technologies used to capture, manage, store, preserve, and deliver content and documents related to organizational processes. ECM tools and strategies allow the management of an organization's unstructured information, wherever that information exists. [...] Content must be managed so that it is used to achieve business goals. Central to this strategy are the tools and technologies of ECM, which manage the complete lifecycle of content, birth to death" (AIIM, 2005). The view of limiting ECM to un- and semistructured data is not only shared in the practitioners' literature evaluated in the following chapter, but scientific literature such as for example Andersen (2008) also cites the AIIM definition. Dilnutt (2006) also limits ECM to unstructured information, but does not quote any scientific source for defining ECM.

The first mentioning of the second group can be found in Tyrväinen et al. (2003) from January 2003 (an introduction to a conference minitrack) where ECM is described as focusing "on the management of textual and multimedia content across and between enterprises, emphasizing the coexistence of technical and social aspects within the content management. Methods and techniques applicable for managing textual and multimedia information with all sizes of content units, ranging from XML and database structures through web pages and documents to document collections, are studied as well as approaches focusing on specific content structures" (Tyrväinen et al., 2003, p.2). H. A. Smith and McKeen (2003)'s definition from May 2003 similarly defines ECM as an "integrated approach to managing all of an organization's information including paper documents, data, reports, web pages and digital assets" (H. A. Smith and McKeen, 2003, p.647) and "the strategies, tools, processes, and skills an organization needs to manage all its information assets (regardless of type) over their lifecycle" (H. A. Smith and McKeen, 2003, p.648). They also mention that part of organizing content is "linking content and databases together" (H. A. Smith and McKeen, 2003, p.652). This definition is followed by Chiu and Hung (2005), Kwok and Chiu (2004), Reich and Behrendt (2007), and Rückel et al. (2007).

The remaining scientific literature on ECM is dominated by a group of four Norwegian researchers from Agder University College in Kristiansand (Munkvold, Nordheim, Päivärinta, and Tyrväinen), who have presented various definitions and descriptions next to their initial definition from 2003 (cf. table 3.3 on the preceding page). That definition has evolved into the newest version from 2006: "ECM represents a modern concept of Information Resource Management in general, addressing the integration of semi- and unstructured data with the management of formal databases" (Nordheim and Päivärinta, 2006, p.649). In their latest publication (Tyrväinen et al., 2006), they also further specify the content lifecycle to include "activities such as content creation and capture, content editing, review, approval, content indexing, classifying and linking, content distribution, publication and use, update, preservation, format transformation for long-term archival, and retention" (Tyrväinen et al., 2006, p.631).

3.2.4 ECM as a field of IS research

In Tyrväinen et al. (2006), the authors' broad perception of ECM is further defined. They do not provide a new, more precise definition, but rather elaborate on their former description of ECM and state that ECM should be perceived as a field of IS research which incorporates the areas depicted in figure 3.1.

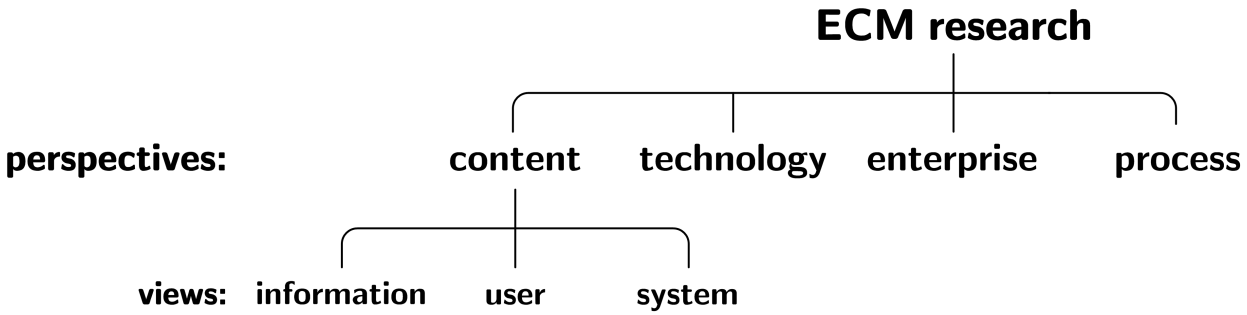

Figure 3.1: Fields of ECM research (Tyrväinen et al., 2006).

ECM research includes four perspectives. The content perspective is composed of three views: the information view is concerned with finding out how content can be structured for different purposes and within the user view, it is elaborated how content should be presented in order to fit the specific needs of the users. The systems used to manage content are the research subject of the system view. However, the actual technologies used within these systems are addressed by the technology perspective, as e.g. specific algorithms. The differences with the system view are that systems contain content and incorporate different technologies which operate on the content. The third perspective is the enterprise perspective, which "considers organizational, social, and business issues" (Tyrväinen et al., 2006, p.630). However, there has not been extended research on this subject yet, so that the definition of this perspective remains vague. Finally, the process perspective subsumes research about both the development and the deployment of ECMSs (Tyrväinen et al., 2006). In conclusion, ECM is a field of IS research which has some specific research areas of its own and aggregates research results of different other disciplines.

Despite the breadth of subjects, Nordheim and Päivärinta (2006) and Päivärinta and Munkvold (2005) regard ECM as a subfield of Knowledge Management (KM), since ECMSs can be used to capture and utilize content that contains explicit knowledge in repositories or to manage organizational knowledge resources (Lindvall, Rus, and Sinha, 2003). In turn, KM is considered to be a wider concept than ECM. However, this view is only partly valid. As Munkvold et al. (2006) and Päivärinta and Munkvold (2005) argue themselves, ECM also incorporates fields that are distinctly different from KM such as the long-term storage of content (preserving) or managing scans of invoices. By definition, this kind of content is not organizational *knowledge* which only exists in the heads of humans. Although in some cases ECMSs are used for supporting KM, it rather seems as if ECM and KM are in fact different fields of research that partly overlap each other (Dilnutt, 2006; Herschel and Jones, 2005; Kuechler and Vaishnavi, 2006), but which should neither be compared with nor be subordinated to each other.

3.2.5 Proposed new definition

The broad range of subjects covered by ECM shows that it is more than "the latest buzz-word" (Mescan, 2004, p.55). However, in view of the variety of partly contradicting and incomplete definitions, a synthesizing definition of ECM is required and the following one is used in this document as the answer to sub-question 2 *What is Enterprise Content Management?*, incorporating the previously provided definition of content:

**Enterprise Content Management is concerned with
the strategies, processes, methods, systems, and technologies that are necessary for capturing, creating, managing, using, publishing, storing, preserving, and disposing content across and between organizations.**

This synthesizing definition summarizes all relevant facets of ECM which have been mentioned in the past seven years of research on this topic and provides a common conceptual basis for further research in this field. It points out that ECM is not limited to technologies, but rather covers a wide range of subjects so that this definition is aligned well with the notion of ECM being an own field of IS research. The definition also includes a specification of the content lifecycle mentioned in previous definitions[4] and by that it further illustrates the breadth of the concept. Finally, it is based on the improved definition of the term content and therefore implicitly includes 'structured data' as a subject to be managed.

[4] Several of these stages are further specified in sections 4.3.1 and 4.3.2.

We shape our buildings; thereafter they shape us.

Sir Winston Churchill

4 Designing the Reference Architecture for ECM

The Reference Architecture for ECM presented in this chapter has been designed for answering sub-question 3: *What are the potential functionalities offered by Enterprise Content Management Systems?* In the following, the process of designing the RAE is described first. This includes descriptions of the requirements for the RAE and of the chosen design approach. Afterwards, the ISs preceding ECMSs are concisely described for achieving a deeper understanding of the potential functionalities offered by an ECMS. Then, the RAE is presented and explanations of its composition are given; all being accompanied by explications of the underlying theories. The chapter concludes with several additional observations regarding ECMSs.

4.1 Scientific need

Following the definition of ECM given in section 3.2.5, an ECMS should support organizations to capture, create, manage, use, publish, store, preserve, and dispose content. However, there is considerable disagreement both within the scientific literature as well as among the latter and practitioners' literature about the functionalities offered by an ECMS. Dilnutt (2006) has proposed an ECM architecture consisting of eight components. Other ECM literature such as for example Andersen (2008), Chiu and Hung (2005), Päivärinta and Munkvold (2005), H. A. Smith and McKeen (2003), and Sprehe (2005) mention these components as well but also include several additional components. Even more components can be found in practitioners' literature. Therefore, there is the need for an overview of all potential functionalities of ECMSs. In response to this need, the Reference Architecture for ECM (RAE) as a conceptual division of the potential functionalities provided by ECMSs (Hac and Mutlu, 1989) has been designed.

4.2 Design research process

Previous literature on reference architectures has provided the following three main purposes which the RAE should serve. The first purpose is a direct response to the scientific need presented above. The other two are of a more practical nature and fulfilling them should make the RAE suitable for applied research.

- P1: Provide a conceptual division of the potential functionalities offered by ECMSs (Hac and Mutlu, 1989), based on the current status of research, e.g. for unifying and rationalizing the further discussion on ECMSs.
- P2: Be an assessment tool for benchmarking/comparing the functionalities provided by existing ECMSs (Grefen and Vries, 1998).
- P3: Be a foundation for the development and design of new ECMSs (Angelov, 2006; Grefen and Vries, 1998).

4.2.1 Design requirements

Based on previous literature, the following design requirements have been defined for the RAE. Together with the three purposes defined above, these statements also represent the 'testable propositions' required by Jones and Gregor (2008).

R1: The RAE needs to be conceptually integral, i.e. there should be "an underlying theme that unifies the design of a system at all levels" (Angelov, 2006, p.172). This can be achieved by using an accepted design approach such as well-established architectural styles and patterns (Angelov, 2006; Bernus and Nemes, 1996; Grefen and Vries, 1998).

R2: It has to be generic so that it is supplier- and solution-independent and can be used for comparing ECMSs from different suppliers. In consequence, the RAE should hide low-level and supplier-specific details (Grefen and Vries, 1998; Williams, 1994).

R3: The RAE needs to be specific enough so that differences between implementations at different organizations can be captured and analyzed (Grefen and Vries, 1998).

R4: It needs to be complete, i.e. it has to include all possible functionalities currently described and has to be independent of the thought that there needs to be a concrete ECMS that meets all requirements (Angelov, 2006; Grefen and Vries, 1998; Williams, 1994).

R5: The RAE has to be "understandable and usable by the communities targeted" (Bernus and Nemes, 1996, p.180). In this case, the communities targeted are the ECM research and the ECM practitioners' ones.

R6: It needs to be constructed in such way that it is able to accommodate future changes (Bernus and Nemes, 1996).

4.2.2 Design approach

The RAE is designed by combining two perspectives. Subsection 4.3 elaborates on the scientific point of view on ECMSs. In subsection 4.4, sources from practitioners literature are studied. Both groups of sources have been evaluated with regard to potential components and functionalities of ECMSs. This resulted in a list of potential functionalities which, after combining and structuring it, has been transformed into the RAE presented in subsection 4.5.
The included non-scientific literature represents the "clinical perspective" described by Schein (1987)[5], who states that there often is a difference between what is being described in scientific literature and what practitioners believe to be "really going on" (Schein, 1987, p.13). In turn, he considers results obtained from clinical work as important for "the construction of variables and theoretical models" (Schein, 1987, p.54). Although he presents his arguments based on his experience in the social sciences, the underlying observation of a gap between research and reality in organizations also holds for IS research as it has been indicated in the introduction. Therefore, the usage of practitioners' literature representing results obtained through experience is also appropriate for this field of research.

4.3 Components and functionalities from scientific literature

A study of the currently available scientific ECM-literature (cf. table 3.3 on page 20) showed that an ECMS can include the following functionalities:

- Electronic Document Management (EDM)
- Electronic Records Management (ERM)
- Web Content Management (WCM)
  - Intranet
  - Organization's website

[5] The author thanks Richard Baskerville who pointed to the work of Schein at ECIS 2009.

- Workflow Management (WfM)
  - Business Activity Monitoring (BAM)
  - Business Intelligence (BI)
- Application integration with
  - Enterprise Information Systems
  - Client applications
- Additional functionalities
  - Capturing
  - Collaborative editing
  - Digital Rights Management
  - Digital signatures
  - Information retrieval
  - Imaging
  - Library services
  - Mobile use
  - Portal integration
  - Taxonomy

In the remainder of this subsection, the first four items of the above list (being positioned as the main elements of ECMSs) are described based on scientific literature. All sources mentioning these items and their definitions are provided in section A.2 on page XIX.

4.3.1 Electronic Document Management Systems

The first Document Management Systems were used to merely support the management of paper documents. Eventually, they evolved into Electronic Document Management Systems (EDMSs) which could both handle digital representations of documents and regular computer files (Sprague, 1995). EDMSs as a class of ISs usually offer the following core functionalities:

- **capture:** A digital image of an existing paper document is created by scanning it and the text is captured by means of Character Recognition (Sprague, 1995). In addition, "digital cameras, audio capture board, and computer graphics systems that produce animation are used for digitizing non-text information" (Sprague, 1995, p.37). The resulting files are then integrated into the EDMS. This activity is also called Document Imaging (Zantout and Marir, 1999).
- **creation:** 'Regular' applications such as word processors or graphic software can be used for creating documents and these files can be uploaded as well (Sprague, 1995).
- **metadata:** After capturing or creating a document, metadata for example about access rights and the author are added. This data is used for managing and retrieving documents (Dourish et al., 2000; Sprague, 1995).
- **collaborative editing:** Documents often need to be edited in a group. An EDMS offers group-authouring functionality which for example can merge different versions or which prevents that several employees work on the same version of a document. Next to this, documents can also be commented on or be approved for publication (Zantout and Marir, 1999).
- **library services:** They are defined as document control mechanisms such as checkin/-out; version control; displaying a version history; managing the access, authenticity, and security of documents (Cleveland, 1995; Dilnutt, 2006; Sprague, 1995; Zantout and Marir, 1999).
- **management reports:** Overviews about the administrative properties of documents can be produced, for example about the author, access right, and recent activities (Sprague, 1995).

To summarize, EDMSs are responsible for the capturing, managing, using, and storing parts of the document life cycle (Dilnutt, 2006).

4.3.2 Electronic Record Management Systems[6]

The element of concern within Records Management are records, which are defined as "information created, received, and maintained as evidence and information by an organization or person, in pursuance of legal obligations or in the transaction of business" (ISO, 2001, p.3). The scientific literature elaborates that a "record is always associated with some action or event, as an agent, product, or by-product; a record includes, at a minimum, a definable set of metadata that serves to provide evidence about that action or event" (Gilliland-Swetland, 2005, p.224). This definition implies that not all documents are records but are rather declared being one at a certain point of time (Johnston and Bowen, 2005). The above definition refers to mechanically created records, but is also the basis for the definition of an electronic record which "is a record made or received and set aside in electronic form" (Duranti, 2001, p.272).
The term ERM is defined less precisely since it has become "a blanket term that refers both to the practical management of electronic records, from birth to final disposition, and to theoretical and applied research relating to the nature, management, and use of those records" (Gilliland-Swetland, 2005, p.224 et seq.). In the remainder of this text, the first meaning is referred to because it is used within the context of Electronic Records Management Systems (ERMSs), which are "automated system[s] used to manage the creation, use, maintenance and disposal of electronically created records for the purposes of providing evidence of business activities. These systems maintain appropriate contextual information (metadata) and links between records to support their value as evidence. ERMS are a subset of business information systems whose primary purpose is the capture and management of digital records" (National Archives of Australia, 2006, p.66).
In the following, the core functionalities provided by an ERMS are described. This list has been composed by comparing the ISO standard 15489-1 (ISO, 2001), the Model Requirements for the Management of Electronic Records (Serco Consulting, 2008) prepared for the European Commission, and the Functional Specifications for Electronic Records Management Systems Software (National Archives of Australia, 2006).

- **metadata:** Electronic Records are to be accompanied by relevant metadata, as for example date or author.
- **capture:** An ERMS can register electronic records in any file format, ranging from regular text-documents over e-mails to blogs. Scanning of paper documents is on the one hand seen as part of the capturing process (Serco Consulting, 2008), on the other hand as part of the EDMS (National Archives of Australia, 2006).
- **store:** Records are stored in the ERMS in such a way that they remain physically accessible on their storage media, also in case of disasters.
- **use:** The records contained in an ERMS are searchable by a large number of criteria. Records selected by the user are retrieved from the system and presented (this includes for example playing audio or video files).
- **preserve:** Contained records are kept in a format so that they remain accessible during their whole lifecycle. This functionality is different from the store one as is e.g. also includes migrating records between different storage media.
- **retention and disposition:** Not all records have to be kept for an unlimited amount of time. Retention and disposition schedules define how long records have to be kept as well as how and why they should be disposed. Depending on the requirements, the disposition can occur automatically or needs to be controlled by authorized personnel.
- **management reports:** Reports about all activities and statuses within in the ERMS can be produced, for example over user activities, permissions, or disposition dates.

In addition, the use of electronic signatures and encryption are mentioned as optional features (National Archives of Australia, 2006; Serco Consulting, 2008). ERMSs are usually integrated with the previously described EDMSs (National Archives of Australia, 2006; Serco Consulting,

[6] This subsection only focuses on presenting some minimal definitions of and thoughts on ERM. The reader is referred to Gilliland-Swetland (2005) for an elaborate description of this field of IS research.

2008) and by allowing the archiving of documents, ERMSs add the preserving, retaining, and disposing parts of the document life cycle (Dilnutt, 2006). Finally, ERMSs can also be integrated with Workflow Management Systems (WfMSs) (National Archives of Australia, 2006; Serco Consulting, 2008), which are described in the following subsubsection.

4.3.3 Workflow Management Systems

The third main ECMS-component are WfMSs which became broadly used during the early 1990s (Aalst, 2004; Stohr and Zhao, 2001). The raise in interest lead to the foundation of the Workflow Management Coalition in 1993, an international organization bringing together suppliers, implementors, and researchers engaged in WfM (Workflow Management Coalition, 2008). This organization has issued the following definitions of the fundamental terms used in this area.

A workflow is the "automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules" (Aalst, 2004, p.6). A WfMS is a "system that defines, creates and manages the execution of workflows through the use of software, running on one or more workflow engines, which is able to interpret the process definition, interact with workflow participants and, where required, invoke the use of IT tools and applications" (Aalst, 2004, p.6). In Aalst and Hee (2004), a more elaborate description definition can be found, namely that a WfMS "supports business processes by taking on their information logistics. In other words, workflow management systems ensure that the right information reaches the right person at the right time, or is submitted to the right computer application at the right moment. A workflow management system does not, therefore, actually perform any of the tasks in a process" (Aalst and Hee, 2004, p.xv). The result is that information about the process is not hard-coded into a single application, but managed by the WfMS, even different ISs are required for supporting the process (Aalst and Hee, 2004).
WfMSs center on handling process and activity instances, which are defined as the "representation of a single enactment of a process, or activity within a process, including its associated data. Each instance represents a separate thread of execution of the process or activity, which may be controlled independently and will have its own internal state and externally visible identity" (Workflow Management Coalition, 1999, p.15). A process instance is also called case (Workflow Management Coalition, 1999) and can also be considered to be the 'product' which is created by the particular workflow. Aalst and Hee (2004) note that every case has a specific set of conditions based on which a particular workflow is chosen to solve the case in the first place. The conditions also determine the activities to be carried out within a workflow (Aalst and Hee, 2004). Examples of case results are a granted parking permit or a finished assurance claim (Aalst and Berens, 2001; Aalst and Hee, 2004).

WfMSs can be divided into two different categories according to the type of workflow they support. The first main type are *ad hoc workflows* which represent processes, "where there is no set pattern for moving information among people [and whose] tasks typically involve human coordination, collaboration, or co-decision. Thus, the ordering and coordination of tasks [...] are not automated but instead controlled by humans" (Georgakopoulos, Hornick, and Sheth, 1995, p.125). They are usually performed in knowledge-intensive environments (Stohr and Zhao, 2001). A second category is formed by administrative or *production workflows*. They are used in "routine, clerical situations that demand efficient, consistent and accurate execution of fairly standard processes" (Stohr and Zhao, 2001, p.286). The order of the tasks is defined beforehand and their coordination can be automated. Production workflows differ from administrative workflows in the facts that they are more complex and that they usually involve accessing a number of different ISs (Georgakopoulos et al., 1995).

In Aalst (2004), this categorization is extended to the model presented in figure 4.1 on the following page. The horizontal axis captures the main driver of the IS: a data-driven workflow focuses on the information needed for accomplishing the goal of a process whereas a process-driven workflow's

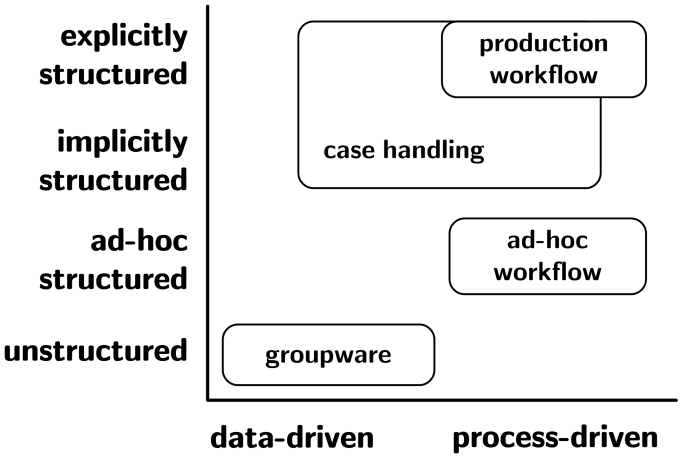

Figure 4.1: Classification of systems to support work processes (Aalst, 2004, p.30).

focus is more on the order of the tasks. On the vertical axis, the degree of structuredness of the tasks to be performed is plotted (Aalst, 2004). A new type of WfMS being introduced are *case handling* systems which place the single case in the center of attention and "not the activities or the routing from one [worklist] to another" (Aalst and Berens, 2001, p.43). They provide all information available to the user who, based on this information rather than on the activities performed before, decides what to do next (Aalst and Berens, 2001; Aalst, 2004). The second new term *groupware systems* refers to for example Lotus Notes or Microsoft Exchange (Aalst, 2004).

4.3.4 Website Content Management

WCM is defined to incorporate "the activities involved in the creation and deployment of digital content to Web based audiences, where these audiences may consist of customers, suppliers, partners and staff accessing Web content via extranet, Internet, or intranet. A WCM system consists of the software tool(s) used to provide automated support of WCM activities" (McKeever, 2003, p.688). This view is supported by Vidgen et al. (2001) who characterize WCM "as an organizational process, aided by software tools, for the management of content on the Web, encompassing a life cycle that runs from creation to destruction" (Vidgen et al., 2001, p.466). One of the central characteristics from most WCMSs is the clear separation of content and format (Clark, 2008; McKeever, 2003). Therefore, WCMSs can be qualified as a subcategory of CMSs since they focus on only one publication channel and the following functionalities of a WCMS described in McKeever (2003) are also comparable to the ones offered by a CMS.

- **content collection:** e.g. simple easy to use interface, multi-user support, distributed authorship, versioning, localization
- **content delivery:** e.g. support for dynamic content, automated site changes, content personalization
- **workflow component:** for development and approval processes, including monitoring features and support for workgroups
- **control and administration:** e.g. user administration, system configuration, reporting functions about site usage

A different list of functionalities is given in Benevolo and Negri (2007). However, this list contains a number of inconsistencies and also overlaps with other ECMS components so that it is refrained from presenting it here.

4.4 Components and functionalities from practitioners literature

Since the number of scientific publications on ECM and ECMSs is limited, publications from the ECM industry have been evaluated for constructing the RAE as well. The sources presented in table 4.1 have been selected because they represent a broad mix of descriptions of two frequently employed ECMSs as well as of texts from an often referenced industry association, from consultants, and from market researchers.

	source(s)	description
1	AIIM (2005); Pelz-Sharpe (2008); Regli and Kas (2008)	Sources published by the AIIM. The first source is a general description of ECM and ECMSs, whereas the third one is an article published in their Infonomics magazine. The second source is an article in the 'buying and implementation guide' of the AIIM.
2	Doculabs (2004)	A report from Doculabs, an IT consulting company. The report presents a logical ECM reference model which is — despite its name — more a technical description of an ECMS than a functional reference model.
3	Doculabs (2005); International Business Machines Corporation (2008)	The former is a report which mainly describes how Business Process Management and ECM can be integrated in an Enterprise IT Architecture, but also contains the Reference Architecture of the ECM solution FileNet P8. This architecture is more function-oriented than the previous one, but also contains a large number of technical details. The second source is the Filenet P8 System Overview from IBM.
4	Kampffmeyer (2006)	A White Paper on ECM published by Dr. Ulrich Kampffmeyer, the founder of a consulting company specialized in document-related technologies.
5	Glazer, Jenkins, and Schaper (2005)	A book published by the Open Text Corporation, a large supplier of ECMSs.
6	Forrester Research, Inc. (2007)	A vendor comparison report published by the technology and market research company Forrester, Inc.

Table 4.1: Groups of sources from practitioners' literature used for designing the Reference Architecture for ECM.

Almost all sources have also mentioned the functionalities derived from scientific sources. In addition, the features presented below have been described in practitioners' literature. Their definitions can be found in section A.2 on page XIX as well.

- Capturing
  - content aggregation
  - digital forms
  - digital sources
- Collaboration: project management
- Component Content Management (CCM)
- Digital Asset Management (DAM)
- Publication
- E-Mail Management
- ERM: management of physical records
- Messaging Management
- Presentation: desktop application
- Repository
  - analog storage

    - auditing support
    - localization
- WCM: extranet

4.5 The Reference Architecture for ECM

The previously described potential functionalities of ECMSs have been combined into the RAE depicted in figure 4.2 on the facing page. The definitions of the RAE's elements can be found in section A.2 which also shortly comments on some of the ECMS modules which provide the functionalities depicted in the RAE. In the remainder of this section, the design decisions that have been taken during the design of this artifact are explicated and related to the previously defined design requirements. The explication also includes a description of the RAE's general 'principle form and function'.

The underlying idea of the RAE is to design it as a layered architecture (R1, R6), which is a common technique to structure complex technical issues (Buschmann, Meunier, Rohnert, Sommerlad, and Stal, 1996, p.31; Fowler, 2003, p.17). The RAE is a modified version of the 'classical' three-layer pattern, separating presentation logic, domain logic, and data source (Fowler, 2003, p.19 et seq.). The domain logic has been further split into the process and services layers (Fowler, 2003, p.30 et seq.). This division and the naming of these two layers have been adopted from Doculabs (2004) and Linthicum (2007) (a meta-model for Service Oriented Architectures developed by a consulting company which has also been used by Ganser, Hurtz, and Lichter (2008), Noran and Bernus (2008), and Santillo (2007)). Finally, the lowest layer has been renamed to infrastructure as the contained components form "the underlying foundation" (Merriam-Webster Online Dictionary, 2009) of ECM. The original name 'data' was not suitable since the repository potentially contains both data and information. The layers are further modularized into components so that the RAE cannot only be easily extended with new components or functionalities but can also be broken down into more details if necessary so that the RAE is easily mutable (R3, R6).
In addition, the process and services layers are to a certain extent structured horizontally (R1). Within the process layer, the analysis component not only processes data from lower layers, but also from the other two components. This results in an information flow from left to right. This horizontal flow is present even more in the services layer. These components have been named according to the three main concepts of CM presented in section 3.2.2, except for the first one (capturing) which is labeled with the term that is common for the ECM domain (Päivärinta and Munkvold, 2005). Via the functionalities of the capturing component, content is imported into the ECMS. Depending on the nature of the content, it is managed by one or more of the modules within the management component. Finally, content can be transferred to external parties via the publication component. Throughout the arrangement of the functionalities into different layers and components, it has been made sure that they are functionally decomposed, i.e. that "at each level, the identified sub-components provide functionalities that are non-overlapping with " (Angelov, 2006, p.173) other components which increases the modifiability (R6). The decomposition is also the reason why the management component is limited to the types of content and does not include further functionality as it would need to be duplicated among different types of content and also since implementations are supplier-specific (R2).

As mentioned in section 5.2.2.1, the main goal of the RAE is to operationalize the influencing factor functional scope as an independent variable for the course of this specific research. Therefore, R3 was of high importance during the design and the level of detail has been chosen in such a way that cases could be mapped to it by respondents (R2, R5), i.e. so that it was practical for conducting a CSR. This decision had two major consequences. First of all, it has been refrained from including components for access and authorization of users since these are considered to be technical details that also do not influence the impacts (R2). Secondly, it was decided not to assign meaning to the size of individual elements since the relative size and importance of a component

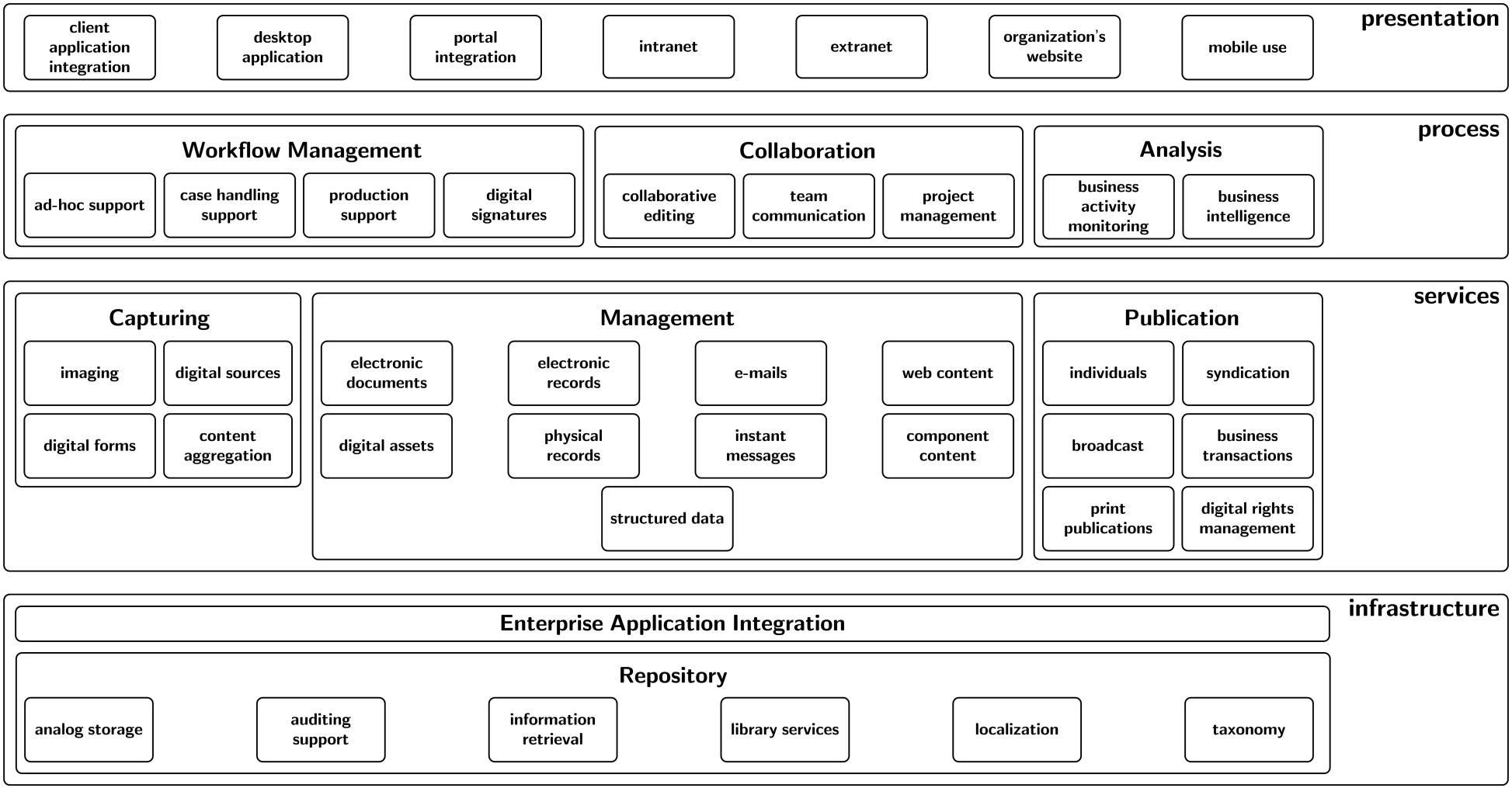

Figure 4.2: Reference Architecture for ECM.

or even its mere availability can vary per supplier and individual ECMS implementation (R2, R3). By focusing on the fact whether a certain functionality is available or not, different ECMS implementations can be compared with each other more easily (R2, R3, R5). The remaining requirement R4 has been tried to fulfill by studying a very broad set of literature and creating a 'set union' of the described functionalities.

4.6 Additional observations

During the literature study, three noteworthy issues have been encountered.

4.6.1 ECMSs as middleware

For reasons of completeness, it should be mentioned that a different view regarding the main purpose of an ECMS can be found in literature. Although Bandorf et al. (2004) agree that an ECMS includes components for EDM, WCM, portals, and information retrieval, they consider ECMSs to be mainly a content middleware infrastructure. In their perception, the ECMS itself only stores metadata which describes content that is stored in repositories managed by other systems (i.e. file systems, databases, and applications). The ECMS integrates the various repositories and provides other applications with access to these 'content stores' (Bandorf et al., 2004). Related to the functionalities mentioned above, this point of view would mean that the Enterprise Application Integration (EAI) component is the central component of an ECMS. Since only Reimer (2002) has been found to partly agree on this perception, it is not further elaborated on.

4.6.2 Management of structured data

As described above, ECM is also concerned with the management of structured data. The BAM and BI components are often used for analyzing structured data about workflow initiations and therefore ECMSs already contain certain functionality for managing structured data. However, hardly any source further elaborates on this topic, for example by explaining how other sources of structured data are accessed and managed in practice. H. A. Smith and McKeen (2003) mention that data bases and data warehouses can be used for managing structured data, but for example do not define whether these databases are part of the ECMS or whether an ECMS needs special components next to the ones previously mentioned. Even exponents of the inclusion of structured data in ECM state that "ECM and ERP systems [containing structured data, ed.] clearly represent two different approaches to such issues as workflow and data management" (Nordheim and Päivärinta, 2004, p.7) or describe a project where the structured data remains in the ERPS and is only linked to content stored in the ECMS (Päivärinta and Munkvold, 2005). These observations confirm the previous conclusion that the EAI component of an ECMS presumably plays an important role in the management of structured data. It is also assumed that this component needs to be combined with a special management module for structured data, e.g. for Extraction, Transformation and Load operations. Further research is required for elaborating on this topic.

4.6.3 ECMSs as multi-product software

The descriptions of the different ECMS-components show that an ECMS offers functionalities which are very different, if not entirely opposite, from each other. ERMSs are designed to protect content from changes, potentially for an unlimited period of time and even if it has become outdated. An EDMS allows changes to occur, but normally tracks them so that old versions of a document can be reverted to. Systems for DAM can for example be used to handle large video files which require different user interfaces than programs that display scanned documents. All

three kinds of systems almost inseparably combine content and its layout. On the other hand, WCMSs and Component Content Management Systems usually use a Database Management System (DBMS) to clearly separate content and layout and are also designed to usually present only the newest information available.

These dissimilar characteristics and the diversity of functionalities offered lead to the conclusion that although ECMSs are marketed under a single term, implementing an ECMS will be an integration of several individual applications (Reich and Behrendt, 2007). This view is concurred by the history of ECMSs which are rooted in different classes of ISs. Some suppliers of traditional EDMSs/ERMSs have extended their products with WCM functionality by acquiring specialized companies, some traditional suppliers of WCMSs have done the opposite (Dilnutt, 2006). The product pages of for example EMC Documentum or IBM Filenet (two major ECM products) show a multitude of available packages, most of them covering only a single area of the RAE. Böhm (2007) even argues that certain functionality is not covered by software from the ECMS providers, but rather by specialized third-party software.

Therefore, a parallel can be drawn with the best-of-breed approach of ERPS implementations: instead of introducing only a single ERPS that needs to cover all functionality, several standard and custom-made applications are integrated with each other. It is known that this approach requires a different implementation process than the introduction of a single system (Light, Holland, and Wills, 2001) and it can be assumed that this is also true for ECMSs. However, no literature could be found that analyzes the process of 'multi-product implementation' within the context of ECMSs and therefore, this topic also remains for further research.

Research is the process of going up alleys to see if they are blind.

Marston Bates

5 Defining the ECMS impact model

The first section of this chapter elaborates from a theoretical perspective on the dependent variable of this research — the impacts of implementing ECMSs. A literature study is conducted for determining potential impacts of implementing ECMSs. Then, a framework for categorizing these impacts is designed. The combination of the impacts and the framework is part of this variable's operationalization. The second section focuses on the independent variables by explicating their choice and by describing how these variables are operationalized during the CSR.

5.1 Designing the impact framework

This section elaborates on the impacts of implementing ECMSs as the dependent variable of this research. Sub-question 4 *Which impacts can occur when an Enterprise Content Management System is implemented in an organization?* is not only answered by evaluating ECM literature. In addition, literature about related classes of ISs is studied since ECMSs for example consist of various older types of ISs. Afterwards, a framework for categorizing impacts is designed which is the main contribution towards the answer to sub-question 5 *How can the impacts of implementing Enterprise Content Management Systems be categorized and operationalized?* The final piece of the answer is provided by the impact coding scheme created in section 6.1.1.2.

5.1.1 Potential impacts of implementing ECMSs

Merriam-Webster defines an impact as "the force of impression of one thing on another : a significant or major effect" (Merriam-Webster Online Dictionary, 2008c). This broad definition is followed in this document, i.e. the word impact refers to the consequences having occurred due to the implementation of an ECMS. Serving as the preliminary answer to sub-question 4, table A.2 on page XXVIII presents potential impacts of implementing ECMSs which have been described in literature. Next to the description of the impact, the table also contains a column denoting for which type(s) of IS the described impact has been observed. Table 5.1 on the following page also lists the sources studied and characterizes the type of IS or the topic they have examined. It needs to be mentioned that strictly speaking, governmental or non-profit organizations do not have customers and that therefore the word 'customer' should be replaced by clients. However, in order to avoid unusual terms such as for example 'client service improvement', the word customer has been put in between single quotes.
Most of these studies are qualitative in nature. A much more quantitative approach has for example been taken by Dehning and Richardson (2002), who evaluate the impact of introducing ERPSs on the financial figures (net profit margin, return on assets etc.) of several companies. Due to the current, not yet sophisticated state of research on ECM, this kind of research is out of scope and has not been included in this research.

	source	research focus
1	Aalst and Hee (2004)	WfMSs
2	Aalst, Hofstede, and Weske (2003)	WfMSs
3	Andersen (2008)	ECMSs
4	Ash, Berg, and Coiera (2004)	Patient Care Information Systems
5	Chiu and Hung (2005)	ECMSs
6	Davenport (1998)	ERPSs
7	DeLone and McLean (2003)	success of ISs
8	Dilnutt (2006)	ECMSs
9	Doherty and Perry (2001)	WfMSs
10	Gattiker and Goodhue (2004)	ERPSs
11	Hendricks, Singhal, and Stratman (2007)	ERPSs
12	Karimi et al. (2007)	ERPSs
13	McAfee (2002)	ERPSs
14	Newell, Huang, Galliers, and Pan (2003)	ERPSs
15	Nordheim and Päivärinta (2006)	ECMSs
16	Päivärinta and Munkvold (2005)	ECMSs
17	Reijers and Aalst (2005)	WfMSs
18	Richard, Thirkell, and Huff (2007)	Customer Relationship Management Systems (CRMSs)
19	Shang and Seddon (2002)	benefits of ESs
20	H. A. Smith and McKeen (2003)	ECMSs
21	Sprague (1995)	EDMSs
22	Sprehe (2005)	ECMSs
23	Symons (1991)	IS evaluation
24	Tyrväinen et al. (2006)	ECMSs
25	Zantout and Marir (1999)	EDMS

Table 5.1: Sources of impacts and respective research foci.

5.1.2 Design research process

The previously created list of potential impacts is not practical with regard to the goal of this research, namely to relate influencing factors with impacts of ECMS implementations. A simple list does for example not allow determining potential relations among different impacts nor does it deliver insights into the nature of the impacts. Therefore, a framework is needed which allows categorizing impacts and it is designed in the following. Its purpose is to operationalize the dependent variable of this research, i.e. the impacts of implementing ECMSs, so that it can be related to the independent variables. The scope of the artifact is aligned with the scope of this research which means that it is limited to evaluating impacts at single organizations. The following requirements have been defined by the author. Together with the artifact's purpose, they constitute the testable propositions required by Jones and Gregor (2008).

- R1: The framework has to provide a way to gain detailed insights into the nature of the impacts by providing categories that can e.g. differentiate types of impacts and parties concerned.
- R2: The chosen (sub-)categories should be mutually exclusive and collectively exhaustive to the greatest extent possible.
- R3: All impacts identified during this research have to fit into the framework.
- R4: Both qualitative and quantitative impacts should fit into the framework.
- R5: The framework should be constructed in such way that it is able to accommodate future changes.

The mutually exclusive and collectively exhaustive (sub-)categories also represent the artifact's principle of form and function. Taking into account these requirements, the artifact qualifies both

as a construct since it defines terms, but to a certain extent also as a model since the categories depict relations among the different impacts. The categorization frameworks from previous IS research which were used as the basis for this design research are described in the remainder of this subsection. The definitions of the categories given there and the definitions of the impacts in table A.2 represent the constructs of the newly designed artifact. Afterwards, the three frameworks are combined into the new impact framework.

5.1.2.1 Frameworks from previous IS research

In literature, three frameworks for categorizing the potential impacts of implementing ISs have been found and they are presented next.

Smithson and Hirschheim

Smithson and Hirschheim (1998) define five levels of IS evaluation. National or international IS impacts are evaluated on the *macro* level, e.g. the influence of IS on national productivity. The *sector* level is concerned with research on a specific industrial sector. Then there are the *organization*[7] and *application* levels. Finally, the impacts of IS on *stakeholders* other than the organization itself can be analyzed, e.g. on customers or the community (Smithson and Hirschheim, 1998). At the organization level, impacts can in turn be divided into the four subcategories *economic* (e.g. "costs, output"), *organizational* (e.g. "changes in organizational structure or procedures"), *social* (e.g. "quality of working life, organizational culture"), and *management* (e.g. "information access and decision making") (all quotes from Smithson and Hirschheim (1998), p.161.).
Considering the purpose and scope of this artifact, this classification is not fully applicable. Since this research aims at evaluating the impacts of a certain class of applications on an organization and its stakeholders, the analysis would concern three levels at once. Although Smithson and Hirschheim (1998) do not describe the levels as being exclusive during the analysis, mixing them does not seem to be desirable. In addition, impacts 21 (enabling worldwide expansion) and 29 (increased IT infrastructure capability) cannot be placed in the levels, breaching R3.

Bouwman, Hooff, Wijngaert, and Dijk

Another categorization of impacts of ISs[8] developed by Bouwman et al. (2005) is presented in figure 5.1 on the next page. The first main category are impacts on the *individual*. Quoted impacts range from enhanced productivity of individual tasks over empowerment to decreased employee satisfaction. The second main category *organization* has been divided into the subcategories *processes* and *structures*. The former includes impacts as for example increased efficiency, external effectiveness, and other characteristics of the organization's business processes. A further subdivision has been done for the sub-category structures. Following a model presented in Fulk and DeSanctis (1999), this subcategory is split into *horizontal coordination*, *vertical control*, *types of connection* as well as *size, scope, and product domain*. Impacts of the category horizontal coordination are for example the reduction of transaction costs of cross-functional or virtual teams. This can result in a decrease of vertical control, i.e. the control of employees by their superiors. The size of an organization, e.g. with regard to number of employees or hierarchical layers, can change due to IS and the same is true for the activities carried out by the organization (scope) or the products offered (product domain) (Bouwman et al., 2005). The types of connection refer to the relations that exist in and among organizations, but Bouwman et al. (2005) do not elaborate further on this category. In the original work, these categories describes how organizations can design their relations with other organizations, e.g. with strategic alliances or federations (Fulk and DeSanctis,

[7] In their article, Smithson and Hirschheim (1998) call it firm level.
[8] To be precise, Bouwman, Hooff, Wijngaert, and Dijk (2005) describe effects of information and communication technology in general.

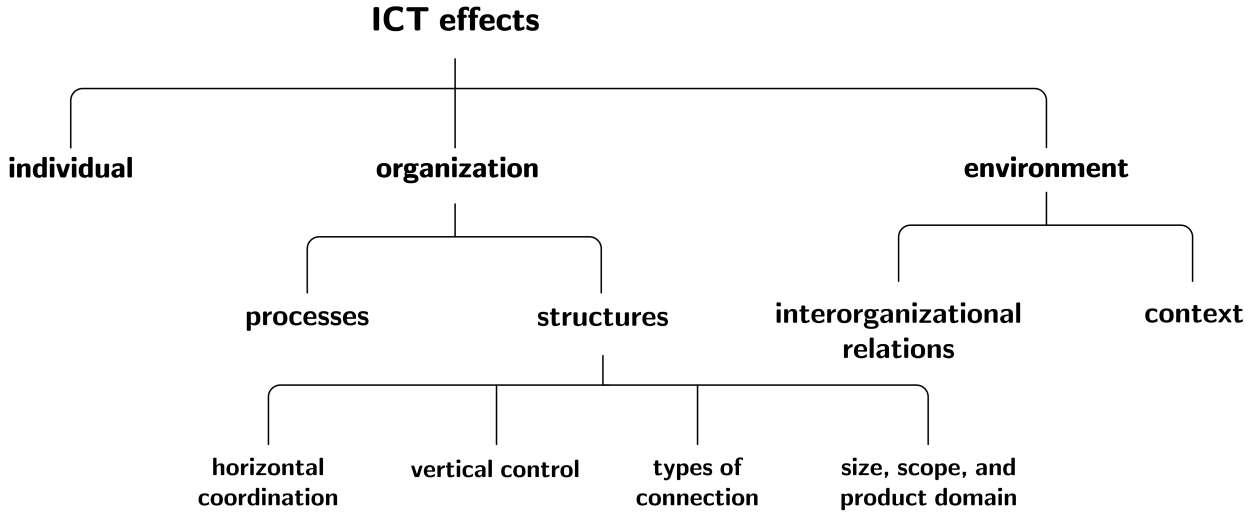

Figure 5.1: Effects of ICT in organizations (Bouwman et al., 2005, p.116 et sqq.).

1999). *Environment* is the final main category and consists of the two sub-categories *interorganizational relations* and *context*. The former is concerned with the different forms of cooperation with competitors, suppliers, and customers. One example is the current trend of changing the interorganizational relationships from a value chain to a value network. In the latter sub-category, the general economic movement towards an information economy is described.
When looking at the impacts listened in table A.2, it becomes apparent that several impacts cannot be placed in this classification, violating R3. A changed organizational culture can by definition (Merriam-Webster Online Dictionary, 2008b) not occur at a single individual. Following the definitions of the elements in the category organization, this impact also does not fit into this category. The same holds for the impact social conflicts. Next to this problem, impacts 13 (risk mitigation), 16 (increased compliance), and 17 (deteriorated business adaptability) do not belong to the third category, neither do they fit into any of the headings of the category organization. Finally, enhanced 'customer' integration and improved 'customer' relations clearly belong into the third category, yet do not form part of one of the subcategories (R2). In addition, this framework also has a shortcoming regarding the mutual exclusiveness of the categories. The category 'types of connection' is located under the main category organization, although it describes impacts of the third main category environment in the original research. Finally, environment's sub-category context exceeds the scope of this research.

Shang and Seddon

Shang and Seddon (2002) have presented a framework for categorizing benefits of ESs. Based on an extensive literature study, they define the following five areas:

1. Operational: impacts on "day-to-day activities that involve acquiring and consuming resources [which] are usually repeated periodically" (Shang and Seddon, 2002, p.278)
2. Managerial: This dimension comprises impacts on activities such as resource allocation, operations monitoring, and support of strategic decisions.
3. Strategic: The third dimension includes the impacts on high-level, long-range planning decisions.
4. IT infrastructure "consists of sharable and reusable IT resources that provide a foundation for present and future business applications" (Shang and Seddon, 2002, p.279) and it is impacted by the implementation of new ESs.
5. Organizational: Benefits "in terms of focus, cohesion, learning and execution of [the organization's] chosen strategies" (ibid) are subsumed in the final dimension.

The framework appears to be exhaustive and all impacts described in table A.2 can be placed into this framework, even though for example placing impact 33 (enhanced 'customer' integration)

would not be distinct: on the one hand, it is a strategic impact (since it concerns building external linkages), but on the other hand it can also be an operational one (since it potentially concerns day-to-day activities carried out by employees). The main point of criticism however is that the amount of just five categories is too limited for fulfilling R1.

5.1.2.2 Enhanced impact framework

Since it has been demonstrated that all three frameworks presented above are not entirely suitable for this specific research, the new framework presented in figure 5.2 has been designed. It addresses the mentioned shortcomings and fulfills all five requirements.

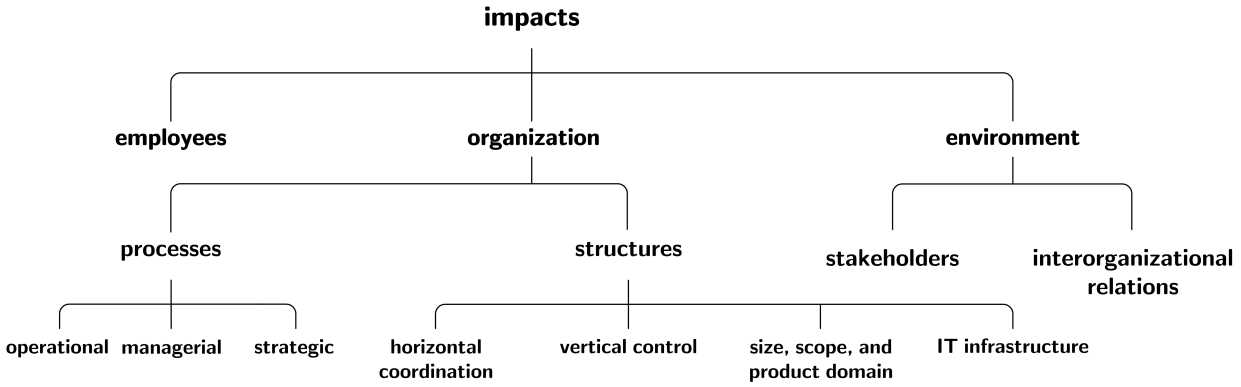

Figure 5.2: Enhanced impact Framework (Bouwman et al., 2005; Shang and Seddon, 2002; Smithson and Hirschheim, 1998).

The framework from Bouwman et al. (2005) served as a basis for the design because it is already very detailed and, other than the levels from Smithson and Hirschheim (1998), does not encompass different foci of analysis. It has been combined with elements from the framework of Smithson and Hirschheim (1998) and the name of the original category 'individual' has been changed to 'employees' so that group effects can be captured as well. The framework from Shang and Seddon (2002) has also provided two major inputs. The idea of categorizing processes into operational, managerial, and strategic ones has been incorporated. In addition, the category 'IT infrastructure' has been included as well in order to render the framework more IT-specific (R1).[9] This change of the categories shows that the structure of the framework is extendable so that future changes and additions (such as for example the inclusion of financial figures or a further detailing of categories) can be expected to be easily realizable (R5).

Table 5.2 on the next page (the impact table mentioned in table 2.2 on page 10) shows the results of categorizing the impacts from table A.2 according to this framework (R3, R4). It should be noted that a number of impacts could be categorized differently and therefore the reasons for their categorization are described. Applying a less strict interpretation, all impacts from the category structures could be categorized as impacts on operational or managerial processes. However, the four categories under structures are more specific than the three process categories and therefore allow more precise insights into the nature of the impacts. The argumentation also holds for the impacts of the category context which could be considered to belong to the categories managerial or strategic processes. This explanation shows that the newly designed framework violates R2 to a certain extent, which on closer examination partly conflicts with R1. Since the latter is the main goal of the framework, the limited violation of R2 is acceptable.

[9] Actually, the framework might also be used for categorizing impacts of various organizational decisions if the category 'IT-infrastructure' would be called assets instead.

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user (dis)satisfaction
			4	facilitating organizational learning
			5	concentration on core work
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	risk mitigation
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	deteriorated business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table 5.2: Categorized potential impacts of implementing ECMSs.

5.2 Determining potential influencing factors

After creating an understanding of the dependent variable, the independent variables of this research are defined in this section. These are formed by factors which influence the impacts of implementing an ECMS, as it is reflected in both the research question and sub-question 6. The word factors refers to the "individual, organizational, and technological forces which are important to" (Cooper and Zmud, 1990, p.123) the results of ECMS implementations.

5.2.1 Previous IS research

The existing literature on ECM does not mention any factors which influence the impacts of implementing ECMSs. Therefore, the literature on ERPSs has been studied for obtaining potential factors what follows the train of thought from Nordheim and Päivärinta (2006). Although ERPSs in general provide more functionalities than ECMSs, they are considered as a comparable class of ISs: ERPSs are meant for the holistic management of business processes, supporting them from beginning to end (Davenport, 1998) and the goal of ECMSs is the holistic management of content by supporting the entire content lifecycle. In turn, there is a large chance that impacts of both ISs are influenced by similar factors.

This first paper studied is concerned with Material Requirements Planning Systems (MRPSs), the predecessors of ERPSs. Cooper and Zmud (1990) have determined that two factors influence the degree to which this type of IS gets adopted in an organization, namely the characteristics of the MRPS itself and the characteristics of the tasks supported by the MRPS. Similar, yet slightly different observations have been found in a study from Hong and Kim (2002). They showed that two critical success factors of ERPS implementations are the adaption of the ERPS itself to the organization and the adaption of the ERPS-supported processes. These findings are in congruence with the ones from Cooper and Zmud (1990) with regard to the first factor since both studies agree that characteristics of the IS influence the outcomes of its implementation. Yet, the authors differ about the scope of the second factor. Whereas Cooper and Zmud (1990) focus on task characteristics, Hong and Kim (2002) focus more broadly on the process.

For this research, it has been decided to incorporate the focus of Hong and Kim (2002), due to the following two considerations. Firstly, another piece of ERP research has also demonstrated the significance of business *process* characteristics for the outcomes of ERP implementations (Karimi et al., 2007). Secondly and as it has been demonstrated in the previous chapter, a major component of an ECMS is the WfM one. Previous research on this subject has also indicated that the characteristics of the processes which are supported by a WfMS influence its outcomes: Agostini, Michelis, Grasso, and Patriarca (1993) argue that *process* characteristics influence certain outcomes of WfMSs. Oba, Onoda, and Komoda (2000) showed that the *type* of the WfM-supported *processes* influences the effects of implementing WfMSs. In the remainder of this document, the term *process type* is used for this factor since it is able to summarize several characteristics. With regard to the role of this factor in the research model, it is assumed that the occurrence of certain impacts can be related to the process type, but that ECMSs can be generally used for all processes types.

The significance of the other factor ('characteristics of the IS') is also concurred in numerous other pieces of research on ERP, for example in Mabert et al. (2003) where it is stated that the functionality provided by an ERPS has a major influence on the buying decision. Ranganathan and Brown (2006) empirically showed that the range of implemented ERP modules influences stock market returns. The term which is often used to describe "the range of business functions" (Karimi et al., 2007, p.105) offered by a specific IS is *functional scope* and it will also be used in this document. It has been demonstrated in the previous chapter that ECMSs can have a large functional scope and the assumption behind this factor is that the occurrence of certain impacts is related to the presence of certain functionality. It is also assumed that the size of the functional scope positively correlates with the number and intensity of the impacts.

Although more potential influencing factors can be found in literature, it has been refrained from including more of them into this research. For example, another critical success factor initially studied by Hong and Kim (2002) is the adaption of the ERPS to the users. The large potential functional scope of ECMSs can be expected to result in much interaction with users, so that this kind of adaption might also be a relevant factor for this research. However, Hong and Kim (2002) showed that this factor is not of significant influence and therefore, the adaption to users has not been incorporated into the research at hand. Numerous other factors can be found in literature, such as for example 'top management support' (Holland and Light, 1999), but they are rather seem to be generally influencing IS implementations and not to be specific for ECMSs. As demonstrated above, the two factors functional scope and process type are however associated with specific characteristics of ECMSs and therefore are also assumed to have a larger influence on this class of ISs than the general factors. In addition, this limitation leaves more possibilities to evaluate the (assumed) relations with the impacts in more detail. In turn, these two factors can potentially form a well-explicated core of future research models after they have been studied, even when other factors might be identified during the exploratory part of this research.

5.2.2 Factor operationalizations

As asked for by sub-question 7, the independent variables need to be operationalized.

5.2.2.1 Functional scope

In the previous chapter, the RAE has been designed as a complete (cf. requirement R4) conceptual division of the potential functionalities provided by ECMSs which means that it represents the maximum functional scope an ECMS can posses. Therefore, the RAE is used as the basis of the operationalization for the independent variable functional scope. The operationalization is completed by the coding described in section 6.1.1.2.

5.2.2.2 Process type

As already implied in subsection 5.2.1, the factor process type refers to the process/es which is/are supported by the ECMS. As such, it is an *information process* consisting of "automated tasks [...] and partially automated tasks [...] that create, process, manage, and provide information" (Georgakopoulos et al., 1995, p.120). It is different from material processes (which handle physical goods) and business processes. The latter are more abstract, describe the goals of an organization from a market perspective and are in turn achieved through one or more information and/or material processes (Georgakopoulos et al., 1995).

Karimi et al. (2007) have identified the process complexity as indirectly influencing the impacts of ERPS implementations. This concept "was measured by the degree of nonroutiness, interdependence, complexity, and uncertainty" (Karimi et al., 2007, p.111). However, they do not provide a precise definition of these terms so that their research cannot be used for the operationalization of this factor. The measures of process characteristics which have been used in WfM research (Agostini et al., 1993; Oba et al., 2000) are also not usable for this research. The former is heavily quantitative (including factors such as for example "the number of sub-processes running in the same period of time" and "the turn-overrate of the organization") and the latter is too simplistic by only differentiating paper- and computer-based processes and mixed forms.

One more concrete definition has been found in Mani, Barua, and Whinston (2007) who have researched the information processing requirements of Business Process Outsourcing relationships. One of their findings is that the type of the outsourced process has an influence on how the relationship should be managed. Their categorization of the process type is presented in figure 5.3.

The combination of classification with the coding scheme created in section 6.1.1.2 forms the operationalization of the independent variable process type.

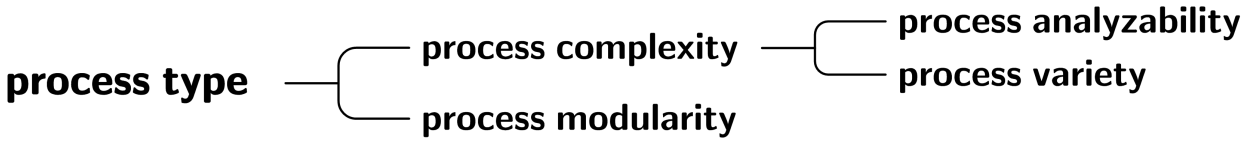

Figure 5.3: Categorization of the factor process type (Mani et al., 2007).

Process complexity and process modularity are the main characteristics of a process. The former includes the two sub-elements process analyzability and process variety. The construct *process analyzability* is adopted from organizational science, where it determines the attitude of an organization towards its environment. An analyzable environment provides the organization with relatively unambiguous data and external "events and processes are hard, measurable, and determinant" (Daft and Weick, 1984, p.287). Therefore, internal processes can be planned well, "participants follow an objective, computational procedure to resolve problems" (Daft and Macintosh, 1981, p.208), and there is hardly any uncertainty about the outcomes of the process. Managers can, based on previous experience, for example assume that the sales of their products (such as clothing) are directly linked to determinable factors such as economic or population growth. The opposite is an unanalyzable environment where external data does not lead to clear-cut answers. Instead, the organization needs to embark in an interpretation process, which is characterized by creativity, ad-hoc decisions, and personal understanding (Daft and Weick, 1984): "[p]articipants may have to spend time thinking about what to do, and they may actively search for solutions beyond normal procedures" (Daft and Macintosh, 1981, p.209).
Process variety refers to sequential variety which is defined as the "variability in the sequence of events or actions that make up a process" (Pentland, 2003, p.857). It differs from the classical definition which is mainly concerned about the quality of the output of a process (Pentland, 2003). Instead, processes should be perceived as "patterns or sequences of events" (Pentland, 2003, p.858) whose exact composition can change with each instantiation.
The second main characteristic is *process modularity*. A process is highly modular if it is hardly interrelated with other organizational processes so that it can function "as a coherent sub-task that can be analyzed, modified, and enhanced, independent of its influence on other organizational processes" (Mani et al., 2007, p.8). This means that the process is 'autonomous' and can be executed independent of other processes. The opposite holds for a lowly modular process.

5.3 Initial version of the ECMS impact model

In the previous section, the functional scope and the process type have been identified as potential factors influencing the impacts of implementing ECMSs. They have been summarized in the initial version of the ECMS impact model presented in figure 5.4. During the CSR being described in the following chapter, this model acts as the initial research model mentioned by Yin (2003).

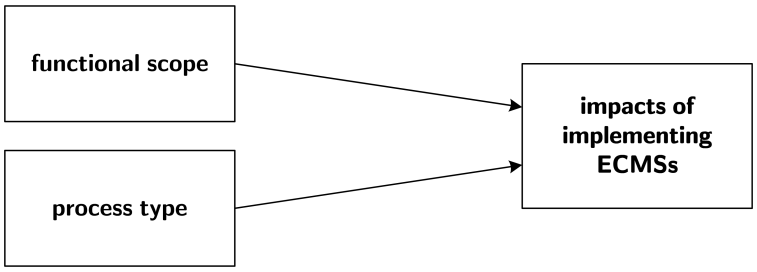

Figure 5.4: Initial version of ECMS impact model.

I never guess. It is a capital mistake to theorize before one has data.

Sir Arthur Conan Doyle

6 Case studies

After presenting the design and preparation phase of this CSR, this chapter provides the case study reports which also include the preliminary analyses of the three cases that have been conducted so that iterations in the research process can take place. In the following chapter, the cross-case analysis is performed which forms the basis for the final conclusions.

6.1 Design and preparation

As described in section 2.1.1, conducting a CSR requires that numerous activities are to be carried out before the data collection in order to ensure validity. This includes defining the unit of analysis, the description of the case study protocol, and the case selection.

6.1.1 Research design

This CSR focuses on answering sub-questions 4, 6, and 8:

- Which impacts can occur when an Enterprise Content Management System is implemented in an organization?
- Which factors influence the impacts of implementing an Enterprise Content Management System?
- How are the influencing factors related to the impacts?

The initial version of the ECMS impact model defined in the previous chapter (cf. figure 5.4 on page 45) contains the propositions that guide the search for evidence during this CSR. As the latter has a primarily explanatory character focusing on sub-question 8, the research model does not only guide the further research process for example with regard to the asked questions, but is also be evaluated during the coming steps (Yin, 2003) so that afterwards, it can form the final version of the ECMS impact model mentioned in the research plan (cf. table 2.2 on page 10).

6.1.1.1 Unit of Analysis and set-up

The unit of analysis of this CSR are ECMSs (as defined in chapter 4) which have been successfully implemented in an organization. The definition of success follows the one from Bridges (2007): users are aware of the ECMS's presence and they use it for their regular work. Being a mainly explanatory CSR, a multiple-case design has been chosen as the research design (Yin, 2003, p.52). Due to the fact that the elements of the initial version of the ECMS impact model are already extensively operationalized, it was decided to include only an 'optional pilot case'. This means that the first case will only be considered as a pilot case if its results require major changes in the case study design, but otherwise will be used as a regular case.

process characteristic	coding: low	coding: high
analyzability	• During the course of their work, employees *often* come across difficult problems that they do not know how to solve immediately. • Process managers *do not quickly know* whether the process has been executed successfully. • Activities performed and methods used during the execution of the process are *not common* across different inputs and parameters. • Employees *often* have to adopt different methods or procedures to do their work. • External data does not lead to clear-cut answers and the organization needs to embark in an *interpretation process*, which is characterized by creativity, ad-hoc decisions, and personal understanding and which participants may have to spend time thinking about what to do, and they may actively search for *solutions beyond normal procedures*.	• During the course of their work, employees *hardly* come across difficult problems that they do not know how to solve immediately. • Process managers *quickly know* whether the process has been executed successfully. • Activities performed and methods used during the execution of the process are *(very) common* across different inputs and parameters. • Employees *hardly* have to adopt different methods or procedures to do their work. • Environment provides organization with relatively unambiguous data and *external events are hard, measurable, and determinant*. In turn, internal processes can be planned well and participants follow an *objective, computational procedure* to resolve problems.
variety	• The activities of the process *hardly depend* on the particular case. • The process generates a set of *identical sequences*. • There is a *standard procedure* to be followed for solving almost all cases.	• The activities of the process *depend to a great extent* on the particular case. • The process generates several basic sequences with *frequent variations*, exceptions, or shortcuts. Alternatives are commonplace. • There are *several ways* for solving cases.
modularity	• The process has *many* interfaces with other organizational processes. • Changes in the process effect other organizational processes *to a large extent*. • The performance of the process *cannot* be assessed independently of other organizational processes.	• The process has *hardly* any interfaces with other organizational processes. • Changes in the process *do not/hardly* effect other organizational processes. • The performance of the process *can* be assessed independently of other organizational processes.

Table 6.1: Coding scheme for process type (cited from Aalst and Hee, 2004; Daft and Macintosh, 1981; Daft and Weick, 1984; Mani et al., 2006; Pentland, 2003).

6.1.1.2 Guidelines for data analysis

The first independent variable is the functional scope. As described in section 5.2.2.1, the RAE is used for the operationalization of this factor. The coding is done by marking the elements found at a particular ECMS in the RAE. The second independent variable is the type of the process(es) which is/are supported by an ECMS in a specific organization. Section 5.2.2.2 has presented a

framework for categorizing processes which is used for defining the process type and table 6.1 on the facing page explicates the used coding scheme.

The impact table (cf. table 5.2 on page 42) is used for coding the impacts observed in a case. Impacts which have not been observed have a white background, whereas the background colors of observed impacts are changed according to the coding scheme presented in table 6.2. In the textual reports, the coding of the impacts derived from the evidence is denoted in the following manner: [→ 25 high, 32 low] for example means that impact 25 has been coded as high and impact 32 as low.

intensity	description
low	minor change in comparison with the previous situation (i.e. before the implementation of the ECMS); respondents only used 'soft' adjectives such as small
medium	moderate level of change; respondents did not make explicit remarks about the impact's strength
high	major change in comparison with previous situation; respondents have (extensively) stressed this point

Table 6.2: Coding scheme for impact intensity.

Next to the codified results, the reports on the individual cases also include textual descriptions of the organization and its process(es), the implementation project, the ECMS, and the impacts. This allows for an enriched understanding of the problem domain and also increases the internal validity and reliability. The interview summaries and the individual case reports have been reviewed by the respondents. Next to confirming the facts, these 'project reviews' (Dubé and Paré, 2003) also serve as an implicit coding check. After the individual case studies have been performed, a cross-case analysis is conducted.

6.1.2 Case study protocol

The case study protocol is not as comprehensive as suggested by Yin (2003) because this CSR is embedded in a thesis research and much information is already presented in other chapters of this document, as for example the background information of this research project in chapter 1. It has also been refrained from elaborating on obvious remarks such as bringing material for taking notes or typing out the interview summaries as quickly as possible. Therefore, only the case study questions (which are the same as the three initially mentioned sub-questions) and interview questions for the semi-structured interviews are mentioned (cf. appendix B) and an outline of the case study report is given. The latter one consists of four parts: an individual report of each of the three cases in this chapter and the overall analysis in the following chapter. The individual reports adhere to the following structure:

- background and goals of the implementation project
- process type
- implementation
- description of the ECMS
- impacts
- preliminary analysis and implications for remaining research process

The issue of implementation had not been included in the initial research scope, but arose as a potentially influencing factor during the first case (cf. sections 6.2.3 and 6.2.6). This is a an example of the flexible and opportunistic nature of the data collection phase in CSR.

6.1.3 Case selection

ECMSs that fulfilled the criteria for being an adequate unit of analysis were available to the author for conducting a case study. A preliminary screening of the cases was conducted for determining their suitability. The only independent variable of the initial version of the ECMS impact model about which information was available for all cases was the process type. As can be seen in table 6.3, all three cases were expected to display different results with regard to process analyzability and variety, but not with regard to process modularity. The latter observation is not desirable from the viewpoint of external validity but the characteristics constellations from Organization A (Org. A) and the department Work, Care, and Income (WCI) were expected to allow at least for a theoretical replication.

	Organization A	department WCI	Hoge Raad
analyzability	low	high	low
variety	high	low	low
modularity	high	high	high
preliminary sources	Organization A (n.d.), Organization A (2008a)	interview with consultant	n.a. (n.d.)

Table 6.3: Preliminary screening of the process types at the three organizations.

6.2 First case: Organization A

The first case study was conducted at Organization A (Org. A) and examined the ECMS consisting of Client & Engagement Management, Acceptance & Continuance (CEM/A&C) and map[10]. During July and August 2008, three interviews have been conducted with a senior user (product champion), the project leader of the implementation, and a partner. An additional informal discussion with another senior user (not a product champion) took place afterwards. Both senior users are employed at the partner's groups. As for the following two cases, transcripts of the conversations were not produced, but detailed summaries authorized by the respondents have been created instead. During the first and second interview, demonstrations of the ECMS were given. In addition, a handout of the engagement lifecycle (see below) has been handed over to the author. The annual report of the financial year 2007/2008 (Organization A, 2008b) and the staff directory have been consulted as well. Finally, several internal mails regarding process audits have been evaluated. An overview of the collected evidence is presented in table C.1 on page XXXII.

6.2.1 Background and project goals

Org. A, a consulting company, has been founded in December 2004 and attracted not only people from the parent company, but also people from other companies. Because of the different backgrounds, there had not been a uniform way of putting projects into execution and the project documentation had differed a lot. In order to overcome this situation, the so-called engagement lifecycle was adapted to the Dutch organization and introduced. The engagement lifecycle is an internationally defined process model for doing projects within Org. A.

However, both an internal audit and an external audit (ISO 9000) showed in 2006 that although the process had been described, it was put into execution in different ways: proposals were created with different structures, client evaluations were not done the same way etc. The non-standard practice did not meet the criteria for successful reviews. Failing these audits was undesirable due to three reasons. Firstly, Org. A tries to win EU-tenders which include a question whether the applying company has been certified. Negating this question requires many explanations and decreases the chances of winning projects. Secondly, Org. A wants to be an excellent consulting company and part of this aspiration is that there exists a standardized process for delivering high-quality results. A certification helps to communicate this fact of uniformity towards the market. Finally, there is the Org. A-internal requirement that all organizations worldwide follow more or less the same process, in particular with regard to the way how the acceptance of clients and engagements is managed and monitored. Although this requirement stems from legal obligations such as the Sarbanes-Oxley Act, it was not possible to control its correct execution.
Due to these reasons, the board of Org. A saw the necessity to further standardize project execution and an ECMS was seen as a tool to reach this goal since this kind of application had already been in usage within other divisions from Org. A. map had already been implemented in a number of other companies of Org. A worldwide. Therefore, a certain political pressure to introduce an ECMS existed as well. In addition, consultants not only work at their officially assigned office, but also at other offices of Org. A, at the client's location, or from home. An ECMS was expected to offer the advantages of digital files as for example the fact that access to the files is not bound by time or physical location, so that consultants could become more flexible in organizing their work. All in all, it was decided to implement the ECMS for Org. A in 2006. The system was finally introduced in January 2008.

About 490 professionals and approximately 130 people support staff work for Org. A. The main users are the professionals who, in theory, use the system on an almost daily basis for storing and exchanging project documentation and information. The support staff also uses map, but not as frequently as the consultants.

[10] The interviewed project leader stressed that the correct spelling is with a lower case m.

6.2.2 Process type

Org. A is a consulting company giving advice to clients. Therefore, doing consulting projects is the only primary work process and the so-called engagement lifecycle defines how these projects should be put into execution. It consists of eight phases with 23 steps and 54 activities in total. The first five phases take place before the actual execution of the project and are mainly about creating a proposal and include administrative details (e.g. “check for client acceptance”, “agree terms and obtain client signed engagement letter and other contracts”). This part of the process roughly described is the following: A so called lead for a new project is usually triggered by a client who asks for a specific consulting service (in the form of an official tender or informally) and who gives an approximate description of what needs to be done during the project. Normally the triggers are followed by an intake-meeting where consultants and client(s) sit together to investigate the specific business issue. The responsible partner assigns a consultant the role engagement manager who enters client information (this includes for example (scans of) the project description) in an application. Several backoffice departments (data quality, compliance etc.) check the input of basic client and engagement data. They also perform a structured risk assessment. The partner and a second review/risk partner check the risk assessment and the client/the project is accepted (or not) and only afterwards, a proposal may be created. After the client accepts the proposal (or a modified version), the project team enters phase six, the actual project phase.

During the sixth phase, the project team works on the assignment, collects evidence, conducts interviews, assesses the situation, develops solutions, presents results etc. The final activity of this phase is “billings and collections”. Phase seven and eight are mainly concerned with evaluations (e.g. “issue client satisfaction survey”, “engagement debrief”). Only a small number of steps (9 out of 23, e.g. step “complete engagement acceptance” with activities such as “check for suitable resources” or step “manage engagement and team” with “reporting to client”) are mandatory to be done by all projects. The reason for this freedom is that Org. A deals with many projects being different with regard to objectives and size. Therefore, the general nature of the engagement lifecycle is that it does not define how exactly the engagement has to be done. The engagement manager and the team are — within certain boundaries — rather encouraged to have their own way of coming to a result.

This process needs to be split up in two segments since the nature of the contained activities differs. The first segment comprises the first five phases of the engagement lifecycle and the activities performed are clearly determined and follow a predefined path. Following the coding scheme, the analyzability of this segment is high and the sequential variety is low. This is different for the second segment which consists of the last three phases. Although the form of the final result is known to be some form of report (a written document is usually combined with one or several presentations), the actual content of the report is often not known in the beginning. Although some projects are more limited in scope and follow several defined steps in phase six, most projects have a broad scope and consultants often do not know the answer immediately and have to adopt different methods to do their work. The activities of phase six depend to a great extent on the particular case. Therefore, the second segment displays a low analyzability and is highly variable.

However, both segments are part of the only (ECMS-supported) primary work process of Org. A, namely the execution of projects. Next to general support processes as for example Human Resources or IT support, the whole consulting process is linked to only two other processes: during projects, consultants need to keep track of their work hours and travel expenses and afterwards (sometimes also during projects, depending on their size), billing is done. Accordingly, the modularity of the consulting process as a whole (i.e. also of the individual segments) is high.

6.2.3 Implementation

The implementation was not part of the initial research model, the respondents often mentioned this topic. Although map had existed before, it took more than a year to implement it because for example the language of the user interface needed to be discussed. Since map had already been used internationally, only slight modifications were considered to be necessary and no requirement elicitation with the stakeholders has been conducted. Yet, pilot implementations were done before the roll-out to the whole organization. In summary, the implementation has been done top-down and this classification is confirmed by the observation that although feedback meetings with product champions occur regularly, the interviewed production champion has the impression that suggestions stemming from the group do not always get implemented.
The roll-out itself was done differently for the two applications. map was introduced locally; mainly by two presentations about map and how to use it. The first one was part of a general training about the 'way of working' which has been quite short and vague. Part of the decentralized approach was also to appoint a so-called map champion in each group. The group's product champion gave a second introduction during a group meeting. However, not all group members were able to attend this meeting and therefore did not received the same information as the rest of the group. The product champion did not feel properly supported since because their training has been limited and only insufficient documentation had been provided. One respondent mentioned that this approach contradicts the idea of map being a tool for standardizing the work process across whole Org. A since the way how it has been presented in different groups neither has been standardized nor was adequate for the ambitious goal.
The introduction of CEM/A&C differed a lot. Next to appointing product champions and distributing information material, several mandatory information meetings have been centrally organized. More points about the implementation process of CEM/A&C have not been mentioned.

6.2.4 Description of the ECMS

The ECMS used at Org. A consists of the two applications CEM/A&C and map which provide the functional scope depicted in figure 6.1 on the next page. Both applications are no commercial-off-the-shelf software but are proprietary development based on Lotus Notes and the functionalities of the other layers can only be accessed through the Lotus Notes client application.
During the first five steps of the engagement lifecycle, map is not used at all, but only CEM/A&C. As described above, the client and project information (this includes for example (scans of) the project description) is entered into CEM/A&C and it is used for the risk assessment. After (and only after) both the client and the project have been completely accepted in CEM/A&C, two things are created. Firstly, a Work Breakdown Structure (WBS)-code (A WBS code for the SAP system is required for being able to book one's working hours.) is created. Before the introduction of CEM/A&C, WBS codes needed to be created manually in SAP. Secondly, a so-called map-file (i.e. an electronic project file) is automatically created for every project. After projects have been created in CEM/A&C, the latter continues to monitor the respective client and sends an e-mail to the engagement manager(s) of old project(s) if a new project is started at that client. [→ 23 low, 24 low] This description shows that CEM/A&C is mainly a small-scale production WfMS.

During the remaining phases of the lifecycle, only map is used. It is important to know that the philosophy behind map is that it does not do the actual work itself, but that it rather supports capturing the results of process steps at a moment chosen by the user. The processing of the individual steps has to be done by the users and the way how this is done is left open to the largest extent possible.
Map-files are generally structured according to a central process definition with all phases, steps, and activities of the engagement lifecycle. For each activity, there is an individual 'page' which is separated into five parts. The first part is the file upload area for the members of the project team. The documents produced in this particular activity are uploaded here. Documents are

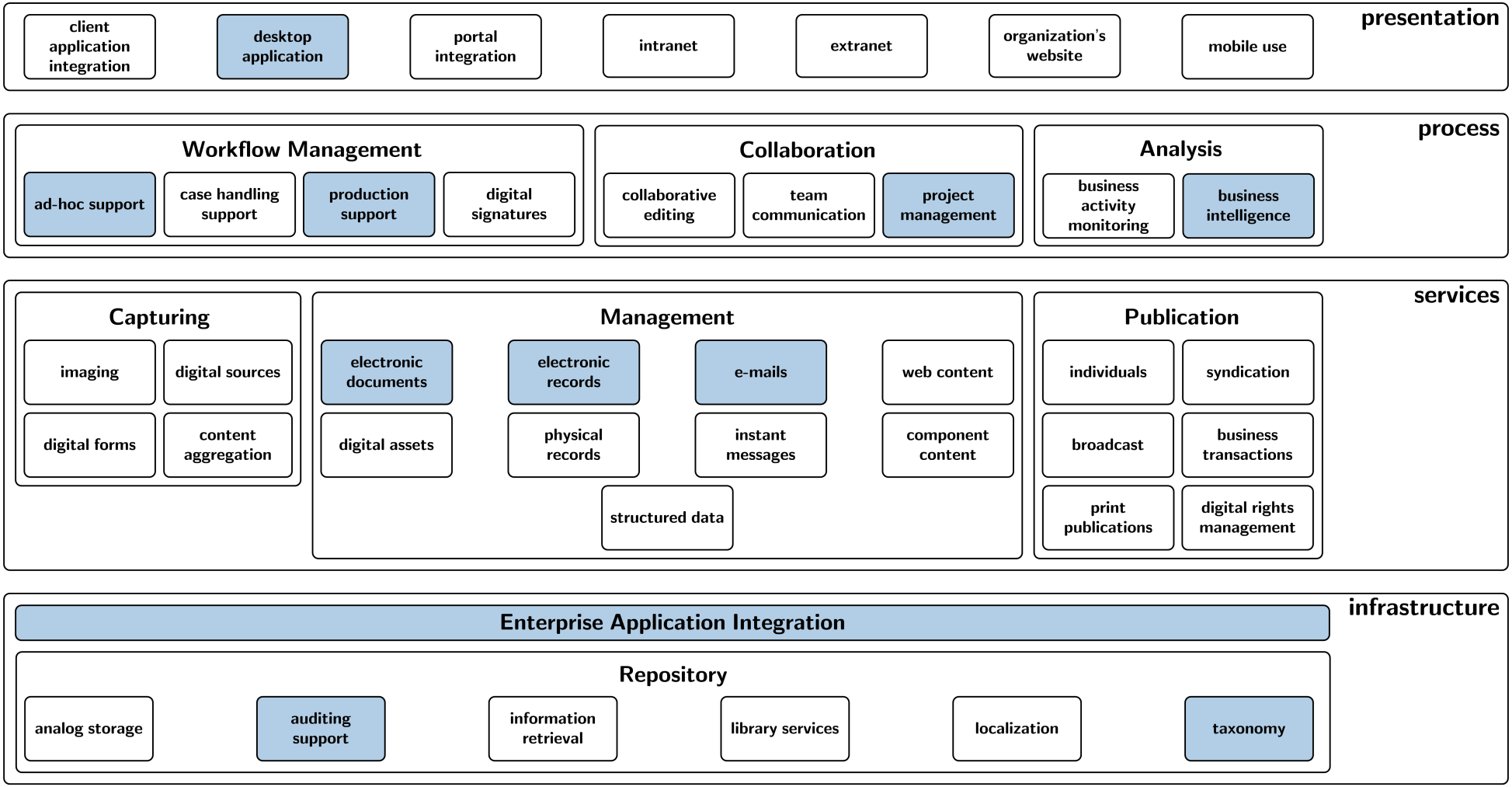

Figure 6.1: Functional scope of CEM/A&C and map.

not created within map but with other programs (e.g. MS Excel and Word) and they are also not signed digitally. Most documents are only uploaded in their original file format and only from documents with legal implications (e.g. signed contracts) a scan is uploaded as well. This means that the services layer does not include special functionality for capturing external content. Next to regular files, e-mails can be manually integrated in a map-file. A mini-questionnaire with questions about the completion of activities is the second part of an engagement lifecycle page.
The next part is the description of the particular activity from the quality manual (the handbook of the engagement lifecycle), so that members of the project team do not need to consult the written documentation if they need an explanation of what needs to be done. Another advantage is that in case of changes to the manual, they can be easily disseminated. Administrative information as for example roles and reference numbers are displayed as well. However, they can only be edited by administrators and are usually only interesting for them as well. A change history is the fifth part, but only the fact that something has been changed is recorded which means that there is no versioning of uploaded files. Next to the pages of the engagement lifecycle, there are also 'free-format pages'. These are blank Notes workspaces which can be filled with content using standard Notes functionality (e.g. upload document, insert table, insert text). They can for example be used for storing concept versions of documents.
Once a project is finished, the related map-file is closed ('wrapped up') and afterwards, only administrators can access or change it. In case regular staff members need access, they can be granted temporary access privileges. Since the map-file is part of the Lotus Notes system, it is also integrated in the respective backup mechanisms and in turn provides limited ERM functionality.

map also offers several functionalities of the process layer. First of all, a limited ad-hoc WfMS is implemented in map. Project members can decide to notify the responsible director/partner of the completion of an activity or ask for their approval before proceeding to the next step. In both cases, a notification is sent to the appropriate person. The director/partner can also configure a map-file in a way that his/her approval is required for completing certain activities. It is for example possible to not require any approvals at all for small projects, just one approval of the final report of medium projects, but several approvals in between for large projects. However, many groups are still in the process of determining how these controls should be set in practice. An additional feature is that project members can be notified automatically about changes (e.g. about newly uploaded files). In general, the implementation of this WfMS component is not strict, meaning that no hard deadlines are defined for completing activities. Only when a map-file is closed, the mandatory steps have to be completed. Closing a map-file is mandatory and can be monitored by the partners and the board.
Some collaboration functionalities are offered as well. There is an overview of the Lotus Notes calendars of all team members which can be used for planning appointments. However, this feature is not widely used due to the fact that several employees use a paper agenda instead of the Notes calendar. The project management is implemented through the feature that to-do's (i.e. both specific activities of the engagement lifecycle and general project to-do's arising in the sixth phase) can be assigned to team members who in turn are presented a personal to-do list. Finally, there is the possibility to maintain a list of contact information. This functionality is rarely used because it is not handy to use so that uploaded Excel files are often used instead.
The so-called portfolio is a Business Intelligence functionality. It is a report about a group of map-files, e.g. presenting per project which activities have been completed. The reports are intended for the management and can for example be filtered by engagement manager or partner. In addition, the board can also produce an overview for Org. A as a whole.

The infrastructure layer is not of elaborated nature: CEM/A&C is only integrated with one other ES, namely the SAP system. Besides the change history described above which provides a limited auditing functionality, only some very limited information retrieval functionality is contained in the repository component: a list of map-files can be displayed and filtered, but the content of map-files cannot be searched.

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user dissatisfaction AND user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table 6.4: Coded impacts of CEM/A&C and map.

6.2.5 Impacts

Table 6.4 displays the coded impacts observed in this case study. According to this overview, the implementation of this ECMS mainly impacted the operational and managerial processes as well as the horizontal coordination.

Compliance Since both CEM/A&C and map had only been introduced recently at the time of the interviews, the respondents found it difficult to clearly specify impacts already. One effect mentioned several times was that the compliance with the engagement lifecycle has been increased. However, it is important to notice that there are two different sorts of compliance in this case. The increase in compliance with regard to accepting clients and engagements results from the simultaneous introduction of CEM/A&C. map on the other hand contributes to an increased compliance with regard to documentation requirements. Since the system does not enforce deadlines during the execution of projects and also does not enforce that files are closed, the contribution to compliance is only of indirect nature. The direct impact is that map has considerably increased the BI capabilities with regard to file keeping. They in turn are used for getting an overview of files which are not kept properly so that the responsible employees can be approached. The impacts with regard to compliance have been confirmed by the ISO audit which took place in December 2008. The auditor stated that the definitions of the first steps of the engagement lifecycle which are supported by CEM/A&C are strictly complied with. The uniform usage of map however still varies across the different groups of Org. A and so does the compliance with the file keeping requirements. [→ 16 medium]
According to the project leader, the BI functionality of map is intended to be used for monitoring how projects follow the engagement lifecycle. Interestingly, the partner did not know during the interview that the feature had already been implemented. Therefore, he did not use map yet for BI purposes. In the meantime, this has changed and the functionality is used for preparing quality audits, e.g. for attaining an overview of map-files which have not been completed yet. Based on the latter, members of the group studied are asked to complete the file(s) they are responsible for. This impact of an increase in management information is also valid for CEM/A&C since the respective process phases could also only hardly be monitored before the introduction. [→ 14 high, 15 low, 27 low]

Process definition During implementation (in particular of map), the engagement lifecycle needed to be precisely defined and structured. Throughout the definition, several shortcomings such as unclear definitions have been discovered. Solving these issues led to a clearly defined and customized process. Another impact is that the presentation of all process steps in map-files makes the employees more aware of the engagement lifecycle. [→ 4 low]

Dissatisfaction The introduction of map has lead to dissatisfaction among several consultants. Next to a certain change resistance in the beginning, there are also a number of objective reasons. First of all, map is considered to be user-unfriendly since a number of features are missing or have been implemented insufficiently. This results in the feeling that map does not simplify, but rather complicates things. For example, the proposal description is already captured in CEM/A&C, bus has to be uploaded again in map. In addition, map is not integrated with the time keeping, expenses, and billing system. Therefore, activities have to be performed in different systems which means that not the whole process is supported. The bottom line is that despite its aspiration of supporting the whole engagement lifecycle, map does not do so. Secondly, map requires additional work steps next to the regular work. Although they are necessary for the company as a whole, there is limited added value for the actual project. Lastly, map brings a massive change in work practice for the consultants. Some of them only used a stack of paper as their project file, some even only in a relatively sloppy way. Now, they are required to electronically keep a very detailed file. However, there are also several employees who used a similar application before and the change is less extreme for them. [→ 3 medium, 12 low, 26 medium]
The resulting atmosphere in the group studied was summarized by one respondent in the following sentence: “In general, I have the feeling that the technology [map, ed.] has been tossed into the organization without really thinking how it should be adapted to the work process”. Despite the negative overall perception of map, it is planned to link the completion rate of the file keeping activities within map with the annual bonuses in order to increase the efforts spent on keeping files and in turn compliance with regard to file keeping. Other than map, CEM/A&C has

been received very positively. It has been reported as being well adapted to the needs of its users who perceive it as a simplification of their work. [→ 3 medium]

Organizational culture An influence of the ECMS on the culture within the group is not visible yet due to the fact that the implementation only occurred recently. There are however some employees who prefer to focus on the content of a project and have an aversion against paperwork since it keeps them from being active for the client. They might get the idea that there are constantly more rules to be followed and that they are also monitored on how they keep their files what in the end may create a repressive sphere in their perception.

Productivity The impact of the ECMS on productivity has not been formally evaluated yet. However, the respondents mentioned that the acceptance procedure has been both simplified and accelerated. Before the introduction of CEM/A&C, paper forms needed to be mailed what had the disadvantages that the procedure was not time efficient, that forms sometimes contained incomplete information, and that forms got lost. Due to the forced compliance (including the improved availability of documentation), more founded decisions can be taken. [→ 5 low, 6 low, 7 low, 8 low, 11 low, 15 low, 22 low, 27 medium] The productivity impact of map is evaluated slightly differently. The project leader's point of view is that file keeping is essential for Org. A and despite the fact that all employees have to get used to using the system and to doing the mandatory steps now, he expects that the actual time needed for keeping files will decrease (in comparison with the paper version). He got the impression that the performance has increased until now. This view is only partly shared by the other respondents. Although they did not notice an increase in time spent on file keeping so far, they are afraid that map could potentially decrease the productivity in the end, considering the current status of its implementation. However, map also simplifies the cooperation for projects where a lot of documents have to be shared since it provides a central and secure document storage. [→ 5 low, 6 low, 22 medium, 24 low]

Risk profile The last impact observed is a change in risk profile. In the past, files used to be stored in offices in closed file cabinets or in archives. Now, they are digitally stored on servers. Therefore administrators have access to all files now and the company has also become more vulnerable to digital attacks. Another consequence is that the size and number of backups have increased what would need to be considered in a detailed cost/benefit analysis. [→ 11 low, 13 low]

6.2.6 Preliminary analysis and implications for remaining research process

The codifications and analysis in case study report show that the initial case study design does not need major changes. Besides a minor data collection issue (question about implementation), the data collection procedures (interview questions, coding schemes, design of case study report) have worked well. Therefore, this case is not be considered as a pilot case, but as a regular one.

compliance The main goal of this ECMS was to enlarge the compliance with the engagement lifecycle. As described before, the degree to which this goal has been achieved varies between the different phases of the main process. This observation can be traced back to the fact that different types of WfMS within one ECMS are used; a situation which could not be found to be described in literature yet. The first five phases are supported by a tightly configured production WfMS and they display a high degree of compliance with regard to acceptance requirements. map on the other hand contains an ad-hoc WfMS which by its nature leaves a considerable amount of autonomy to its users. This large degree of freedom goes along with a lower degree of compliance achieved. This leads to the preliminary conclusions that the type and the rigidness of a WfMS are positively correlated with compliance.

It should also be noted that the process type of the different phases supported by CEM/A&C and map varies. The first five phases of the engagement lifecycle have a low sequential variety and are therefore suitable for a production WfMS. The project phase though is highly variable with

regard to type, order, and number of activities carried out and a rigid production WfMS can be expected to not be able to properly support all different types of projects.

implementation approach Another goal of the introduction of map was to deliver an application which supports the whole engagement lifecycle. Considering the current status of it, this goal has not been achieved since only an application which mainly focuses on supporting the file keeping needs of projects has been created. A potential reason is that the project management for the implementation of map has not actively involved the users in the implementation process which has resulted in the (presumably unexpected) impacts 3 (user (dis)satisfaction), 12 (compromise costs), and 26 ((additional) efforts are required for keeping content up to date). It seems as if map is mainly aligned with the goals of the organization and only partially with the practical needs of its users. In order to study whether the factor implementation approach needs to be added to the research model as an independent variable, the list of interview questions has been extended by a question about this matter.

It should be noted that the impact framework needed to be updated to accomplish all research findings of the first case. The definition of impact 13 (risk mitigation) has been changed since the observed impact that the risk profile has changed was not included in the old definition. The updated version is presented in table 6.5 and is used in the remainder of this research.

	impact	new or changed description	source	type(s) of IS
13	change in risk profile	mitigation of risks associated with uncoordinated content exchange and storage (e.g. integrity, redundancy, versioning) or e.g. increased dependency on IT, increased vulnerability (Karimi et al., 2007; H. A. Smith and McKeen, 2003)	Karimi et al. (2007); H. A. Smith and McKeen (2003); C1	ECMS, ERPS

Table 6.5: Updated definition of impact 13 after first case.

6.3 Second case: department WCI

The combination of Document Informatie Systeem (DIS) and Geintegreerd Welzijn Systeem (engl. Integrated Welfare System) (GWS4all) from Centric forms the ECMS used at the department WCI of the Dutch Municipality Anoniemstad[11]. The department WCI is responsible for a number of areas within the field of social welfare. The staff members oversee the processes of directing several governmental benefits to citizens, as for example unemployment benefits, support of low-income citizens, or home care. They also co-operate with the local employment office.
Two interviews were conducted: The first interview took place with the head of the documentaire informatie voorziening (engl. documental information provision) (DIV) group, a process engineer, and a system administrator. During that interview, the author was accompanied by a colleague. A second interview was conducted with a consultant who was actively involved in the early stages of the implementation project. The other evidence used can be found in the case study database presented in table C.1 on page XXXII.

6.3.1 Background and project goals

The department WCI had to move to a new office building in the beginning of 2003, which acted as a trigger for the introduction of DIS. At that time, GWS4all was already in use for coordinating the work processes. All documents were however kept in paper files only what lead to a number of problems. Firstly, the department WCI had to pay a considerable amount of fines each year, mainly due to the fact that deadlines had been exceeded. Large stacks of files and single sheets of papers could be found on and in the desks of staff members. Files were sometimes lost or could only be rediscovered with large efforts and information was often not promptly available. The second problem was that changes in legislation occurred frequently and it was hard to put them into practice, for example because outdated forms were still used etc.

The head of the department at that time had the vision to turn the department into the most modern social service department of the Netherlands. The relocation should be taken as a chance to modernize the department and to support its work with a sustainable IT solution. Next to solving the problems mentioned above, the introduction of an ECMS should also increase the customer satisfaction and the internal efficiency. The latter should also result in cost reductions, mainly due to a reduction in storage space and less printouts in a paperless office. Finally, the 'need to change' was intensified by the fact that the new building would be less spacious so that no assigned workplaces would exist anymore. In 2001, the general trend in the municipality was to wait for the introduction of a central, municipality-wide EDMS. However, the decision to introduce DIS and have it in production by the time of the relocation was taken nevertheless.

6.3.2 Process type

The main work processes of the department WCI which are supported by the ECMS are structured along the laws describing the requirements for receiving and the extent of certain social benefits. Therefore, several main processes exist, but their structures are very similar. They all start with an incoming request for a certain service from a citizen (called client). Depending on the request, a case is assigned to a case manager who performs a number of checks and in the end, the request is accepted or declined. The processes are clearly structured so that the order of activities is strictly defined and deviations are hardly possible. All operational process steps are defined and mandatory steps have to be finished, otherwise a case can neither be passed on to the next staff member nor be closed. Only the execution of a few optional steps is left to staff members, but these steps are also clearly defined and limited in scope.

[11] The department requested to remain anonymous.

There are no dependencies among the main work processes as this has been deliberately avoided during their definition. The main processes only share a common complaint/appeal procedure, which is the only dependency with regard to executed activities. When an appeals procedure is started, the process that led to the appeal is 'paused' until the appeals process is finished.
Considering these descriptions, the process analyzability is high since the processes and their external triggers are clearly defined and since the activities performed are very common across different inputs. In addition, the possible actions have been limited to a number of mandatory and optional steps so that no undefined actions can occur. All activities of the processes have to be performed in a pre-defined order and therefore, the sequential variety is low. Finally, the main work processes have hardly any interfaces with other processes and are therefore modular. For the case a complaint is started, this 'detour' needs to be considered more as an extension of the process than as a dependency because the process is just paused.

6.3.3 Implementation

The implementation of DIS started with a detailed process and document analysis. Most of the processes were already defined in GWS4all, but at that time, some were not supported (yet) by this application and still needed to be described. All of them also needed to be adapted to the new possibilities of the ECMS. A major activity was the analysis of all documents used within the organization. Per process step, an overview of required, used, and produced documents was created and the documents were consolidated when possible. The final overview (document structuur plan, document index) is grouped according to main processes (i.e. in general a particular social benefit law) and document types. For both analyses, interviews were held with relevant staff members and the results were checked by them as well. During the two analyses, the processes were linked with the used documents. This description served as a blueprint for the following steps of the implementation.
Towards the end of the two analyses, a pilot project was carried out at a single unit (a group of staff members working on one main process). During a period of about three months, the feedback of these staff members was used for finalizing the functional requirements for the future system. They could also gain experience about working in a digitized environment and this helped to further fine tune the processes to the new possibilities provided by the ECMS. Finally, the staff members' also provided insight into how the work places should be setup and equipped.

The next step of the implementation was to put out an EU-tender in April 2002 which was granted to Integratie[12] in June 2002. Afterwards, additional user sessions for the detailed functional design took place. Integratie also studied in further detail how the users actually work with documents. The users were trained in using the ECMS and a train-the-trainer approach was taken. Staff members of all organizational layers were also asked to test two different setups of the future workplaces and voted unanimously for using two separate 15" LCD screens; one in portrait modus for displaying documents, one in landscape modus for working on applications. The other option of using a single 21" LCD screen was perceived as less ergonomic and less user-friendly.
A pragmatic approach was chosen for the conversion of old paper files. First of all, only files from pending cases and from cases from clients who also had already requested/were expected to request additional services were set into the ECMS. During the conversion, not the complete files were scanned, but only relevant documents from it and some of them even only in a stack together with other ones from the specific file. The document index was used for determining the relevant documents. The roll-out of the ECMS was started while the department was still located in the old building and occurred in phases. The first unit to work with the ECMS was the one where the pilot study had been conducted. There, the ECMS was fine tuned and then went into production. Afterwards, all units were consecutively switched over to the ECMS, with the last unit just before the relocation in February 2003.

[12] Name changed due to the department's request for anonymity.

Halfway during the final roll-out, response times increased significantly, even up to ten seconds for simple activities. Since the error could not be located exactly, the responsibilities for fixing it were not clear. Integratie blamed the fault on the network, which is managed by the municipality. The system engineers of the municipality blamed the fault on the hardware delivered by Integratie. Therefore, it took almost six weeks to normalize response times.

6.3.4 Description of the ECMS

This ECMS is formed by the applications GWS4all and DIS. The latter actually consists of three applications which provide EDM and ERM functionality: an Oracle database, IBM FileNet, and OIS DossierWeergave ('file presentation' from Olveco Informatica Services. ODW is a front-end for IBM FileNet mainly for the Dutch market.). The functional scope provided by the two main applications is depicted in figure 6.2 on the facing page.

Although both applications provided a separate desktop application for accessing them, mostly GWS4all is used since it is the leading application in the department (see below). The usage of the ECMS is usually triggered by an incoming document. The DIV group scans all incoming documents, tags them with the appropriate metadata, and stores them in DIS. Given the high volume of incoming documents, DIS provides extended imaging functionality such as controlling high-volume scanners. During the subsequent course of the processes, internal and outgoing documents are usually edited in Word or in a specialized application such as GWS4all. Whenever a final document is created in these applications, a TIFF-document of this version is automatically created and all images are archived in DIS.
The record management of the department falls under the supervision of the Regionaal Historisch Centrum Anoniemstad (RHCA), the institution being responsible for the archives of the region. The central element for this activity is the previously mentioned document index which contains a minimum retention time for every document category, starting at the point of time when a case has been closed. When this retention time has been reached, a list of documents that have to be destructed is created. This list is checked by the affected department heads so that for example files from ongoing law suits can be excluded. It is then forwarded to the RHCA where it is checked for correctness and accepted. Finally, the list is given to Integratie so that they can destruct the documents.

GWS4all is the main application in the department and therefore provides all functionalities of the process layer. All data about clients is centrally stored in GWS4all and e.g. the client number is only used as a key by DIS. The main processes are defined in GWS4all which contains a tightly configured production WfMS. The link between DIS and GWS4all is also strict: all documents which, according to regulations, have to be created for certain steps are also mandatory in DIS. GWS4all is also used for monitoring the performance of the processes, as for example cycle times and the number of cases. This information is used for managing the department. Finally, GWS4all also contains graphical and textual descriptions of all processes which can be consulted by staff members.

The infrastructure layer contains a number of links from GWS4all to other specialized applications. The repository provides several standard functionalities: a search function, the possibility for version management, and a change history. Technically seen, the repository consists of two media types as all data is both written to hard disks and on 'Write Once, Read Many'-media.

6.3.5 Impacts

Fines The initial goal of reducing the amount of fees which had to be paid for exceeding deadlines has been achieved and this resulted in considerable cost savings. This situation had already begun to change before the implementation of DIS, but the introduction of DIS has further

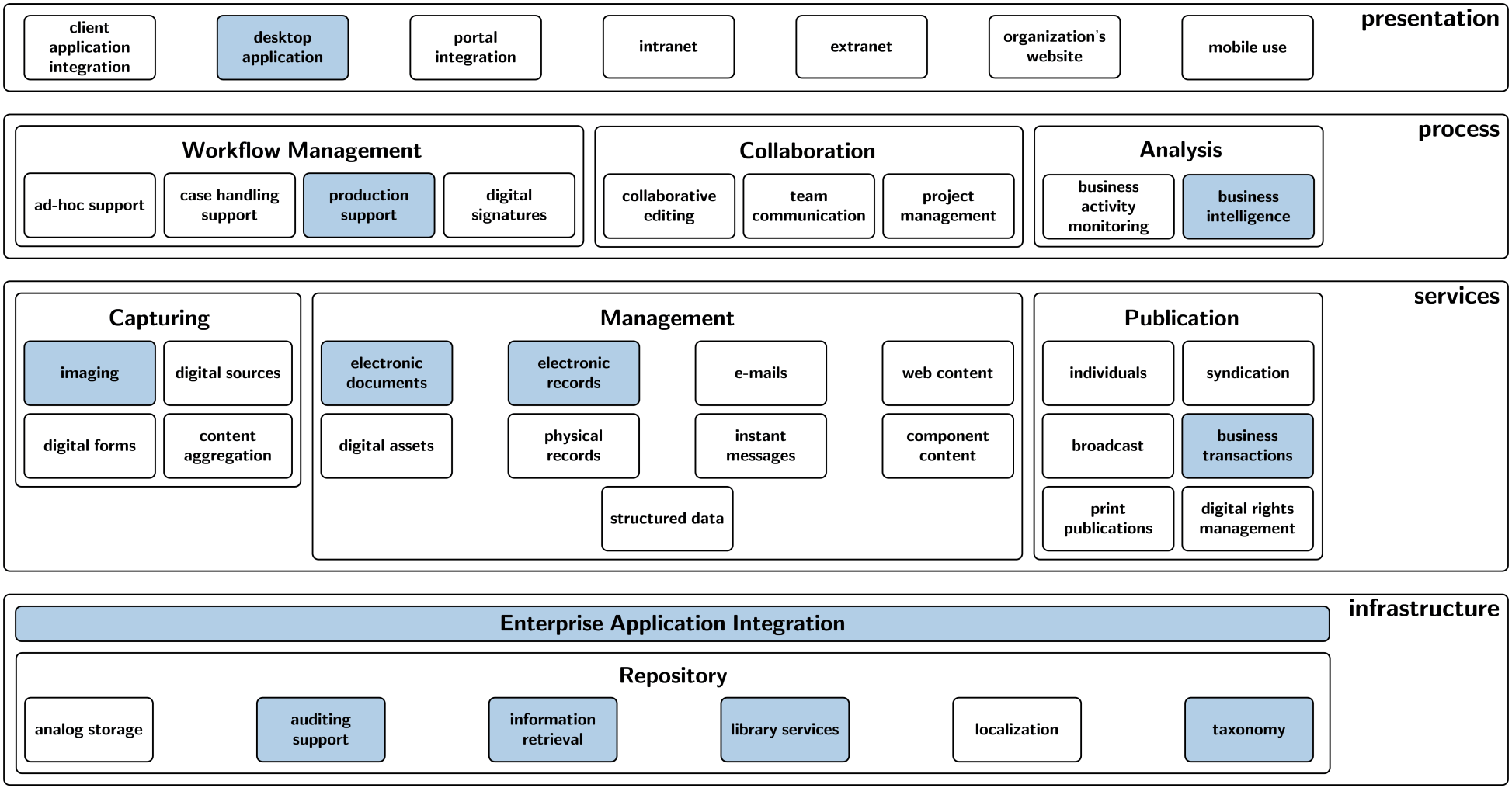

Figure 6.2: Functional scope of DIS and GWS4all.

increased the compliance with deadlines. By now, no fines due to exceedance of deadlines have to be paid anymore and the department WCI is often referred to as an example for how a WCI department should be organized because of the quality of their work. [→ 8 medium, 11 medium, 16 high]

Role of the DIV group Before the implementation of the ECMS, the DIV group had two main functions:

a) distributing incoming documents (mail room) and
b) archiving the records after a case had been closed (main task).

The group was set up in a way that teams of usually two or three staff members were responsible for distributing documents belonging to one or more processes to the case managers. After these had finished the case, the documents were returned to the DIV group who archived it in a paper file. There was little hurry for archiving since other staff members hardly depended on its fulfillment (only when there was for example a law suit). The group had the particular disadvantage that staffing was difficult due to the fact that at any point of time, members of each team needed to be present so documents for all processes could be registered.
The Business Process Reengineering (BPR) which took place during the implementation of DIS has changed the role of the group. First of all, the explicit archiving function has become obsolete since it is done by DIS now. Secondly, the DIV group is also not (formally) responsible anymore for keeping records properly, since this task has been taken over by the case managers. Finally and most important, the main task of the group has been moved from the end to the beginning of the process. All documents have to be scanned and tagged with the appropriate metadata. On basis of the categorization, documents are automatically assigned to a certain process which in turn is the prerequisite before any case manager can start working on a case. Therefore, the whole organization depends on the work of the DIV group which has become 'mission-critical' what gives an increased feeling of self-esteem to the staff members. A respondent put it like this: "the structure of the organization has been turned upside down". Another consequence of the new process structure is that the speed of the categorization has become an essential requirement next to its correctness. The latter used to be the foremost guiding principle for the work of the group but the categorization can easily be changed by case mangers now. [→ 6 high, 7 high, 10 medium, 28 medium]
The new role of the DIV group has been clearly demonstrated right after the relocation and the final roll-out. It turned out that DIS and its functioning had not been explained well enough to the DIV group. The new location and the new procedures caused much confusion in the group so that a four week long backlog of not scanned and registered documents occurred. Consequently, backlogs in the whole department occurred and extra efforts were needed to catch up.
The introduction of DIS was also used for a job enlargement within the DIV group, i.e. for broadening the scope of the group's staff members. Over a period of three years in total, it took some convincing and intensive training to enable all staff members to be able to register all types of documents. However, this has increased the flexibility of the group since staff members can act as a substitute for each other more easily. Meanwhile the staff members have experienced the advantages of the new task distribution (mainly a simplified and more flexible vacation planning) and support it. It should be noted that this impact is not a direct impact of having an ECMS since it could have also been accomplished without DIS. The implementation of DIS rather acted as a trigger for this organizational change. [→ 3 high, 4 medium, 15 medium, 36 low]

Work of case managers The implementation of the ECMS also created new management possibilities for the case managers. Staff members kept the paper files at their personal desks. When a staff member dropped out unexpectedly, taking over the responsibilities was hard since e.g. deadlines were not easily identifiable and files were hard to find. Now, all files are visible to all staff members within DIS. Some files (the so-called kabinetszaken, e.g. files from family members of staff members) are excluded from this rule, but the department head can change the particular authorization if necessary. Therefore, the department became more flexible in its

staffing and the new oversight also influenced the reduction of fees to be paid. [→ 5 low, 7 high, 8 medium, 15 medium, 9 low, 22 medium]
The case managers had already been skeptical towards the ECMS from the very beginning and saw the six weeks with increased response times and the four week long backlog as a confirmation of their initial concerns. During this time, the atmosphere among the case managers was quite negative. However, after the errors had been fixed, the atmosphere changed significantly and the case managers have been very satisfied with the system since approximately half a year after the final roll-out. [→ 3 high]

Attitude and Role of the IT administrators The IT administrators used to have a relatively relaxed attitude towards availability of IT systems: if problems occurred, it took them a while to fix them and the solutions were sometimes not of high quality. However, DIS and GWS4all are critical to the whole organization because no staff member can work without the ECMS. Therefore, availability and performance are crucial now and the administrators had to realize that. It also changed their role within the organization to a certain aspect since all other staff members depend on them now. [→ 13 medium, 28 medium]

Archiefwet Governmental institutions in the Netherlands are required to obey the regulations of the Archiefwet of 1995 (Archiving Act). The Archiefwet not only requires institutions to archive certain information but also obliges them to destruct documents after a certain period of time. Before the introduction of DIS, the whole file was always archived for the longest individual retention time of all documents contained since managing the destruction of single documents would had been too time-consuming. Since the retention time is defined per document in the document index, DIS allows destructing only specific documents from a file. This is an advantage to the old situation since the requirements of the law can be followed more precisely. However, no documents are destructed at the moment: the scan-software was configured to capture only the used page from single-sided pages when it was certain that the second page contained no pieces of information and the RHCA does not fully accept this mode of operation. However, this view is currently under discussion and in general, DIS is expected to simplify the collaboration with the RHCA. [→ 16 high]

Paperless office The goal of introducing a paperless office has been achieved since all communication regarding cases between employees has to occur digitally via the ECMS. Staff members may only print documents for personal use what actually happened a lot during the first months after the roll-out. Meanwhile, they have got more used to working with digital representations of documents, resulting in less print-outs and a cost reduction. [→ 11 medium]

Changes in FTE distribution A reduction of at least one full-time equivalent (FTE) occurred in the case manager group. In the DIV group, one staff member was asked to leave the department before the implementation of DIS because he was physically not able to read a computer screen. Two members of the DIV team left after the implementation because they could not cope with the change in pace. In total, a reduction of eleven FTEs occurred in the DIV group. On the other hand, five new employees have entered the DIV group including a scan team coordinator which is a job that needed to be created so that the DIV group is always able to fulfill its new role. In the beginning of the project, it has also not been anticipated that the process descriptions and the document index needed to be actively maintained. Therefore, the position of an 'informatie consulent' (information adviser who manages changes of and additions to the document index) needed to be created in the DIV group. Thus the FTE-reduction did in total not lead to a decrease in personnel costs. [→ 36 low]

Process thinking Since GWS4all coordinates a large share of the department's daily work, adherence to pre-defined processes has become mandatory. The first impact is that staff members are now used to thinking about their work processes in a structured way. Secondly, new national laws or requirements from the municipality can be implemented more quickly. On the one hand, this is due to the fact that staff members are used to flexible process thinking now. On

the other hand, it can also be argued that the WfMS with its strict configuration 'just' enforces new or updated processes. Another impact of the increased reliance on technically prescribed process descriptions is the strict change procedure (with regard to data, documents, processes, and corresponding functionality) which has been implemented so that all process and document definitions also remain maintainable in the long-term. [→ 4 medium, 17 medium, 22 medium, 27 low]

Common language The document index also caused a discussion about definitions of documents used in the department. The members of the DIV group have to use the same expressions for describing documents as case managers. It took the department seven months to come to a common understanding being formulated in the document index and the creation of a 'common language' has simplified the internal collaboration, for example because staff members can be exchanged more easily among different units. [→ 24 low]

Citizens The respondents did not notice a change in client satisfaction. In their opinion, the ECMS probably just fulfills their expectations how an organization should be able to react to inquiries from clients in these days, i.e. have all information about cases immediately available. They also uttered the idea that there have been less troubles and potential aggression from the clients as a result of having every file available when needed, but could not further quantify this opinion. [→ 9 low]
In a survey among a certain group of clients (receiving unemployment compensation or social benefits) from 2005, a slight increase in client satisfaction has been noticed since 2003. However, the fields in which changes have been noticed (e.g. how clearly information and explanations have been presented, privacy when dealing with case managers) cannot be clearly related to the introduction of the ECMS and therefore, it has been refrained from including this impact.

The coded impacts of this case are summarized in table 6.6 on the next page. This case did provide new examples for impact 4 (facilitating organizational learning), impact 9 ('customer' service improvements), and impact 15 (improved decision making and planning) which are included in the updated versions of the impact definitions in table 6.7 on page 69. In addition, the text of impact 17 has been changed to 'change in business adaptability' because the novel reliance of executable process definitions and the increase in process awareness have actually increased the business adaptability of the department WCI. Its adapted definition and the definition of the new impact 36 (change of work organization) are also included in table 6.7. The inclusion of the latter was necessary so that the impact with regard to simplified and more flexible vacation planning as well as the changed type of work in the DIV group could be captured.

6.3.6 Preliminary analysis and implications for remaining research process

Compliance It can be observed that although GWS4all was used before the introduction of DIS, the presence of this WfMS by itself did not increase the compliance with regard to timely dealing with requests. Only after the files itself had been both digitized and tightly linked with GWS4all, this extended ES was powerful enough to strictly enforce compliance. The opportunities with regard to process control provided by a WfMS could not be taken advantage of since the files itself could still get lost in a stack of files on some staff member's desk. It can be concluded that only the combination of an EDMS/ERMS and a WfMS formed the basis for compliance. Further research is needed for evaluating whether this conclusion is only valid for the specific environment of the department WCI or also for other organizations.

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table 6.6: Coded impacts of DIS and GWS4all.

Societal consequences The impact that several employees of the DIV group could not cope with working with an IS or with the requirements of the job enlargement can be placed in a broader societal context. In the knowledge economy of today's world, IS and the knowledge how to

use them have become crucial (Bouwman et al., 2005, p.124 et seq.). In addition, this case has demonstrated that a number of simple activities are now carried out by an IS rather than by staff members. A direct consequence of these two observations is that the number of jobs that require a relatively low skill profile decreases through the introduction of IS. Since this research focuses on the impacts on a single organization, this discussion exceeds the scope of this document. However, the personal consequences of impact 33 'facilitating organizational learning' for certain employees should be taken into consideration when an ECMS will be implemented.

The updated and added definitions of impacts which have been induced by this case are presented in table 6.7.

	impact	new or changed description	source	type(s) of IS
4	facilitating organizational learning	e.g. broadened employee skills or increase in process awareness	Shang and Seddon (2002); C2	ECMS, general
9	'customer' service improvements	e.g. more simple access to better data and information about 'customers'; long-term and centralized content storage prevents its loss when employees leave the organization or are temporarily not available; allows to manage content for several departments/lines of business/etc (Hendricks et al., 2007).; C2	Chiu and Hung (2005); Hendricks et al. (2007); Shang and Seddon (2002); C2	CRMS, ECMS, general
15	improved decision making and planning	improved management of organizational resources, e.g. through more flexible staffing	Shang and Seddon (2002); C2	ECMS, general
17	change in business adaptability	decrease e.g. through inflexible implementation of the ECMS (standardized content models) (Andersen, 2008); increase e.g. through process awareness and executable process descriptions (C2)	Andersen (2008); H. A. Smith and McKeen (2003); C2	ECMS

...continued on next page

	impact	description	source	type(s) of
36	change of work organization	Work organization is defined as "the way work is structured, distributed, processed and supervised [and it] deals with subjects such as the following: the scheduling of work (such as work-rest schedules, hours of work and shift work), job design (such as complexity of tasks, skill and effort required, and degree of worker control), interpersonal aspects of work (such as relationships with supervisors and coworkers), career concerns (such as job security and growth opportunities), management style (such as participatory management practices and teamwork)" (Carayon and Smith, 2000, p.649). An example is a simplified and more flexible vacation planning.	C2	ECMS

Table 6.7: Updated and added impacts after second case.

6.4 Third case: Supreme Court of the Netherlands

The Supreme Court of the Netherlands (in the remainder: Hoge Raad) is the highest Dutch court for civil, criminal, and tax law. It is concerned exclusively with so-called cassation rulings, that means that rulings of lower instances are only evaluated whether the law, including the procedural rules, has been applied properly. The evidence established by other courts is accepted and therefore, cases are not fully reheard. The 38 Council Lords who form the so-called raad are part of the Dutch judiciary and are by that independent from the executive and legislature.
The Hoge Raad also includes the Attorney-General's office, consisting of 21 State Attorney's. They form the so-called parket and provide independent juridical advice (in the form of the so-called conclusions) before many cases are dealt with. As the Council Lords, they are not employed by the Public Prosecution Service, but are independent of government and the parliament as well.
The raad and the parket are supported by the Operational Management Division (OMD) which is not completely independent because it is funded by the Department of Justice. The government officials working at the OMD (approximately 75 FTEs) are responsible for providing the 'administrative infrastructure' of the Hoge Raad, for example by manning secretaries, registering cases, administering the IT etc. Next to the administrative support, the OMD also includes the research office in which young lawyers (95 FTEs) support both the raad and the parket in coming to their conclusions and judgments.

The work of the Hoge Raad is structured according to its three main chambers, namely the civil, criminal, and tax chambers. Every Council Lord, prosecutor, researcher, and most administrative staff members of the OMD are assigned to one of the three sectors. There are some groups within in the OMD providing services to all sectors (as for example IT) which do not belong to a specific sector. In total, there are about 250 people working at the Hoge Raad who provide the means to deal with the approximately 5000 cases which are brought before the Hoge Raad every year.

The Hoge Raad has participated in the GlobalStar Enterprise Award 2008 which is organized annually by the Hoge Raad's main ECMS supplier OpenText Corporation and in which they have been pronounced as the winner in the category agility. The document which has been submitted for the competition contains an elaborate description of the organization, the implementation project, and the ECMS. After having studied this document, one interview was conducted with the operations manager of the implementation project and a former external consultant, who has meanwhile joined the Hoge Raad as the assistant director of the OMD. In addition, four fact sheets about C@sus published by the Hoge Raad, an article from the Dutch computer magazine Computable, and an article in a juridical professional journal have been evaluated (cf. table C.1 on page XXXII). Both the interview summary and the case description have been checked by the two respondents.

6.4.1 Background and project goals

In 2001, the administration of IT infrastructure within the juridical power has been reorganized which gave the Hoge Raad the opportunity to organize their IT infrastructure themselves. At that time, the infrastructure consisted of several servers in not properly equipped rooms and all personnel had individual PCs. This brought two main problems: there was no central file storage and the maintenance costs were high because individual PCs needed individual maintenance, sometimes even at private homes. In 2001 and 2002, a Server Based Computing (SBC) environment was installed and the servers were moved into two separate, adequate server rooms.
Next to the hardware, the software was heavily outdated as well. Four different systems were used only for registering incoming documents and the data of case participants (e.g. lawyers, lower courts, plaintiffs, and defendants) was kept separately in each system (two systems for the civil sector, one system each for the other two sectors). Within a couple of months, it became clear that some of the old software (i.e. a heavyly used Microsoft Access application) did not run

properly in the new SBC environment since for example databases got corrupted. This created an immediate need for introducing a new registration system.

In 2003, it was therefore decided to introduce a new system which was also taken as a trigger to introduce a number of organizational changes. The following goals were defined for the implementation project:

- The new system should provide an exclusive way of uniformly registering case data across all three sectors.
- The processes of the administrative support department should both be modernized and made more efficient.
- The main business processes should also be supported through modern IT and its new possibilities.
- It should be possible to deploy staff members more flexible across all three sectors and their jobs should be enriched and enlarged.
- Restructuring of the archiving of both paper and digital records.
- More data and information sharing/exchange among the raad, the parket, and the scientific support staff.
- Increased possibilities for obtaining management information.
- Improving the possibility for teleworking.
- Reduction in copying and paper costs.
- Conversion of all the data from all four legacy systems.
- Improve the data and information exchange with external parties such as other courts or lawyers.

6.4.2 Process type

The work of the Hoge Raad is started by incoming documents, usually from a lawyer representing a party or from a lower court. All relevant incoming documents are scanned by an administrative staff member and are set into C@sus. During this activity, the relevant metadata is added, as for example parties concerned, lawyer(s), affected sector within the Hoge Raad etc. and the staff members also check whether the case has been received earlier (e.g. as a fax). All documents are labeled with a sticker containing a bar code, which helps to identify and retrieve files. Afterwards, the documents are put into a paper file which is also labeled with a bar code. During the whole process, all final versions of relevant documents are also placed in the paper file and — depending on the users — intermediate versions as well.
In general, a case belongs to one of the sectors of the Hoge Raad and the juridical work regarding a case is performed by members of this sector. After the registration, a case is assigned to a researcher from the research office who usually spends several months with searching for facts in the juridical literature about the specific case and summarizing them. After the researcher, one of the parket members usually analyzes the case and writes a conclusion. Subsequently, a group of three or five Council Lords renders a judgment based on the previously created documents. Finally, the judgment is pronounced and its written version is sent to the parties concerned.
This is a simplified description of the process and it should be noted that all three fields of law have different rules and conditions for going to the Hoge Raad. To further complicate things, the cassation jurisdiction for the Netherlands Antilles and Aruba are subject to additional specializations as well. Therefore, the staff members have to know the requirements very well so that they can form case-based decisions.

Although the general structure of the process has been defined, its execution is not deterministic. All employees at the Hoge Raad, especially members of the parket and the raad, have considerable freedom how to enact a case in a particular situation. They do not immediately know how to solve cases. Instead, they have to interpret the information of each particular case and also have to use their personal understanding for forming a decision. Taking into consideration the long

duration of the process as well, the analyzability of the main process is low. The sequential variety is low since there are strong logical dependencies among the steps which for a large deal are even prescribed by law and which therefore do hardly depend on the particular case. Besides some possibilities for inquiries etc. during the first (administrative) phase of the process, there are no interfaces to other processes or institutions. Therefore, the modularity of the Hoge Raad's main work process is high.

6.4.3 Implementation

The implementation was lead by three main mindsets:

1) The content of files should not be changed, but only the way they are handled should be modernized.
2) The mode of operation of the main processes of the parket and the raad should not be changed as well (and for a great deal cannot be changed since it is prescribed by law), but only a new foundation for working should be created.
3) As many standard products and as much standard functionality as possible should be used.

As part of an overall labor agreement, the project was granted to CapGemini in 2003 who served as the system integrator and supported the project and change management during the whole duration of the project. In 2004, a number of preliminary studies, an intensive process analysis, and a first inventory of user requirements have been conducted. One main result of the process analysis was that the activities for handling incoming and outgoing documents (these are activities performed by the administrative department) are very much alike which lead to their centralization in the newly created central unit for mail processing, file processing, and record management. The metadata about cases of both the old systems and the paper archive has been analyzed as well. The documents used during all stages of the main process have also been inventoried, analyzed, and consolidated. The result is the Documentary Structure Plan (DSP) which lists all document types and — based on the relevant laws — the particular storage time.

Afterwards, the list of user requirements was made more comprehensive and the prototyping started. The latter was done in such a way that the project team came up with initial ideas which functionality would probably be necessary and tested the ideas with the so-called user and advisory groups. During presentations in later stages of the project, the first results of the data conversion were used as input for the prototypes. The user groups usually consisted of administrative staff members and researchers, whereas the advisory group comprised members of the parket and the raad. Based on the feedback of these meetings, the next version of the prototype was developed and tested etc. It was made sure that all groups were involved at a point when the prototype was still 'sufficiently flexible' so that changes could still be easily adapted. An interesting side effect was that future users saw the prototypes and started having a lot of ideas. The project team was sometimes even "passed on the right lane" by the users (as one respondent put it) who became extremely enthusiastic about C@sus' potential and wanted more features than currently available or planned. In addition to the technical part of the implementation, the organization was also actively involved in the organizational redesign of the operational management division which took place during 2006. Next to conducting a BPR, the reorganization also included creating the new job descriptions. Core values for this organizational redesign were the freedom to act and the individual responsibility of staff members.

In total, the implementation of C@sus took about 2.5 years as the functional design was ready in December 2006 and user acceptance tests, functional tests, and production acceptance tests took place during the first months of 2007. C@sus was rolled out per sector from late June till early August 2007. The roll-out was accompanied by intensive training of end-users, which were also supported by so-called super users who supported their colleagues on the work floor. This approach helped to lower the workload of the implementation and helpdesk teams during the transitional period.

During the whole duration of the project, future users were constantly involved in the project. Next to the participation in user groups, all staff members were also informed by periodical newsletters, newsflashes, photographs, or videos. Special interest groups such as the board and the management were regularly updated by presentations. The major decisions of the project were also discussed with the works council from the beginning on. Next to the internal quality assurance, the implementation was also assessed externally. Important milestones were checked by auditors and the security was verified by penetration tests. [→ 13 low]

The project organization was clearly defined and included pre-defined roles, fixed consultation structures, and descriptions of all tasks, mandates, and responsibilities of the members of the project team. The project team stayed relatively small: the data analysis and conversion was done by two people over a period of approximately two years. During the whole duration of the implementation, about six to seven people worked on 'building' the application, i.e. configuring and integrating the standard components and creating the customized functionality. The other activities such as communication, process analysis and redesign, preparation of the re-organization, and user training were done by four people, also during the whole duration of the project. The permanent project team has been supported by a number of external experts, for example for setting up the network architecture or the in-depth configuration of the OpenText modules.

6.4.4 Description of the ECMS

As depicted in figure 6.3, C@sus provides a number of functionalities which are mainly accessed via a custom-made desktop application which has been implemented in Microsoft .NET, using the regular OpenText API. Although as much standard functionalities as possible were used during the implementation, the desktop application also contains some custom-made functionality. A frequently used one is the management of the list of trials of a specific day (in Dutch: rol), for which the desktop application heavily depends on the customized workflow and BI components. This list contains the metadata of the cases, a short summary, and also the bar codes of the cases' files. During the hearings, the bar code can be put under the scanner and the particular file is opened automatically. Next to the desktop application, C@sus is also tightly integrated with client applications such as Microsoft Outlook and Word.

The services layer is the most advanced of the three cases studied. All incoming paper documents and faxes are captured with the applications Kofax and TopCall. After capturing, all documents are automatically placed in the right location within their file, based on the provided metadata which is linked to the DSP. The digital sources from which content is imported are Bistro and Cendris. The latter is a server for importing postcode data, whereas Bistro (Bureau Internet Systemen en -Toepassingen Rechterlijke Organisatie) is an IT infrastructure for the Dutch judicial system. It contains, amongst others, a list of all active lawyers in the Netherlands and this information is used for the metadata of the cases.
SmartDocuments, a digital letter book, is the CCM module. It uses a decision tree so that when users choose to create a document, a dialog is started which asks questions such as 'What type of document?', or 'What kind of case?'. Based on the answers, relevant text blocks are chosen and the final document respectively parts of it are created. In addition, the information about the case available in C@sus (e.g. addresses of the parties) is automatically placed in the document. SmartDocuments's feature of providing text blocks in several languages is also used for C@sus.
EDM and ERM functionality is provided by the respective OpenText LiveLink ECM modules. The management of the ERM module is based on the DSP which is used for determining dates for deletion or for producing a list of documents which need to be transferred to the National Archive. However, the latter does not accept digital documents yet, so that only the paper files are transmitted at the moment (i.e. a part of the syndication functionality is not used yet). However, the publication component (and the CCM module) is used for creating letters to the concerned parties and the conclusions of the parket and the judgments of the raad are also sent digitally to the previously mentioned Bistro infrastructure so that they can be made available to the public.

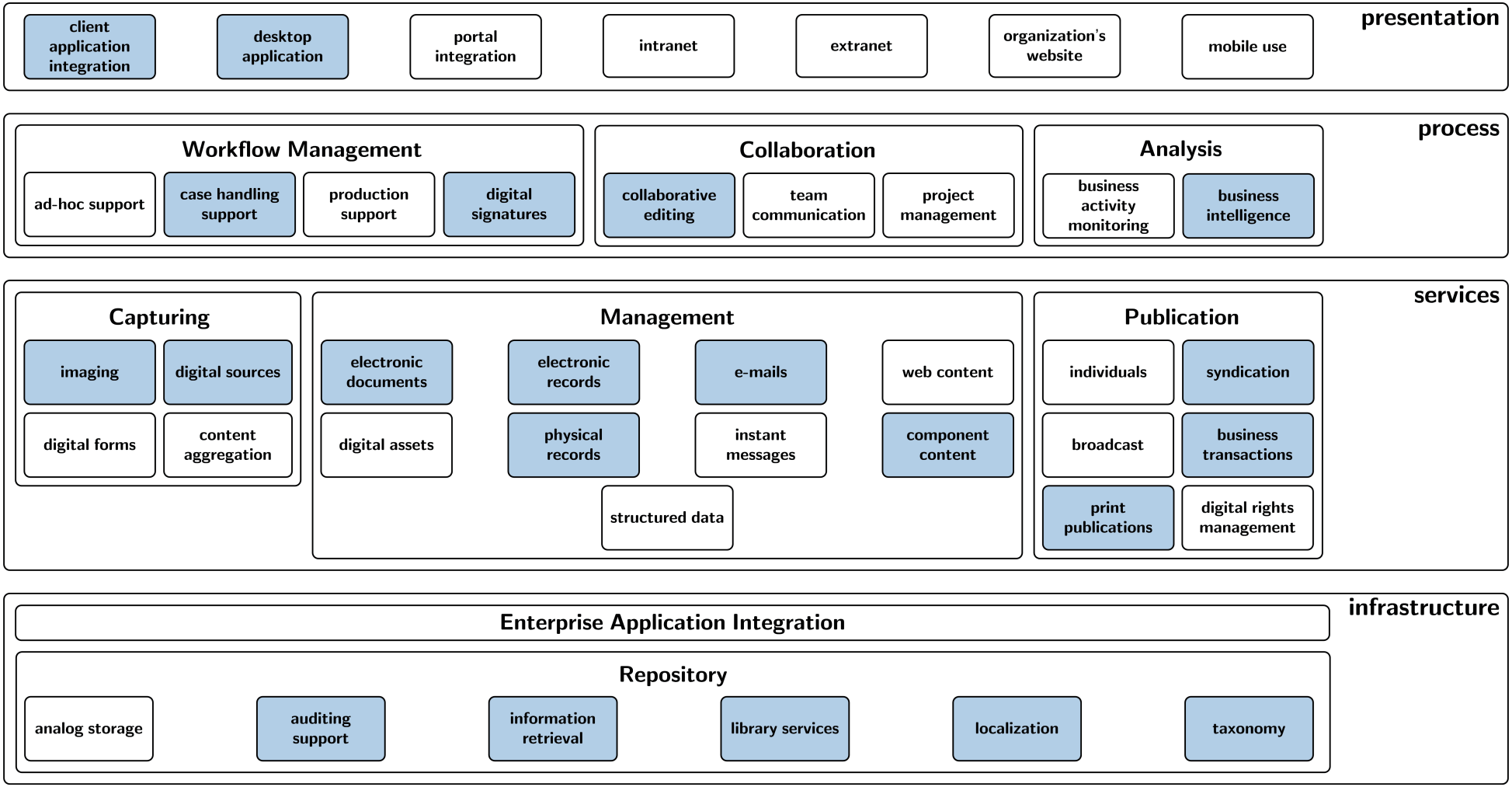

Figure 6.3: Functional scope of C@sus.

According to the written documentation, C@sus also supports the physical flow of files between process participants. In the interview however, it was mentioned that C@sus is not actively used for the management of physical records but that this information could only be deducted from the current status of the case.

The workflow component is not configured strictly at all. Two of the main ideas for the configuration were to leave as much freedom as possible to users and to trust in their individual responsibility. Although the process is in general clearly defined, exceptions have to be made from time to time. These are hard to capture in a strict workflow definition and therefore, C@sus only supports users, for example by reminding them that deadlines are approaching or have passed. However, they are not strictly enforced and a particular user can decide how to proceed in a particular case. Another example of the WfMS's mere supportive role is that based on the current status of a case, the initial choice of activities which can be performed is limited to the ones which would in theory be most applicable. However, users can always choose to see the whole list of activities and may perform them as well (within the boundaries of their authorization). Part of the case handling WfMS is also that the application PROTOS has been used for the definition and description of the processes. This information is available from C@sus' user interface so that users can easily refer to the process manual in case of questions. The functionality for electronically authorizing documents is provided by the application Cosign. However, this feature is not in production use yet.
The application Workshare is used for collaborative editing and is for that purpose integrated with MS Office. Finally, the OpenText BI module is used for providing the BI functionality. According to the sources studied, this functionality is used extensively as it was for example necessary to setup a replication of the primary database for performing the BI queries on.

The repository of the infrastructure layer provides audit trails, logging, and regular library services. The OpenText Livelink KM module is used for supplying a full text search functionality with operators. The DSP explained above provides a taxonomy for the organization. Technically seen, the repository is based on NetApp file servers and Microsoft SQL Servers.

C@sus also provides teleworking capability which is mainly used by researchers and members of the parket and the raad. By connecting special thin clients or notebooks to the Hoge Raad intranet through a virtual private network, they can access files from a distance. There are also a number of extensions planned for the following two major releases: external access to the 'rol' for authorized parties, production use of digital signatures, introduction of C@sus at the secretariats from the parket and raad, usage of C@sus during sittings of the raad, and connection to the National Citizen Register (Gemeentelijke Basis Administratie, GBA) and to a system from the Dutch Deparment of Justice.

6.4.5 Impacts

management information C@sus provides many insights into how processes are executed. There are several layers for the analysis of transaction data: on the organization as a whole, on sectors, on groups, and on individual staff members. Many of these reports implemented in C@sus are used for monitoring risk factors which have been identified during the process analysis. On the organizational layer, general information such as the number and type of cases is evaluated. These pieces of information are, amongst others, used for the budgeting process and for reports to the public or other governmental institutions. In the different sectors, the number of cases per Council Lord/Attorney General/researcher is used for planning. The cycle-times of the whole process and specific steps are monitored in order to discover bottle necks and for staffing purposes. The same kind of analysis is performed in the different groups. In addition, the staff members of the administrative department can be monitored individually for productivity. C@sus also provides audit trails and logs administrative information so that quality checks can be performed more easily. On the other hand, the staff members actively create reports themselves and use

information as for example cycle times or the current size of the case-pool for the individual planning of their daily work. In summary, considerably more information is available now, also about process steps which could not be monitored at all with the old systems. [→ 14 high, 15 high, 27 low, 36 medium]

new personnel policy As mentioned in the beginning, the implementation of C@sus should also be used for the introduction of a new personnel policy. It for example introduced a distinction between junior and senior staff members and includes active feedback from superiors. A job enlargement is planned and staff members will be trained (with regard to the relevant legal situation) so that they can handle cases from all sectors and can be staffed more flexible. Staff members who fulfill this requirement are placed in a higher wage group and for good performance, they can get into the next higher wage group. Staffing them across different sectors has become easier due to the uniformity of the system. The jobs of administrative staff members have also been enriched. They are now responsible for a number of files and when questions about these cases arise, they act as the first point of contact towards colleagues and external parties. As a result, the service to internal and external clients has improved. In addition, the files are also more better maintained. The newly available process information is also part of the new policy as it is used during personal annual assessment discussions. It cannot be said yet if this increase in available information will have an impact within the organization next to the new personnel policy, e.g. with regard to culture. [→ 4 medium, 9 low, 16 low, 36 medium]

user satisfaction According to the two respondents, the members of the OMD are pleased with C@sus. In the criminal and tax sectors, members of the parket and the raad use C@sus as well. Some are said to be quite positive about the system, but depending on personal preferences, other members let their administrative and scientific staff members take care of setting documents in the (C@sus- and paper-)files. The level of satisfaction of all users has been quantified in a user survey after the interview has taken place but the results are not available to the author. [→ 3 medium]

data quality The implementation of C@sus led to a considerable increase in data quality. When the user directory was created, all personnel data records were checked and updated. During the conversion of the old registration systems, the (approximately 445.000) old records from the previous four registration systems have been cleaned up (e.g. correction of spelling mistakes) so that a clean, shared data basis has been created. During the data migration, all digitally available judgments and conclusions have been included in C@sus as well. In the future, the uniformity of the information is tried to safe-guard because this kind of information is stored centrally for all sectors and needs to be chosen from a list. Before the introduction of C@sus, this information was entered manually. In addition, the personnel directory has been cleaned while a biometric access system was implemented. [→ 7 medium, 22 high, 27 low]

time savings Next to a more efficient data input, considerable time savings have been achieved through the streamlined process with less manual steps (as e.g. reduction of the physical movements of files), the use of bar codes, the full text search, and the letter book. Further time savings are expected from using Workshare for collaborative editing (still in pilot use). The creation of management reports has also been simplified considerably. As part of the implementation, 24" LCD-screens have been introduced. In comparison to the old situation, this has also increased the working speed, especially of the administrative staff members. [→ 6 low, 10 low]

unified 'corporate' design The letter book also helped to standardize the external communication. In the past, 600 different types of templates had been used which have been reduced to approximately 240 ones, all following the same 'corporate' design. Their appearance has been aligned and the pre-defined text blocks make sure that the same text is used in similar situations. This did not lead to a decrease in the quality of the outgoing texts, because e.g. judgments are still checked by at least three Council Lords. [→ 32 medium]

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table 6.8: Coded impacts of C@sus.

change in cost structure The time savings are hard to be quantified, but the cost savings of SBC (because of reduced helpdesk and maintenance costs) and the reduction of copying and paper costs have been notified. However, substantial investments in IT infrastructure were necessary

as well: redundant server hardware, software licenses, security measures, and an update of the work PCs (large screens). The number of staff in the IT group has also grown from 1.5 FTEs in 2002 to seven FTEs in 2008 (two helpdesk agents, two functional administrators, two network administrators, and a manager). A detailed analysis of the costs and benefits has been prepared in the meantime but is not available to the author. [→ 11 low, 13 low]

role of paper file, cooperation, and teleworking Although the reorganization of the main process did not completely remove the logistical part of physically moving files around, its influence has been dramatically reduced. For example, it used to be necessary that a case-file went back and forth between administrative staff members and researchers during the creation of the case summary. Now, the summary is kept in the digital file and changes are done electronically. In addition, the requirements for archiving can also be fulfilled more easily than before since C@sus' ERM module provides automatic disposition schedules based on the DSP. The weakened role of the paper file also led to an increase in horizontal cooperation. Members of the parket and raad, researchers, and staff members can cooperate more easily and every case can be seen as a small collaboration project within C@sus. Next to that, files are now digitally accessible everywhere at any time, so that the implementation of C@sus increased the opportunities for teleworking and also reduced the typical problems of paper files, such as files being sometimes only (very) hard to rediscover. [→ 10 low, 16 low, 22 high, 24 medium, 29 medium]

Table 6.8 on the preceding page displays the coded impacts of C@sus' implementation.

6.4.6 Preliminary analysis

compliance The compliance with regard to documentation requirements is achieved indirectly. The general structure of files is defined, but the EDM and WfM modules are not configured strictly so that compliance is not enforced by the ES. The BI module rather provides status information of files and with the new personnel policy, staff members are held responsible for the completeness of files. Therefore, the old situation is simplified by providing enhanced insight.

correlation functional scope and impacts Comparing the functional scope and the coded impacts, it can be noticed that this is the first case where an improved branding has been noticed. Since it is also the first case where a CCM module is used, a correlation seems possible. More correlations between certain impacts or impact categories on the one hand and parts of the RAE might be discovered in the cross-case analysis.

Based on the observations made in this case, the descriptions of two impacts were updated to the versions presented in table 6.9.

	impact	new or changed description	source	type(s) of IS
29	increased IT infrastructure capability	e.g. stable and flexible support of process and structure changes (Aalst and Hee, 2004); provision of (improved) facilities for teleworking (C3)	Aalst and Hee (2004); Han (2004); Shang and Seddon (2002); C3	CMS, ECMS, WfMS, general
36	change of work organization	definition see p.69; the use of information gathered by the BI component for planning of work by staff members (C3), and new job descriptions due to disappearance of paper files (C2, partly C3).	C2, C3	ECMS

Table 6.9: Updated impacts after third case.

Truth is subject to too much analysis.

Frank Herbert

7 Analysis and results

First of all, the case studies are further analyzed in this section. Afterwards, the results are presented and the chapter concludes with comments on the limitations of this research.

7.1 Cross-case analysis

The codified results from all three case studies are compared with each other in order to find similarities and differences. This analysis helps answering the final sub-question: *How are the influencing factors related to the impacts?*

7.1.1 Comparison of the functional scopes

Placing the graphical representations of the three functional scopes side by side (figures E.1, E.2, and E.3 on page LVI) shows that BI, EDM, ERM, and WfM modules are used in all cases. It is also a noticeable fact that none of the organizations uses the ECMS for actively including external stakeholders (yet), for examples by using a WCM module. In the case of Org. A, this functionality would admittedly not match with the initial goal of the ECMS (i.e. to provide an internal digital project file), but especially for the department WCI it could be a valuable extension to provide insight into the process status to concerned citizens. The Hoge Raad plans to provide some process information to external parties and also captures content from digital sources and syndicates its publishable content. Furthermore, the DAM module has also not been used. This can be explained by the fact that the type of content handled by this kind of module (namely rich media as for example videos) is not being used in the three organizations.

In literature, no definition could be found of the minimum functional scope an IS needs to posses before it qualifies as an ECMS or whether a minimum functional scope exists at all. The comparison at hand however can be interpreted in such a way that the four elements of the RAE mentioned above form the minimal functional scope of an ECMS. In particular, it seems as if an ECMS does not need to manage "all [...] information assets" (H. A. Smith and McKeen, 2003, p.648) of an organization since all three organizations also use separate WCMSs. However, this assumption about the minimum functional scope might also be influenced by the general history of ECMSs sketched in section 4.6.3: both IBM Filenet and OpenText Livelink are ECMS products which are rooted in the EDM/ERM domain (eNotes, n.d.; Open Text Corporation, n.d.). Therefore and because of the limited amount of cases studied, the elaboration on the minimal functional scope of an ECMS remains for further research.

7.1.2 Comparison of the process types

All characteristics of the process types from the cases are summarized in table 7.1 on the next page. This overview shows that the initial categorization during the case selection (cf. table 6.3 on page 50) was largely correct and only the difference between the two process segments at Org. A

	Organization A		department WCI	Hoge Raad
	first phases (CEM/A&C)	project phase (map)		
analyzability	high	low	high	low
variety	low	high	low	low
modularity	high	high	high	high

Table 7.1: Comparison of the process types of the cases.

has not been foreseen. The modularity of the ECMS-supported process(es) is in fact always high so that this CSR does not allow to evaluate the influence of modularity on the impacts. However, the three cases do differ on the other two criteria so that statements about to their influence are possible. The comparison of the process type of the first phases at Org. A and of the department WCI shows that there is an unforeseen possibility for observing a literal replication. The latter is elaborated on in section 7.1.4 where the two cases are also evaluated with regard to the potential theoretical replication mentioned in section 6.1.3. Based on this comparison at hand, it can finally only be noted that the process type has proven not to be a factor prohibiting the use of an ECMS for the three factor constellations studied.

7.1.3 Comparison of the impacts

The overview of the impact tables (tables E.1, E.2, and E.3 on page LVIII) shows that in all cases, the implementation of an ECMS resulted in impacts of the five categories

a) employees,
b) operational processes,
c) managerial processes,
d) horizontal coordination, and
e) vertical control.

These impact categories can be summarized as depicted in figure 7.1 The relations of the categories with the functional scope and process type are analyzed in sections 7.1.4.1 and 7.1.4.2.

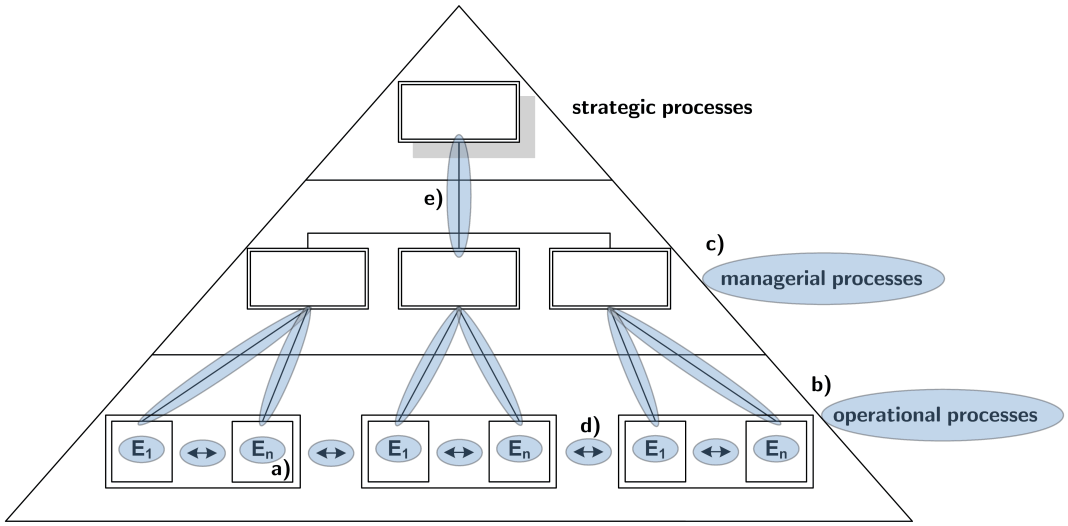

Figure 7.1: Main impact categories of ECMSs matched on an organizational chart.[13]

[13] The figure is a simplified organizational chart divided into the three types of processes of the impact framework. The abbreviations $E_1, \ldots, E_n$ refer to a group of employees in a department and the double-headed arrows represent mutual relations.

ad a) The impacts of this category can be observed, but their nature and intensity differs among the cases. On first sight, a relation for example with the type of WfMS or the process type could be assumed. However, as demonstrated in sections 7.2.2 and 7.2.2.4, the chosen independent variables cannot (fully) explain the differences among the cases.

ad b) The number and intensity of the impacts from this category differ from each other as well. It is assumed that these impacts are largely influenced by the chosen functional scope and this relationship is described in more detail in section 7.1.4.1.

ad c) Other than in the other four categories, all impacts of this category have been observed in all cases. Looking back at the case study reports, it seems likely that the underlying reason for these four impacts is the fact that both the work process(es) itself and content previously only being available in analog form have been digitized. To start with, the digitization led to impact 13 (change of risk profile) which on the one hand can be assumed to be a general consequence of introducing ISs which replace or support processes that had been (mainly) paper-based before. On the other hand, this change was observed to be more profound for an organization which has to rely exclusively on digital files as demonstrated by the initial backlog of the department WCI. The confidentiality of the content also influences the risk profile as it can be seen from the extended security measures which have been taken by the Hoge Raad. Impact 14 (improved quality of management information) is also a direct consequence of the digitization since the provision of management information is one of the major functionalities EDM and WfM modules offer (cf. sections 4.3.1 and 4.3.3). This impact can also be assumed to form the basis for impact 15 (improved decision making and planning) since the new availability of better information and/or of information previously not available at all almost automatically gives the management a better basis for decision-making. Finally and as already mentioned in the three preliminary analyses, impact 16 (increased compliance) can either be a direct impact of the digitization ('strict ECMS') or an indirect one achieved due to improved information.

ad d) A potential reason for the impacts of this category is that an EDM module simplifies the access to digital files. A result of digitizing files and storing them under version management in a central location which is easily accessible is impact 22 (improved and simplified access to authoritative content/organizational memory) and this central repository has also been found to lead to impact 23 (increase in content sharing). Interestingly, impact 24 (improved internal collaboration) cannot only be achieved through the collaboration component as argued in section 7.1.4.1, but also by supporting the network model of KM (Alavi and Leidner, 2001) by bringing together employees working for the same client (cf. section 6.2.4 on page 53).

ad e) In the first and third case, the governance (i.e. the way how the management can enforce its decisions) has been improved indirectly through the improved quality of management information. The resulting increased insights (into for example process execution and the completeness of file keeping) puts the management more easily into the position to take adequate actions on time than before the ECMS implementation. In the second case and for the first phases of the process at Org. A, governance has been caused directly by the production WfMS used.

The comparison of the impact tables also shows that hardly any impacts in the categories strategic processes and context of the organization have been observed. With regard to the strategic processes, this is actually not surprising considering the fact that most of these impacts are by their very nature not applicable to public organizations operating on a local or national level. In the case of the commercial organization Org. A, these impacts are also not applicable mainly due to the nature of the work performed in this organization. For example, business growth in consulting is hardly determined by the ECMS used, but rather by market conditions such as the number of available consulting projects and qualified job applicants. Since Org. A is an international network of independent participating member firms in every country, the enabling of worldwide expansion is not applicable to this implementation project being limited to the Dutch organization. The second observation that only few external impacts have occurred are discussed in the following section 7.1.4.1.

7.1.4 Inter-factor comparison

In the following, the relations among the constituents of the research model are further explored.

7.1.4.1 Influence of the functional scope on impacts

Based on the previous analyses, a number of elements from the RAE can be related to impacts or impacts categories. To start with, the type and configuration of the used WfMS and the 'intensity' of the EDM module usage have been found to influence the impacts on operational processes. The combination of a production WfMS and an intensively used EDM module at the department WCI have resulted in many impacts of that category which are additionally also more intensive than at the other cases. On the other hand, the ad-hoc WfMS combined with the mainly supportive EDM module at Org. A caused only fewer and much less intensive impacts. The type of WfMS can also have an influence on compliance. When a production WfMS is used in conjunction with a 'strict' EDM module, a large degree of 'direct compliance' is likely to be achieved. In the other two cases (ad-hoc and case WfMS), compliance is caused indirectly through the information provided by the BI module. Governance (impact 27 (improved governance)) can also be a consequence of these two paths. As demonstrated in section 7.1.3, the BI module also has a major influence on the managerial processes (e.g. basis for impact 15 (improved decision making and planning)).
By contrast, the relation between elements of the RAE and impacts of the category context are less definite since the ECMSs are not intended respectively not yet (fully) used for external communication. When the department WCI and the Hoge Raad can digitally transfer content to archives via the publication component in the end, impact 30 (new or improved 'business' relationships) might occur as it was mentioned in section 6.3.5. The only relation that can be established stems from the third case, where a CCM module is used which has been reported to have resulted in impact 32 (improved branding).
Interestingly, the decrease in information quality at another ECMS-using organization observed by Andersen (2008) did not occur at the Hoge Raad which may be due to the extremely high importance of the content produced at the Hoge Raad. The observed impact 34 (improved 'customer' relations) of this case has not been caused by the CCM module, but rather by the reorganization of the responsibility for files.
One could have expected a relation between the collaboration component and the impact category horizontal coordination. However, the cases show that this assumption is only partly valid. In all cases, the respective impacts are mainly caused by the EDM and WfM modules or the newly introduced document index, so that only impact 22 (improved and simplified access to authoritative content/organizational memory) can be related to a part of the RAE. However, the collaboration component is really used at the Hoge Raad and can be related to impact 24 (improved internal collaboration) there. Besides these observations, no other relations between elements of the RAE and impacts could be discovered.

7.1.4.2 Influence of the process type on the impacts

The comparison of the process types and the impacts gives the impression that the process type hardly influences the occurrence of the impacts, but rather only their intensity. Impacts from five categories can be observed in all cases and they can be linked with the process type as demonstrated in the following. The last two cases have a low process variety and in turn display a higher degree of horizontal coordination than the first case. Since these two organizations also use an elaborated EDM module, the reason might be that by storing content in an ECMS, it can be passed on more easily between different employees. This might also be true for highly variable processes, but probably this setting would also require a different functional scope, e.g. an extended collaboration component. In the second case, a highly analyzable and less variable process has been ascertained which seems very suitable for automation due to its relative simple

nature. As a matter of fact, this case does indeed display the most intensive impacts on operational processes. The 'opposite' process type can be found at the first case where also much less and also less intense impacts on operational processes have been observed. The process type of the third case is in between these two extremes and so are the impacts on the operational processes.

Since the first phases of the process at Org. A and the processes at the department WCI have the same process type, a literal replication of the respective impacts might be found. It should be mentioned that the first segment at Org. A is not supported by a separate ECMS, but mainly by a single sub-application which is in fact mainly a production WfMS and includes only a minimal EDM module. Since it is improbable that this combination can cause the full range of impacts of an ECMS, the comparison is only partial and the results have to be evaluated very carefully. However, the potential insights justify this approach.
For the replication, the impacts of the first case which can be linked to CEM/A&C have been mapped to the latest version of the impact table as depicted in table E.4 on page LIX. For reasons of convenience, the impacts observed at the department WCI have been repeated in table E.5. The comparison of the two tables shows that all impacts of CEM/A&C can also be observed at the department WCI, so that a literal replication can be observed. It can be concluded from this that the process type influences the impacts, but the previously mentioned theory about how the process type influences the impacts can neither be confirmed nor falsified.

For observing the potential theoretical replication between the project phase at Org. A and the department WCI, the impacts of map have been summarized in table E.6 on page LIX and also been placed next to the ones observed at the second case. The most noticeable difference is that the impacts from the category operational processes differ from each other to a large extent. At Org. A, there are much less impacts which are also less intense than at the department WCI, except for the compromise costs which have only been observed at Org. A. The impacts on the managerial processes are not as much different between the two organizations; they are only more intense at the department WCI. A similar picture can be found at the category employees where the changes are more intense at the department WCI, but where the users are also not dissatisfied with the ECMS. In the category horizontal coordination, the only difference is that impact 23 (increase in content sharing) could only be observed at Org. A. Finally, two differences with regard to single impacts stand out. The introduction of map led to additional efforts for keeping content up to date, whereas the introduction of the ECMS at the department WCI simplified work. Secondly, the change in power structure only occurred at the department WCI.
The interpretation of these observations does not deliver a clear-cut result. Since the impacts of the two cases are not completely different and opposite from each other, a complete theoretical replication cannot be observed. However, the theory of how the factor process type is related to the impacts is supported by the observations since it only influences the intensity of impacts, except for the category operational processes. In the latter, the process type seems to influence the general occurrence of impacts. Based on the results at hand, the process type also influences the occurrence of the three negative impacts 3 (user dissatisfaction), 12 (compromise costs), and 26 ((additional) efforts are required for keeping content up to date) which can only be observed at map. However, the potential conclusion from this observation whether ECMSs are not (entirely) suitable for the specific process type found at Org. A needs to be studied in further research since the result might also be caused by the overall suboptimal adaption of the ECMS to the users' needs as it is argued in section 7.2.2.

7.1.4.3 Influence of the process type on the functional scope

Other than originally expected, the preliminary analyses showed that the functional scopes are (consciously or unconsciously) influenced by the process type of the processes which are to be supported by the ECMSs. Based on the observations of the three case studies, the relations presented in table 7.2 on page 85 have been determined. The table shows that parts of the functional scope (i.e. the type and configuration of the EDM and WfM modules) have been

found to be aligned with the process type of the ECMS-supported processes. Looking back to the literature on WfM described in section 4.3.3, the relationship between the process type and the WfM module is already implicitly described in the paper from Aalst (2004). He states that each type of WfMS can be assigned to a certain category of work processes. Therefore, this research adds to that study by transferring the findings to the ECM domain. In addition, the findings from this research extend the original study to the chosen operationalization of the process type. In contrast, the studied literature on ECM and EDM did not mention the discovered relation between the process type and the EDM module, so that this result represents a new finding. Further research on more cases is required for an extended confirmation of these two relations and for finding out whether for example the non-adaption of the functional scope to the process type leads to the previously mentioned three negative impacts.

7.1.4.4 Influence of the functional scope on the process type

Another unexpected result has been discovered during the repeated examination of the first case study report. The respondents stated that the first phases of Org. A's process used to have a high sequential variety before the introduction of the ECMS. However, the implementation of the production WfMS CEM/A&C changed this particular characteristic of the process type. Now, all the steps of the first phases have to be performed in the predefined order before employees are able to book their working hours. This means that an element of the RAE has changed the process type. Looking at the impact table of CEM/A&C (table E.4 on page LIX), it is noticeable that this change has not lead to negative impacts even though it can be assumed to have a considerable influence on the way work is performed. Potential reasons are that CEM/A&C is perceived as useful since it simplifies the work and that it has been carefully implemented in the organization. However, further research into the reasons is needed to confirm this theory. Further research is also needed for validating this relation at other organizations and for investigating whether a similar influence can also occur for other initial process types.

7.2 Results from case study research

This section presents the results of the CSR and comments on its validity.

7.2.1 Explanatory results

As a CSR with a mainly explanatory character, its main goal was the evaluation of the initial ECMS impact model. During the analysis in section 7.1, it has been demonstrated that the two factors functional scope of the ECMS and process type of the ECMS-supported processes indeed influence the impacts of implementing an ECMS. Although very different operationalizations have been used, this sets a first step towards validating the findings of the authors mentioned in section 5.2 for the ECM domain. Therefore, both concepts qualify for quantitative exploration in future research on this topic. In addition to the predictions from the initial version of the ECMS impact model, the analysis also delivered the unexpected results that two elements the functional scope are aligned with the process type and that the functional scope can also influence the process type of an organization. To accommodate these findings, the initial version of the ECMS impact model has been extended to the version depicted in figure 7.2 on the next page.

analyzability	variety	modularity	influence on WfM	influence on EDM
low	high	high	ad-hoc WfMS for being able to react quickly to changes in the environment; low analyzability and high variety of process preclude the definition of all possible workflows and a strict configuration of the system because employees would be hampered in their work	likely to only have a supportive role, e.g. as central content storage for coordinating geographically dispersed teams; can also not be configured strictly due to low analyzability of the process
high	low	high	production WfMS is most suitable as the sequence of the ECMS-supported processes can be determined beforehand; likely to be the central component since the sequences of the process steps (and the adherence to it) are likely to be of high importance in the particular organization; elevated position of this component within the system provides potential for harvesting a lot of process information	likely to be clearly subordinate to the WfMS; easily combinable with the ERM component via a document index since all documents that can be created are probably known beforehand
low	low	high	case handling WfMS most suitable since the low variety indicates that the tasks to be performed are structured, but the actual execution depends on the specific circumstances of the changing environment (cf. section 4.3.3); strictness of the configuration tends to be low since employees need some freedom within each step	combination with ERM component potentially complicated since the low analyzability of the environment might require the creation of unforeseen (classes of) documents which therefore cannot be defined in a document index beforehand[14]

Table 7.2: Influence of the process type on the EDM and WfM components.

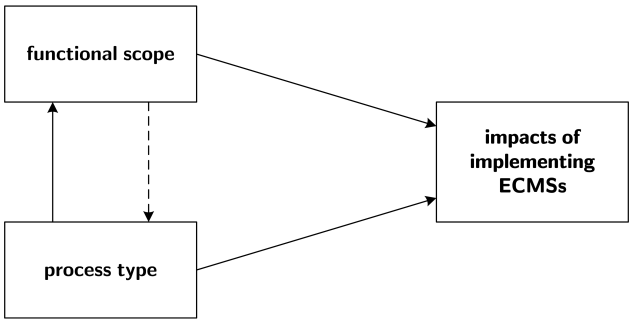

Figure 7.2: Extended ECMS impact model.

[14] At the case studied, this was different because the low analyzability only influences the tasks to be performed, but not the documents to be created.

The major impact categories have been identified to be the five categories described in section 7.1.3 which could to a certain extent also be related to the independent variables, so that this CSR answers sub-questions 4, 6, and 8. Figure 7.3 contains a detailed version of the extended ECMS impact model in which the results of the analyses have been captured in the following propositions:

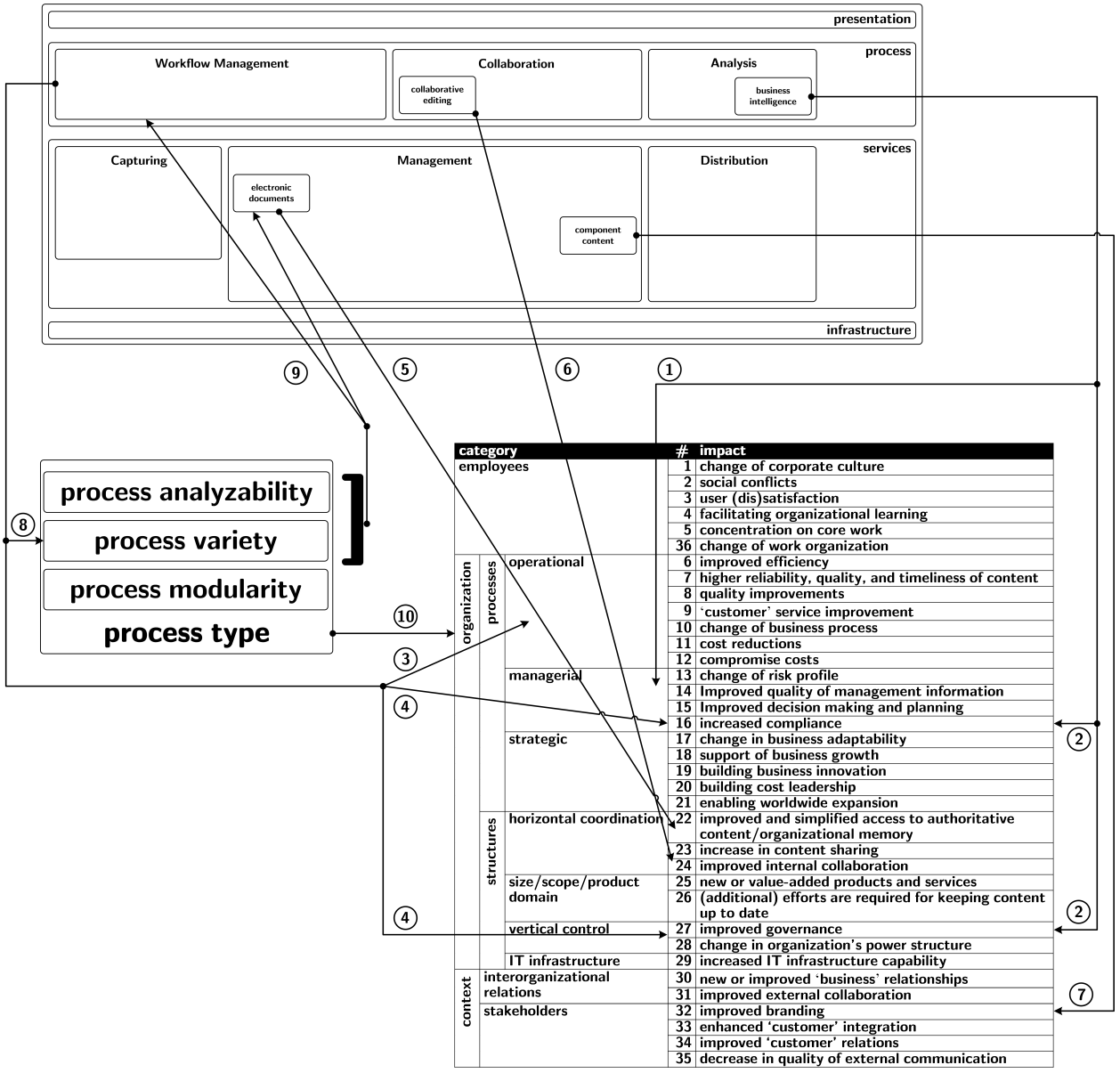

Figure 7.3: Extended ECMS impact model including explanatory results.

Proposition 1: The use of a BI module causes impacts in the category managerial processes (cf. section 7.1.3).

Proposition 2: The use of a BI module can indirectly cause compliance and governance (cf. section 7.1.4.1).

Proposition 3: The type and configuration of the used WfMS module influence the impacts of the category operational processes (cf. section 7.1.4.1).

Proposition 4: The type and configuration of the used WfMS module can directly cause compliance and governance (cf. section 7.1.4.1).

Proposition 5: The use of an EDM module leads to impact 22 (improved and simplified access to authoritative content/organizational memory) (cf. section 7.1.4.1).

Proposition 6: The use of a collaborative editing module leads to impact 24 (improved internal collaboration) (cf. section 7.1.4.1).

Proposition 7: The use of an CCM module leads to impact 32 (improved branding) (cf. section 7.1.4.1).

Proposition 8: Supporting a highly variable process with a production WfMS reduces the variety of this process (cf. section 7.1.4.4).

Proposition 9: The type and configuration of the EDM and WfM modules need to be aligned with the analyzability and the variety of the process(es) they support (cf. section 7.1.4.3).

Proposition 10: The process type influences the intensity of impacts except for the impacts of the category operational processes, where it influences the nature of impacts (cf. section 7.1.4.2).

7.2.2 Exploratory results

Sub-questions 4 *Which impacts can occur when an Enterprise Content Management System is implemented in an organization?* and 6 *Which factors influence the impacts of implementing an Enterprise Content Management System?* are exploratory ones. An analysis of the results of the cases with regard to exploratory findings shows that the initial selection of independent variables and the list of potential impacts are not complete. The reason has been indicated in section 7.1.4.3. The analysis there showed that the first case displays negative impacts although the functional scope has been aligned with the process type which means that the functional scope alone cannot be used as an explanation of the negative impacts. It also seems incorrect to use the process type found at Org. A as the only reason for explaining the negative impacts because in theory, this type of process can also be properly supported by an ECMS (cf. section 4.3.3). Therefore, the initial ECMS impact model lacks (at least) one additional factor which can explain the occurrence of these impacts. Next to presenting candidate factors, the remainder of this subsection also comments on other observations, including some remarks on extant literature and ideas for further research.

7.2.2.1 Updated list of impacts

Although the data collection phase of the CSR has been guided well by the initial impact table, the results of the three cases made it necessary to change the list of impacts and their descriptions to the latest versions presented in table A.2 on page XXVIII. Next to providing more examples in the descriptions (e.g. impact 9 ('customer' service improvements)), two major changes have been done. As described in sections 6.2.6 and 7.1.3, impact 13 has been changed from 'risk mitigation' to 'change of risk profile', because an ECMS has been observed to not only mitigate certain risks, but to also create new ones. Impact 17 has been changed from 'deteriorated business adaptability' to 'change in business adaptability' because the second case showed that an ECMS can also enhance business adaptability (cf. section 6.3.6). Finally, impact 36 (change of work organization) has been added to the list so that observations such as the simplified and more flexible vacation planning as well as the changed type of work from the second case can be captured.

7.2.2.2 Implementation approach

When evaluating how the three ECMSs have been introduced into the respective organizations, differences not only among the approaches, but also among the impacts become apparent. As mentioned in the preliminary analysis of the first case (cf. section 6.2.6 on page 58), the way map has been implemented (e.g. very little inclusion of the future users with regard to requirements, mainly aligned with organizational goals and hardly adapted to users, little training provided) can be assumed to have resulted in the three negative impacts.

This assumption is further supported by the results of the other two cases. At the department WCI, the future users have been actively involved in various stages. They contributed to the intensive analysis of both the processes and the used documents within the department. In addition, they were also asked to help with the functional requirements by testing and commenting on pilot implementations. Finally, the staff members have also been consulted about the set-up of the workplaces. These activities have resulted in an IS which is described as user-friendly and well adapted to the needs of its users. In turn, negative impacts could not be observed. During the implementation of C@sus, the project management also actively involved representatives of all future users groups in the development of the system. In fact, the iterative approach using prototypes can even be considered to be user-centered since it puts the future users in a dominant position with regard to the configuration of the system. The chosen approach resulted in a system which is reported to be well adapted to the needs of the users and to be user-friendly. In turn, the three negative impacts found for map have not been observed here.

Based on these observations, future research on the impacts of ECMSs should initially include the *implementation approach*[15] as an independent variable in order to study its influence. Although extant literature can be found which confirms the existence of this factor (cf. e.g. Lederer and Sethi, 1988; Robey, 1987; Sarker, 2000), this is an unexpected result. This is because the initial research model from Hong and Kim (2002) on ERP implementations also included the adaptedness of an ERPS to its users as a variable, but it was found not to have a significant influence. Therefore, it had not been included into the initial scope of this research.
Next to operationalizing this factor and determining its validity, further research is also needed for studying the relation of this factor with other elements of the research model. During this CSR, several potential relations can be identified. First of all, it remains unclear whether the chosen implementation approach directly influences the functional scope (i.e. the actual selection of ECMS components) or only 'soft factors' such as adaptedness to users and user-friendliness. An example is C@asus' CCM module which is reported to be configured well to the needs of the users (adaptedness) but it is not known whether this module would have also been introduced without the active involvement of the future users. In this case, the implementation approach would not directly influence the impacts, but only indirectly through the functional scope. However, the inadequate inclusion of future users during the development process might also directly result in impacts, for example when an future users become dissatisfied with the IS or when particular user groups are preferred to others. Finally, it is interesting to notice at the third case that it can be assumed that the strong position of the users within the organization (the members of the parket and raad) has largely determined the implementation approach. Therefore, the latter seems not to only be defined and influenced by the management as it can be be assumed to be the case for the other two implementation projects.

7.2.2.3 Soft factors

The previous paragraph already used the term *soft factors* for referring to adaptedness to users and user-friendliness. This factor seems to be worthwhile exploring in future research because the functional scope does not seem to completely describe a given ECMS. The way how the RAE has been used does show differences in the functional scope of different ECMSs (and by this fulfills one of its design purposes), but is not possible to depict the 'intrusiveness' or 'intensity' of the different components of the specific ECMS. For example, both Org. A and the department WCI use EDM and ERM modules, but they are much more comprehensive and have a larger influence on the daily work of the employees in the latter organization than in the former one. In addition, the RAE is a list of potential functionalities, but cannot capture to what extent an ECMS has been adapted to the needs of its users, for example how user-friendly it is. This observation is based on a comparison of figures E.1 and E.3 on page LVI in which the EDM and ERM modules

[15] Implementation is defined as "all that must be done by a specific organization for it to be able to harness the capabilities of a particular information technology as envisioned" (Sarker, 2000, p.195).

are displayed in the same way. However, the ECMS at Org. A has not been adapted well to the needs of its users whereas the one at the department WCI includes both functionalities and a user interface which have been extensively customized.

Therefore, a complete characterization of an ECMS might need to include a description of soft factors as a second element next to the specification of the functional scope. The two already mentioned constructs *adaptedness to user needs* and *usability* (defined as "the ease of use and acceptability of a system or product for a particular class of users carrying out specific tasks in a specific environment" (Bevan, Kirakowski, and Maissel, 1991, p.652)) can be indicated as elements of the new factor. These descriptions appear to be similar to the factors "Perceived Usefulness" and "Perceived Ease of Use" from the Technology Acceptance Model (Davis, 1989; Davis, Bagozzi, and Warshaw, 1989; Venkatesh, Morris, Davis, and Davis, 2003) which might serve as the operationalization of this factor in further research. Another construct of which parts might need to be included is the Task-Technology Fit model from Goodhue and Thompson (1995).

7.2.2.4 Goals

The analysis also gave the impression that the research model needs to be extended by the factor 'goals of the implementation'. If for example an improvement of the quality of management information is not a goal of the project, then the usage of the BAM and BI modules are probably not necessary and in turn, impact 14 (improved quality of management information) will probably not be achieved. In the remainder, a short, preliminary analysis of the three cases with regard to this potential factor is performed.

In the first case, three goals had been defined beforehand: increase of the compliance with the acceptance procedure and with the documentation requirements as well as the support of virtual teams. In fact, all parts of the functional scope can be linked to one of the three goals except for the access method 'desktop application'. This shows that the functional scope has been adapted to the goals, yet mainly to the first two goals. The production WfMS for supporting the acceptance procedure and the ad-hoc WfMS for improving the compliance with documentation requirements lead to the result that the first goal has been achieved completely and the second one to a much larger extent than before the implementation of the ECMS (impact 16 (increased compliance)). The third goal did not have a large influence on the functional scope as can be seen from the limited collaboration functionality offered by the system. This leads to the result that the level of goal achievement is lower than for the other two goals (impacts 23 (increase in content sharing) and 24 (improved internal collaboration)).
Other than with the functional scope, not all impacts can be related to project goals. Next to the supposably unexpected negative impacts stated in the preliminary analyses of this case (impacts 3 (user dissatisfaction), 12 (compromise costs), 13 (change of risk profile), and 26 ((additional) efforts are required for keeping content up to date)), two unforeseen, but more positive impacts occurred as well (impacts 4 (facilitating organizational learning) and 24 (improved internal collaboration during the first phases of the process)).

The department WCI had four goals for the ECMS implementation: reduction of the amount of fines to be paid (i.e. compliance), increased internal efficiency, cost savings, and increased 'customer' satisfaction. In this case, the functional scope has been adapted to the goals as well. Striving for the major goal compliance resulted in choosing a production WfMS and configuring the WfMS as well as the EDM and ERM modules very rigidly. These three elements of the functional scope and their configuration can also be related to the other three goals, because for example a rigid ECMS can be expected to result in increased efficiency and cost savings for this process type (cf. section 7.1.4.3). Digitally available project files are also likely to increase 'customer' satisfaction because they reduce retrieval times.
With regard to the impacts, the first three goals have been completely achieved as it can be seen from the coded impacts of this case (cf. table 6.6 on page 67). The last goal of increased 'customer'

satisfaction has only been achieved to a certain extent as shown by the survey mentioned in the case description. However, at least a slight improvement of the 'customer' service has been achieved, mainly due to the fact that files are always accessible now. Not all of the other impacts have been expected beforehand, but can be related to goals, such as for example impact 28 (change in organization's power structure) which is related to the goal of increased efficiency. Besides these 'relatable' impacts, only impact 3 (user satisfaction) and impact 13 (change of risk profile) cannot be related to any of the goals.

The implementation of C@sus had a larger number of goals than the previous two cases and an elaboration would exceed the scope of this preliminary analysis. A short analysis however shows that the goals can be divided into two groups. The first group contains goals which can be related to elements of the functional scope such as for example the request for an increase in data and information sharing/exchange which resulted in an advanced EDM module. The second group contains goals concerning non IT-related issues which are only potentially supported by an ECMS. Examples are the requirement to modernize the processes of the administrative support department and to make them more efficient or the goal that staff members should be deployable more easily. The impacts also depict a similar grouping into both goal and functional scope related ones on the one hand and impacts which are only or mostly related to the non IT-related goals on the other hand. Only impact 13 (change of risk profile) being a presumably unwanted impact cannot be directly related to a goal, but is a logical consequence of the goal to have a the business processes being supported by IT.

These illustrations show that the goals of an implementation project can influence the functional scope and in turn indirectly cause certain, mostly intended impacts. A common example is the goal of compliance which resulted in including BI, EDM, and WfM modules. However, the second and the third case also evidence that not all goals can be translated into elements of the RAE because they are non IT-related. The fact that related impacts have occurred nevertheless (e.g. impacts 4 (facilitating organizational learning) and 36 (change of work organization)) hints at the existence of an additional influencing factor which causes these impacts. This factor needs to include, presumably amongst others, the measures which have been taken to achieve these impacts such as BPR and job enlargement. The latter two measures are often performed as part of the implementation project and therefore this factor might not be a separate factor but rather an element of the implementation approach. A comparison with extant literature confirms this assumption and also the importance of goals. For example, Castro, Kolp, and Mylopoulos (2002) state that the objectives of an IS implementation project should be translated into requirements which in turn should define the system design. Holland and Light (1999) also mention that project goals play a role in an implementation project, yet limit the influence to "milestones, critical paths, and boundaries" (Holland and Light, 1999, p.31). Other literature also comments on the role of goals, but often refers to a required alignment between general business goals and the IS (cf. e.g. Nah, Lau, and Kuang, 2001; Lederer and Sethi, 1988; Sumner, 1999). In conclusion, further research is needed to fathom the exact role of goals in ECMS implementations.

7.2.2.5 Sequential dependencies

The second case in particular demonstrates that impacts can be sequentially dependent on each other. The fact that a BPR was conducted during the implementation (impact 10) has been depicted as having resulted in the fact that both the power structure (impact 28) and the work organization (impact 36) have been changed. The enlarged process awareness amongst the staff members (impact 4) was mentioned to having caused an increase in business adaptability (impact 17). More examples can be found and a potential notation based on Macintosh, Filby, and Tate (1998) for displaying the difference between direct and indirect impacts has been developed. However, the potential insights with regard to this research seem to be limited and therefore, the example of the notification is only presented in table D.1 on page LIV.

7.2.3 Validity

Rigorous positivist CSR should adhere to the attributes described in section 2.1.1.2 on page 6 and this research has incorporated most of them. In the following, the omitted attributes and the general validity of this research are commented on. As with the general nature of this research, the focus of the design phase lay on the explanatory sub-question 8. Therefore, all used constructs have been defined beforehand so that no clean theoretical slate existed. The use of rival theories was not considered to be appropriate because the infancy of ECM research does not allow developing different, conflicting theories about the elements under study. The premature nature also prohibited the creation of predictions from theory. The case study protocol has been shown to already be elaborated enough for obtaining valid data during the first case, so that it was decided to not include a pilot case. The attributes referring to multiple researchers (including the coding checks from the data analysis phase) are not applicable to this research since it is an individual master thesis. All attributes for the data collection phase are present in this research, except for the requirement of quantitative data which simply was not available. Not all attributes for the data analysis are incorporated. Empirical testing could not be performed since no propositions had been defined and the use of time series did not seem applicable due to the limited scope and duration of the studied implementation projects. Because of the limited number of organizations available for study, natural controls could also not be applied deliberately.

Incorporating almost all of the attributes into this research has resulted that the four types of validity being presented in section 2.1.1 have been achieved. First of all, the construct validity of this research is high. The operationalization of the constructs functional scope, process type, and impacts are indeed able to capture differences between the cases. The codings in each case have been confirmed by the respondents who have reviewed draft versions of the particular case study reports. In addition, multiple sources of evidence have been used and the individual reports also establish chains of evidence. The reliability is also high since all evidence has been collected following a case study protocol and also been registered in the case study database. The procedures taken for both the collection and analysis have also been described. The internal validity of this research is high, too. Using pattern matching, the observed impacts could be clearly related to the implementation of the particular ECMS in all cases. Finally, the external validity is relatively high as well. The comparisons of the functional scopes and process types showed that this research only covers a subset of the possible 'parameter-values' of these two factors. However, a literal and a partial theoretical replication have been observed, many examples have been determined, and the identified patterns are consistent across the three cases so external reliability also is to be assumed.

7.3 Results from design research

As described in section 2.2, several artifacts were to be designed during this research as results of sub-questions 3, 7, and 5. After utilizing the knowledge base of IS research during the design phase being described in chapters 4 and 5, all the artifacts have been used in the CSR and are evaluated in the following. First of all, operationalizing the influencing factor process type with the chosen framework has been successful and the coding scheme has made the categorization easy to handle. The processes from all three cases could be categorized in a discriminating way so that differences became visible. Although it is a relatively simple scheme based on only three characteristics, it proved to be powerful during the analysis phase of the CSR since valuable results have been achieved. In addition, this research is the to the author's knowledge the first one to use the proposed process categorization in a qualitative research setting.

7.3.1 Reference Architecture for ECM

As the literature study indicated, a RAE does not exist in scientific literature yet. Therefore, this artifact is a major contribution to ECM research as it serves the three design purposes and fulfills the six design requirements defined in section 4.2 on page 25. During the design phase, the knowledge base of IS research has been used intensively and the design decisions taken have made sure that all requirements are satisfied as has been demonstrated in section 4.5. Using the RAE in the CSR and letting it evaluate by a subject matter expert showed that the three design purposes have been fulfilled:

ad P1: Provide a conceptual division of the potential functionalities offered by ECMSs based on the current status of research.

The RAE is in fact a graphically structured list of potential functionalities and therefore serves as a functional overview. It also helps to communicate the concept ECM by giving a visual impression of the breadth of possibilities offered by ECMSs and resembles the original pretension that an ECMS should be able to provide the means to manage all types of organizational content. All functionalities found at the three ECMSs from the CSR were already present in the architecture what indicates that the RAE can be assumed to be a complete list of the functionalities an ECMS currently could be able to offer. The evaluation of the architecture by the subject matter expert was also positive, so there is only a small chance for omissions.

ad P2: Be an assessment tool for benchmarking/comparing the functionalities provided by existing ECMSs.

Its successful usage in the case study research showed that it can also be used for comparing different ECMSs. The ECMSs of all three cases could be depicted and differences in the functional scopes of the three systems clearly became visible through the chosen coding notation. Therefore, the RAE can be used for the operationalization of the influencing factor functional scope.

ad P3: Be a foundation for the development and design of new ECMSs.

Due to its completeness, the RAE can guide ECMS providers in further developing their products and can assist during ECMS implementation projects.

7.3.2 Impact framework and impact table

Drawing on the sound foundation of several previous frameworks for categorizing impacts of implementing ISs, a framework has been designed for the specific needs of this research. Together with the list of potential impacts and the coding scheme, it was needed for operationalizing the dependent variable of this research and the analysis phase of the CSR showed that the framework fulfills this purpose. All observations could be assigned to an impact of the updated version (cf. section 7.2.2) of the impact table and therefore also to one of the categories of the framework. Within the scope of this research, the impact framework proved to be complete because no changes to its structure or its definitions were necessary. The detailed categories rather allowed gaining specific insights into the nature of the impacts and this characteristic proved to be useful. This is because differences and similarities between the cases became clearly visible, impacts could be related with each other and independent variables, and meaningful conclusions could be drawn. The final version of the ECMS-specific impact table (initial version cf. table 5.2 on page 42) is presented in table 7.4 on the facing page and the final descriptions and examples of the impacts (one result of the exploratory part of this research) can be found in table A.2 on page XXVIII. In conclusion, the impact table provides a first step towards a complete overview of potential impacts of implementing ECMSs. This overview can also be used for creating awareness within organizations which are to implement an ECMS.

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table 7.4: Final impact table.

7.4 Limitations of research

This research has some limitations with regard to the number and distribution of the cases which are not optimal due to the limited amount of organizations available for study. No organization with a low process modularity could be studied so that no conclusions with regard to this category are possible. The same limitation holds for the functional scope since not even the combination of all three functional scopes contains all potential components and functionalities of an ECMS. Therefore, the impacts of for example extended collaboration or WCM components could not be evaluated and it is also not clear whether the RAE is complete. In addition, assumptions as for example that processes which are less modular require more usage of the EAI module and are more likely to require the integration of external parties through different access methods as well as the capturing and publication components could not be tested. Furthermore, the cases only cover one relatively small commercial organization mainly operating in the Netherlands and two Dutch public organizations. Therefore, it has not been possible to determine whether the impacts are also applicable to organizations with a larger size and/or scope (e.g., large national companies, multinational enterprises).

When a bonsai stops growing, you know it's dead.

Japanese proverb

8 Conclusions

This chapter summarizes the main results of this research, comments on the scientific contributions, presents practical implications, and provides an agenda for further research.

8.1 Answers to research questions

The framework for this research has been provided by the research question: *What are the impacts of implementing Enterprise Content Management Systems in organizations and what are the relevant influencing factors?* It has been further refined into eight sub-questions and following the research plan presented in section 2.2, definitions of two basic terms have been given and several artifacts have been developed using design research. The artifacts were used in a case study research (CSR) in which they have been positively evaluated (cf. section 7.3). The CSR as the core of this research showed that the impacts of implementing ECMSs can mainly be found in the five categories employees, operational processes, managerial processes, horizontal coordination, and vertical control. The functional scope of the particular ECMS (i.e. the range of offered functionalities) and the type of the ECMS-supported processes have been determined as influencing factors. Other than expected from the initial literature study, it has also been demonstrated that these two factors influence each other. The case study reports give rich insights into the process of implementing ECMSs, adding to the scare scientific knowledge base on ECM. By confirming the presumed relations, this research also provides a first step towards quantitative research on the relations between factors and impacts. In the remainder of this subsection, the answers to the sub-questions are presented in further detail and their scientific contribution is highlighted.

Sub-question 1: How can content be defined?

It has been demonstrated by a theoretical discourse in section 3.1 that the currently prevailing definitions and perceptions of the term content are not uniform. Therefore, they have been synthesized into an improved definition of content: *"Content is the aggregation of digital data and/or information objects, and the corresponding metadata."* This definition is more complete, easier to handle, and better aligned with the definitions of its three components than the currently prevailing definitions. Since it differs from perceptions of content found in practitioners' literature, the new definition also has the practical implementations mentioned in the following section.

Sub-question 2: What is Enterprise Content Management?

By performing an exhaustive literature study on ECM, it has been shown that no consistent definition of this term has emerged during the past seven years of research. Summarizing the currently available literature in section 3.2 yielded in the following, more complete definition of ECM: *"Enterprise Content Management is concerned with the strategies, processes, methods, systems, and technologies that are necessary for capturing, creating, managing, using, publishing, storing, preserving, retaining, and disposing content across and between organizations."* This definition provides a common conceptual basis for further research in this field and gives a better impression of this topic because it includes all relevant facets of ECM currently mentioned in literature.

Sub-question 3: What are the potential functionalities offered by Enterprise Content Management Systems?

The literature study also indicated that a complete list of the potential functionalities provided by ECMSs does not exist in literature yet. In response, the Reference Architecture for ECM (RAE) being displayed in figure 4.2 on page 33 has been constructed through a rigorous design research process. It summarizes and structures the current state of affairs of both scientific and practitioners' literature with regard to the potential functionalities provided by an ECMS. In addition, the RAE has been successfully used as an assessment tool during the CSR. As mentioned in the following subsection, it can also guide the development of future ECMSs.

Sub-question 4: Which impacts can occur when an Enterprise Content Management System is implemented in an organization?

Based on the results from the literature study described in section 5.1.1, an initial list of potential impacts has been created. The exploratory results of this CSR led to the updated version which is presented in table A.2 on page XXVIII. This list is the first recapitulatory overview of this kind in ECM literature and also proved to be useful for the CSR by guiding the respective data collection.

Sub-question 5: How can the impacts of implementing Enterprise Content Management Systems be categorized and operationalized?

Mainly because they are not detailed enough, none of the encountered existing frameworks for categorizing impacts of implementing ISs fulfills all requirements that have been defined for this research. Therefore, the impact framework presented in figure 5.2 on page 41 has also been designed through a rigorous design research process. All impacts from the impact list created during answering the previous sub-question have been mapped to the framework as shown in table 7.4 on page 93. This impact table and the respective coding scheme created in section 6.1.1.2 were used for the operationalization of this research's dependent variable. This combination, including the detailed categories of the underlying framework, proved to be useful because it provided the basis for an in-depth analysis of the nature of impacts and their relations with the influencing factors.

Sub-question 6: Which factors influence the impacts of implementing an Enterprise Content Management System?

As explicated in section 5.2, previous research on implementations of other types of ISs indicated that the two factors functional scope and process type might also influence the impacts of ECMS implementations. The analysis of the case study data confirmed this assumption and the exploratory analysis of the case study data also disclosed several other potential influencing factors which are described in section 7.2.2. All these factors have not been mentioned in ECM literature before and therefore provide a basis for future research.

Sub-question 7: How can the influencing factors be operationalized?

The first factor functional scope has been operationalized by coding used functionality of a specific ECMS into the previously designed RAE. The second factor process type is captured by using an existing framework presented in section 5.2.2.2 and a coding scheme created in section 6.1.1.2. Both operationalizations proved to be easily usable and to be able to discriminate the situations found at the cases, so that the elements of the research model could be related to each other.

Sub-question 8: How are the influencing factors related to the impacts?

Four major relations within the research model have been identified. The cases showed that a limited functional scope can already produce a wide range of impacts and some elements of the RAE could be directly related to single impacts and/or impact categories. The second factor process type seems to influence the intensity of impacts in most categories, but also the occurrence

of impacts in the category operational processes. The analysis additionally showed that the functional scope of an ECMS should be aligned with the process type. This initially unexpected finding has been described in literature before, but this research has transferred this finding to the ECM domain and extended it to this particular operationalization of the process type. Finally and totally unexpected from the literature study, it has also been demonstrated that a certain functional scope can change the process type. This relationship has not been described in the studied literature. The explanatory results of this research are summarized in figure 7.3 on page 86.

Considering the meaningful results of this research, the chosen research approach and the created operationalizations of the research model's elements have proven to be suitable as a way for studying impacts of implementing ECMSs. By presenting improved definitions of the terms content and ECM, by developing the RAE, by being the first study to both conceptualize and explore impacts of implementing ECMSs and influencing factors, and by presenting both explanatory and exploratory results with regard to the relations of these elements, this research contributes to the scarce body of ECM research.

8.2 Implications for practice

The results from this research not only contribute to the scientific discussion on ECM, but are also usable for practitioners working in this field. First of all, although the improved definition of content seems to mainly have value for science, it also shows that the role of the so-called structured data has been ignored by practitioners to a large extent and therefore should guide the further development of ECMSs. Secondly, the awareness about and understanding of nECM and related issues can be increased by this research. The more complete definition of ECM and the RAE can help to communicate the breadth of the 'ECM concept' to (potential) customers. The opportunities of ECMSs are exemplified by the impacts observed at the cases (for example streamlining certain processes of the organization, in particular with regard to governance and compliance). The observed impacts can on the other hand also help organizations to realize that ECMSs can have negative impacts. The wide range of potential impacts shows that the implementation of ECMSs, being the third area which can profit from this research, deserves closer attention. Implementation projects in their early stages can for example be supported by combining the RAE with applications overlays (Koning, Bos, and Brinkkemper, 2008) for determining overlapping functionality of existing software products or 'functional blind spots'. The elaborated descriptions of the case studies and their explanatory and exploratory results represent a rich pool of experiences from which future implementation projects can draw. The identified factors and their relations highlight that organizational and project managers need to take into account a wide variety of topics when implementing an ECMS.

8.3 Further research

Next to answering a number of both theoretical and practical questions, this research has raised an even larger number of questions. Throughout the course of this research, several issues have been noted which require further research and they are described in the following. The first area in need for further research arises from the improved definition of content and the RAE. It has been shown that the practitioners' literature does not consider the management of structured data to be part of ECM. Therefore, no descriptions could be found how this type of content is actually managed and experiences concerning this matter should be reported. The omission of this content type from current system descriptions might also be a sign that the relevant technologies are not (fully) developed yet, potentially justifying research activities in the ECM content and technology perspectives, e.g. on how structured content types can be combined with unstructured ones and how they are to be presented to users.

One of the results of designing the RAE is the conclusion that ECMSs are likely to be multi-product software and the observations from the cases confirmed this. For ERPSs, it has been stated that taking a best-of-breed approach with multiple products requires a suitable implementation method. This shows that there is a need to evaluate the applicability of existing IS implementation methods for ECMSs, perhaps resulting in the necessity for ECMS-specific implementation methods, a topic that is currently underexposed in literature.

Further research is also needed for increasing the external validity of the explanatory results. The impacts at organizations with different process types and with different (in particular larger) functional scopes should be studied and it should also be evaluated whether differences in situational factors (e.g. organizational scope, size, or type (i.e. commercial, non-governmental, or public)) influence the impacts. Next to evaluating the factor constellations not included in this research, the results obtained from the factor constellations of this research should be validated and further research should also be aimed at determining the exact relation of the process type with the impacts. The newly discovered relations between the functional scope and the process type (and vice versa) also need fathoming, for example research on the consequences of not adapting the functional scope to the process type.

Finally, this research has also generated several exploratory results (cf. section 7.2.2) which cannot be captured in the extended version of the ECMS impact model (cf. figure 7.2 on page 85):

- the role of the management and users with regard to goals and the implementation approach,
- the relation of project goals with the functional scope and the implementation approach,
- the influence of the implementation approach on the functional scope, the soft factors, and the impacts, and
- the influence of the soft factors on the impacts.

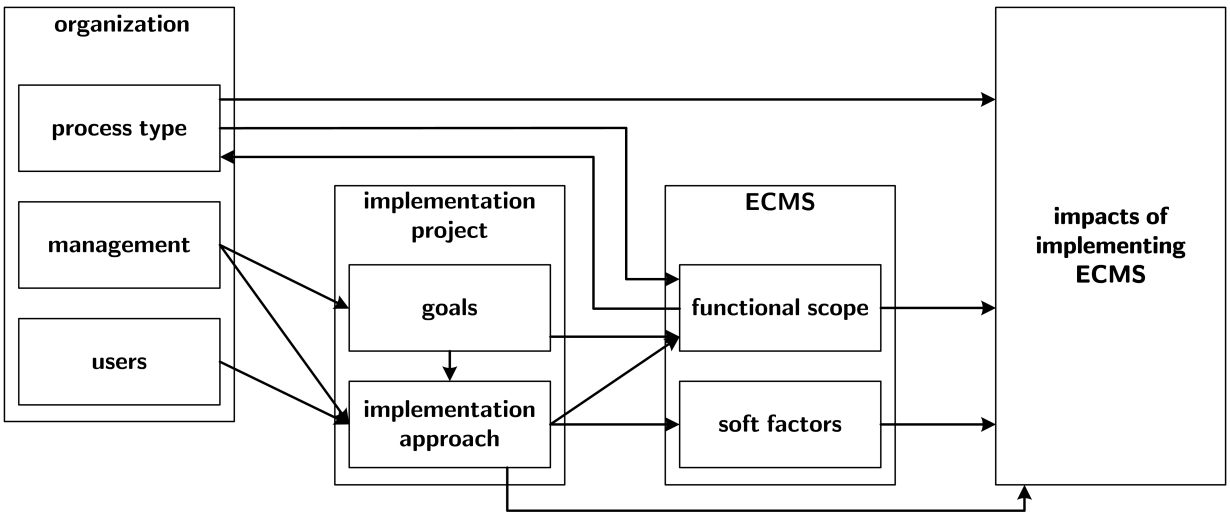

Figure 8.1: Draft ECMS impact model for further research.

The draft ECMS impact model depicted in figure 8.1 has been developed for framing further research. It should be regarded as a graphical summary of the exploratory results of this research. Comprehensive additional research is needed for creating theoretical foundations of the new factors and for further validating the assumed relations among the elements. Research activities might focus on the following issues:

- more exploratory empiricism on influencing factors, e.g. by including literature on critical success factors in IS implementations,
- the development of a framework for soft factors, describing the non-functional part of ISs,
- the extension of the impact framework and impact table to also include financial performances figures of the organization (Dehning and Richardson, 2002),

- the development of a framework for the implementation approach, including e.g. elements such as implementation method, degree of user involvement, amount and quality of introductory trainings,
- the development of a framework for categorizing goals,
- the extended validation of the impact table,
- the quantitative validation of the research model,
- the extension of the impact framework and impact table to other classes of ISs, and
- the validation of the (draft) ECMS impact model to other classes of ISs.

After research on ECM has reached a state comparable to current ERP research what includes an understanding of the just mentioned elements of ECMS implementations, recent, more elaborated fields of study of ERP research can be also studied for the ECM domain, such as for example the influence of national culture on ECMS implementations. Before doing to, there is however still a long way to go and this research has only taken a first small step into that direction.

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Appendix A

Additions to Conceptual foundation

A.1 ECM definitions

The literature study of ECM related literature revealed the definitions presented in table A.1.

	definition	source
1	"Enterprise Content Management is key in creating a dynamic, useful website. It ensures that you have your data organized in a logical structure and that the content is updated frequently by the owners of that information."	McNay (2002)
2	"Content management is framed as an evolutionary step of information management, which integrates the management of structured, semi-structured, and unstructured information - and embedded pieces of software code - throughout the entire content life cycle in the organizational contexts of content production and utilization."	Boiko (2002), cited in Munkvold et al. (2003)
3	ECM "centers on the premise that all forms of content or unstructured data should be managed in a repository, independent of the applications utilizing the information. These concepts parallel first principals of structured data management and data base systems. As in structured data management, where consolidation of existing disparate data into a single enterprise repository is not possible, federation or warehousing of these data may be required to obtain a single logical view."	Reimer (2002)
4	ECM "focuses on the management of textual and multimedia content across and between enterprises, emphasizing the coexistence of technical and social aspects within the content management. Methods and techniques applicable for managing textual and multimedia information with all sizes of content units, ranging from XML and database structures through web pages and documents to document collections, are studied as well as approaches focusing on specific content structures."	Tyrväinen et al. (2003)

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	definition	source
5	ECM "is the technology that provides the means to create/-capture, manage/secure, store/retain/destroy, publish/distribute, search, personalize and present/view/print any digital content (i.e. pictures/images/text, reports, video, audio, transactional data, catalog, code). These systems primarily focus on the capture, storage, retrieval, and dissemination of digital files for enterprise use".	Meta Group, quoted in Munkvold et al. (2003)
6	ECM is an "integrated approach to managing all of an organization's information including paper documents, data, reports, web pages and digital assets" and "the strategies, tools, processes, and skills an organization needs to manage all its information assets (regardless of type) over their lifecycle".	H. A. Smith and McKeen (2003)
7	ECM is a concept which "represents integrated enterprise-wide management of the life cycles of all forms of recorded information content and their metadata, organized according to corporate taxonomies, and supported by appropriate technological and administrative infrastructures".	Munkvold et al. (2003)
8	ECM "concerns the production and use of digital information resources in enterprises. Together with the content items produced and used in an enterprise, ECM concerns business processes in the enterprise, organizations involved, roles of people in the processes, and the systems used in the processes".	Salminen et al. (2005)
9	ECM "integrates the management of structured, semi-structured, and unstructured information, software code embedded in content presentations, and metadata together in solutions for content production, storage, publication, and utilization in organizations".	Päivärinta and Munkvold (2005)
10	ECM is "an integrative perspective on information management in enterprises, involving the following characteristics which together characterize the ECM concept:"	Nordheim and Päivärinta (2006), based on Päivärinta and Munkvold (2005)
	"pursues holistic content life-cycle management"	Päivärinta and Munkvold (2005)
	"logically integrated content models, including understanding of content structures for production and use, metadata, and corporate taxonomies for content retrieval regardless of the format"	Nordheim and Päivärinta (2006)
	"combines the content model with enterprise-wide (and beyond) user and process modeling issues" "covers the process-based and resource-based organizational viewpoints to information management"	Päivärinta and Munkvold (2005)
	"technologically integrated infrastructures or platforms, which make enterprise-wide search, access, and re-use of content possible, irrespective of the technology by which a particular piece of content is initially produced" "administrative procedures continuously maintaining, cultivating, and, when necessary, transforming the technological platforms, content bases and models, user bases and models, and workflows, which make the above issues possible".	Nordheim and Päivärinta (2006)

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	definition	source
11	ECM is "the term used to describe the technologies, tools, and methods used to capture, manage, store, preserve, and deliver 'content' or 'information' across an enterprise or organization. At the most basic level, ECM tools and strategies allow the management of an organisation's unstructured information, wherever that information exists. Unstructured information means letters, emails, reports etc as opposed to databases or accounting systems which contain 'structured' information".	AIIM Europe (n.d.)
12	ECM is "the technologies used to capture, manage, store, preserve, and deliver content and documents related to organizational processes. ECM tools and strategies allow the management of an organization's unstructured information, wherever that information exists. [...] Content must be managed so that it is used to achieve business goals. Central to this strategy are the tools and technologies of ECM, which manage the complete lifecycle of content, birth to death. [...] While there are ECM technologies, more importantly, ECM is an ongoing and evolving strategy for maximizing how your content is to be used."	AIIM (2005)

Table A.1: Previous definitions of ECM.

A.2 Definitions of RAE components and functionalities

In this section, the different components and functionalities of the several layers of the RAE are defined, including the sources which mention the respective ECMS parts. The numbers refer to the six groups of practitioners' literature mentioned in table 4.1 on page 31.

1) AIIM
2) Doculabs
3) FileNet
4) Kampffmeyer (2006)
5) Open Text Corporation
6) Forrester Research, Inc. (2007)

A.2.1 presentation layer

Client application integration means that separate applications (e.g. an E-mail client) that are not part of the ECMS package are accessed by the ECMS or vice versa. They usually run on a client machine and require some interaction of an end-user (Päivärinta and Munkvold, 2005; Sprehe, 2005; 1, 3, 5). A *desktop application* is a stand-alone client application for example provided by the ECM supplier for accessing the ECMS's functionality (1-4, 6). *Mobile use* is the access to the ECMS through mobile devices such as e.g. smartphones (Munkvold et al., 2006; 4-6).

Portal integration means that the functionalities offered by an ECMS can be accessed through a portal, "an infrastructure providing secure, customizable personalizable, integrated access to dynamic content from a variety of sources, in a variety of source formats, wherever it is needed" (M. A. Smith, 2004, p.94) though a single, web based interface (Dilnutt, 2006; Scheepers, 2006; 1-6). Via an *intranet*, the ECMS can only be accessed from within the organization (Päivärinta and Munkvold, 2005; Scheepers, 2006; H. A. Smith and McKeen, 2003; 3-5). An *extranet* is meant to provide access to the ECMS to a limited group of people, e.g. suppliers (1, 4, 5). Via the *organization's website*, the general public can access the ECMS (Päivärinta and Munkvold, 2005; H. A. Smith and McKeen, 2003; 3-5). Although these four access methods are all based on very similar technologies, they are mentioned separately because each of them represents a different 'reach' of an ECMS which is expected to influence the impacts of the particular system.

A.2.2 process layer

The differences between different types of WfMSs (*ad-hoc*, *case handling*, and *production support*) are explained in section 4.3.3 on page 29 (Dilnutt, 2006; Päivärinta and Munkvold, 2005; H. A. Smith and McKeen, 2003; 1-6). *Digital signatures* can be part of a workflow for authenticating digital documents (Päivärinta and Munkvold, 2005; Sprague, 1995; Sprehe, 2005; 1-5).

Collaborative editing refers to the "controlled editing, review, approval, and (multichannel) informing, distribution, publication and update of content" (Päivärinta and Munkvold, 2005, p.4) with a team of employees (1, 2, 4, 5) *Team communication* includes features such as forums, chat-rooms, instant messaging, digital whiteboards, and videoconferencing. It is important to notice that this sub-functionality provides the means to communicate, whereas the management of instant messages (services layer) is concerned with the content produced during the communication (Dilnutt, 2006; Reich and Behrendt, 2007; 1-6). An example of *project management* is the possibility to schedule appointments (1, 2, 4).

BAM is the continuous "monitoring [of] time-critical operational processes" (Golfarelli, Rizzi, and Cella, 2004, p.3) and supports rule interference and dashboards (Aalst and Hee, 2004; Sprehe, 2005; 1-5). *BI* "essentially helps managers to understand their [organizations] by supporting bottom-up extraction of information from data" (Golfarelli et al., 2004, p.1) and is aimed at improving decision-making (H. A. Smith and McKeen, 2003; 1-4).

A.2.3 services layer

Capturing means integrating "content [...] from heterogeneous external and internal sources (integrated production environments, scanning and imaging, conversion of file formats, forms-based data capture)" (Päivärinta and Munkvold, 2005, p.4) into the ECMS. An ECMS can also be integrated with client applications for simplifying the capturing process (Päivärinta and Munkvold, 2005; 1-6). *Content aggregation* is the "process of combining data entries from different creation, capture, and delivery applications. The goal is to combine and unify data from different sources, in order to pass them on to storage and processing systems with a uniform structure and format" (Kampffmeyer, 2006, p.34) (1, 2, 4). *Digital forms* for example on a website have been mentioned in 1-6. *Digital sources* refer to the integration of content which already exists in digital form as e.g. in an XML file (Päivärinta and Munkvold, 2005; 2-4, 6). Imaging is defined in section 4.3.1 on page 27 (Dilnutt, 2006; Päivärinta and Munkvold, 2005; 1-6).

The *management* of different types of content happens with different sub-systems. *Electronic documents* are managed by an EDM module which is further explained in section 4.3.1 on page 27 (Dilnutt, 2006; Päivärinta and Munkvold, 2005; Tyrväinen et al., 2006; 1-6). *Digital assets* are "rich media documents, as for example videos, logos and photographs" (Kampffmeyer, 2006, p.42) which are managed by a DAM module (Reimer, 2002; 1, 3-6). *Physical and electronic records* can be managed by an ERM module (Dilnutt, 2006; Päivärinta and Munkvold, 2005; Sprehe, 2005; 1-6), which is further explicated in section 4.3.2 on page 28. Although physical records do not qualify as content and therefore cannot be managed in the same, digital way, metadata about them supports organizations in reaching RM goals such as e.g. risk reduction and operational simplifications (Johnston and Bowen, 2005;).
An ECMS can be integrated with the e-mail server(s) of an organization so that incoming and outgoing *e-mails* can be captured (1-6). Mainly due to regulatory reasons (e.g. Sarbanes-Oxley Act), *instant messages* are also considered to be content and can therefore be managed by an ECMS (1, 5). *Web content* is created is managed by a WCM module (Dilnutt, 2006; Päivärinta and Munkvold, 2005; H. A. Smith and McKeen, 2003; 1-6), which is illustrated in section 4.3.3 on page 29. Content should not only be manageable at a document level, but also on a *component* one, a "fine granular level, in ways that allow the [content, ed.] components to be easily used, reused, versioned, linked, assembled, and reassembled into different content products" (Trippe, 2005, p.2). For example, a legal copyright statement could be managed in a central place and be re-used in different publications (Andersen, 2008; Doyle, 2007) which can be accomplished by utilizing a CCM module (Andersen, 2008; Päivärinta and Munkvold, 2005; 6). The management of *structured data* is discussed in section 4.6.2 on page 34.

Publication of content can occur through a large number of channels: audio and video streams can be *broadcasted* either to the Internet or to regular TV networks (1, 4-6) and *business transactions* refer to sending out letters (1, 3-6) and/or faxes (1, 3, 4). *Individuals* can be addressed by e-mails or SMS (1, 3-5) or by *print publications* such as brochures or catalogs (1, 3-6). *Syndication* is meant for the "reuse and integration [of content] into other content" (AIIM, 2005), e.g. through RSS feeds (1-4, 6) or through files (e.g. workflow information in EDI- or XML-files) (3, 4). *Digital Rights Management* is a "system to protect high-value digital assets and control the distribution and usage of those digital assets" (Liu, Safavi-Naini, and Sheppard, 2003) (Chiu and Hung, 2005; Päivärinta and Munkvold, 2005; 1-4).

A.2.4 infrastructure layer

The ECMS can be functionally integrated with for example the organization's ERPS, user management, or e-mail servers through the *Enterprise Application Integration* component. The practitioners literature provides more detailed examples: displaying of an order status managed by the ERPS via the organization's website, linking invoice information in the ERPS with an image of the invoice managed in the ECMS, and in particular the functional integration of different systems for executing workflows (Päivärinta and Munkvold, 2005; Sprehe, 2005; 1, 3-5). The *repository* is "the set of databases, file directories, and other systems structures (for example, custom settings for the [ECMS]) that store the content of the system as well as any other data associated with the [ECMS]" (Boiko, 2005, p.88 et sqq.). *Analog storag*e includes the possibility to store content on non-digital media such as microfilm and paper (1, 3, 4). *Auditing support* refers to the provision of "unchangeable storage, protection against manipulation and erasure" (Kampffmeyer, 2006, p.64) and the "generation of logs and journals on information usage and edits" (Kampffmeyer, 2006, p.58) (1, 3-6). The definition of *library services* (Dilnutt, 2006; 1-6) can be found in section 4.3.1 on page 27. *Localization* is the possibility to edit, store, and use content in different languages (1, 4-6).

Information retrieval (Dilnutt, 2006; Päivärinta and Munkvold, 2005; H. A. Smith and McKeen, 2003; 1-6) is an own sub-field of IS research and since the first advancements in the 1950s, a large number of methods has evolved. Examples are indexing or ranked retrieval systems which can make use of various mathematical models for defining the relevance. However, a description of the already performed and ongoing research would exceed the scope of this document and therefore, the reader is referred to Singhal (2001) where an overview of the research domain is provided.
Within the context of an ECMS, information retrieval makes use of *taxonomies* (Munkvold et al., 2003; Päivärinta and Munkvold, 2005; H. A. Smith and McKeen, 2003; Tyrväinen et al., 2006; 1-6), the "logical and conceptual structuring of the content" (Päivärinta and Munkvold, 2005, p.4). They can contain a list of all content types managed by the ECMS together with for example definitions of metadata fields, particular retention times, and access rights. These definitions are used during the (automatic) collection of metadata (Hawkins, Larson, and Caton, 2003; Kim and Compton, 2004; Munkvold et al., 2003). Their main goal is therefore to allow users to access and navigate through the content (Päivärinta and Munkvold, 2005). Another goal is the so-called 'semantic normalization' which should be aspired when integrating content from different sources. Ideally, all content in the ECMS should be described with the same set of metadata even if it stems from various origins. Next to that, the potential multitude of names for identical concepts should be homogenized (Sheth et al., 2002).

A.3 Definitions of potential impacts of implementing ECMSs

These definitions are based on the literature study described in section 5.1.1 on page 37 and the findings of the case studies. In case the definition of an impact or its description have been changed during the course of the research, both the initial and the updated versions are provided. C1, C2, and C3 refer to the respective cases.

	impact	description	source	type(s) of IS
1	quality improvements	streamlined management structures, more centralized control possible (Davenport, 1998)	Davenport (1998); Doherty and Perry (2001); Junco, Bailie, and Ledet (2005)	CMS, WfMS, general
2	social conflicts	e.g. creation of inter-group conflict and resistance through "shift in information ownership" (Newell et al., 2003, p.44)	Newell et al. (2003)	ERPS
3	user (dis)satisfaction	e.g. increase in employee morale due to higher work efficiency or improved employee services (Shang and Seddon, 2002)	DeLone and McLean (2003); Shang and Seddon (2002)	general
initial version:				
4	facilitating organizational learning	e.g. broadened employee skills	Shang and Seddon (2002)	general
updated version:				
4	facilitating organizational learning	e.g. broadened employee skills or increase in process awareness	Shang and Seddon (2002); C2	ECMS, general
5	concentration on core work	e.g. focus on business process and overall performance	Shang and Seddon (2002)	general
6	improved efficiency	e.g. through accelerated exception handling (Chiu and Hung, 2005), decrease of fraction of orders shipped late (McAfee, 2002), shortening service and wait time during process execution (Reijers and Aalst, 2005), simplification of forms (H. A. Smith and McKeen, 2003), cycle time reduction (Shang and Seddon, 2002)	Chiu and Hung (2005); Dilnutt (2006); Han (2004); Päivärinta and Munkvold (2005); Reijers and Aalst (2005); Shang and Seddon (2002); H. A. Smith and McKeen (2003)	CMS, ECMS, ERPS, WfMS, general
7	higher reliability, quality, and timeliness of content	e.g. through central content storage	Han (2004); Päivärinta and Munkvold (2005); H. A. Smith and McKeen (2003)	CMS, ECMS
8	quality improvements	e.g. less errors in products and services through central content storage (H. A. Smith and McKeen, 2003)	Päivärinta and Munkvold (2005); Shang and Seddon (2002); H. A. Smith and McKeen (2003)	ECMS, general

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	impact	description	source	type(s) of IS
initial version:				
9	'customer' service improvements	e.g. more simple access to better data and information about 'customers'; long-term and centralized content storage prevents its loss when employees leave the company and allows to manage content for several departments/lines of business/etc (Hendricks et al., 2007).	Chiu and Hung (2005); Hendricks et al. (2007); Shang and Seddon (2002)	CRMS, ECMS, general
updated version:				
9	'customer' service improvements	e.g. more simple access to better data and information about 'customers'; long-term and centralized content storage prevents its loss when employees leave the organization or are temporarily not available; allows to manage content for several departments/lines of business/etc (Hendricks et al., 2007).; C2	Chiu and Hung (2005); Hendricks et al. (2007); Shang and Seddon (2002); C2	CRMS, ECMS, general
10	change of business processes	e.g. (substantial) reengineering (Sprague, 1995) or simplification of processes (H. A. Smith and McKeen, 2003) through reduced paperwork (Sprehe, 2005), unification of processes (Shang and Seddon, 2002)	Aalst et al. (2003); Aalst and Hee (2004); Davenport (1998); McAfee (2006); Shang and Seddon (2002); H. A. Smith and McKeen (2003); Sprague (1995); Sprehe (2005); Tyrväinen et al. (2006)	ECMS, EDMS, WfMS, general
11	cost reductions	e.g. through reduced material costs (H. A. Smith and McKeen, 2003) and reduced amount of facilities needed for storage of paper documents (Sprehe, 2005)	Chiu and Hung (2005); Han (2004); Junco et al. (2005); Päivärinta and Munkvold (2005); H. A. Smith and McKeen (2003); Sprehe (2005)	CMS, ECMS

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	impact	description	source	type(s) of IS
12	compromise costs	e.g. through decrease in efficiency due to inappropriately designed user interfaces, inappropriate process reproduction in the ECMS (Ash et al., 2004)	Andersen (2008); Ash et al. (2004); Gattiker and Goodhue (2004)	ECMS, ERPS, Patient Care Information System
initial version:				
13	risk mitigation	e.g. of risks associated with uncoordinated content exchange and storage such as integrity, redundancy, versioning etc.	Karimi et al. (2007); H. A. Smith and McKeen (2003)	ECMS, ERPS
updated version:				
13	change in risk profile	mitigation of risks associated with uncoordinated content exchange and storage (e.g. integrity, redundancy, versioning) (Karimi et al., 2007; H. A. Smith and McKeen, 2003) or e.g. increased dependency on IT, increased vulnerability (C1, C2, C3)	Karimi et al. (2007); H. A. Smith and McKeen (2003); C1, C2, C3	ECMS, ERPS
14	improved quality of management information	e.g. through making BAM and BI possible (Dilnutt, 2006)	Aalst and Hee (2004); Dilnutt (2006); McAfee (2006); H. A. Smith and McKeen (2003); Sprehe (2005)	ECMS, WfMS, general
initial version:				
15	improved decision making and planning	e.g. improved management of organizational resources	Shang and Seddon (2002)	general
updated version:				
15	improved decision making and planning	improved management of organizational resources, e.g. through more flexible staffing	Shang and Seddon (2002); C2	ECMS, general
16	increased compliance	enforcement of organization-external regulations, e.g. content retention policies as set by the Sarbanes-Oxley Act (Nordheim and Päivärinta, 2006; Sprehe, 2005)	Nordheim and Päivärinta (2006); Päivärinta and Munkvold (2005); H. A. Smith and McKeen (2003); Sprehe (2005)	ECMS

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	impact	description	source	type(s) of IS
initial version:				
17	deteriorated business adaptability	inflexible implementation of the ECMS, e.g. standardized content models (Andersen, 2008)	Andersen (2008); H. A. Smith and McKeen (2003)	ECMS
updated version:				
17	change in business adaptability	decrease e.g. through inflexible implementation of the ECMS (standardized content models) (Andersen, 2008); increase e.g. through process awareness and executable process descriptions (C2)	Andersen (2008); H. A. Smith and McKeen (2003); C2	ECMS
18	support of business growth	e.g. increase in potential transaction volume	Shang and Seddon (2002)	general
19	building business innovation	e.g. new process chains	Shang and Seddon (2002)	general
20	building cost leadership	e.g. lean structure with streamlined processes, economies of scale in operations	Shang and Seddon (2002)	general
21	enabling worldwide expansion	e.g. centralized world operations, global resource management, or multicurrency capability	Shang and Seddon (2002)	general
22	improved and simplified access to authoritative content/organizational memory	e.g. through central content storage and "ease of navigation" (H. A. Smith and McKeen, 2003, p.649) for regular users, centralized search (Han, 2004)	Han (2004); Hendricks et al. (2007); Päivärinta and Munkvold (2005); H. A. Smith and McKeen (2003); Sprague (1995); Sprehe (2005)	CMS, ECMS, EDMS, ERPS
23	increase in content sharing	e.g. through simplified access to content (H. A. Smith and McKeen, 2003), "improve the efficiency and effectiveness of documents in their role as a primary mechanism for storing and communicating concepts and ideas within [...] organizations (and their groups and individuals)" (Sprague, 1995, p.33)	H. A. Smith and McKeen (2003); Sprague (1995)	ECMS, EDMS
24	improved internal collaboration	"involving knowledge creation and sharing through digital content in [...] enterprises with commonly enacted practices" (Päivärinta and Munkvold, 2005, p.2)	Päivärinta and Munkvold (2005)	ECMS

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	impact	description	source	type(s) of IS
25	new or value-added products or services	e.g. through new organizational capabilities: "ECM development as such builds competence and technological platforms in the enterprise, on which it becomes quicker to develop and maintain targeted content management applications for emerging purposes" (Päivärinta and Munkvold, 2005, p.2), as for example advanced personalization techniques or innovative customer services (Päivärinta and Munkvold, 2005), product differentiation (Shang and Seddon, 2002)	Chiu and Hung (2005); Päivärinta and Munkvold (2005); Shang and Seddon (2002); H. A. Smith and McKeen (2003)	ECMS, general
26	(additional) efforts are required for keeping content up to date	up-to-dateness of content crucial for its credibility and in turn utilization of the ECMS (H. A. Smith and McKeen, 2003)	H. A. Smith and McKeen (2003); Zantout and Marir (1999)	ECMS, EDMS
27	improved governance	enforcement of organization-internal regulations, e.g. through "standardized firm-wide transactions and centrally stored enterprise data" (Hendricks et al., 2007, p.68) or "consistent operating practices across geographically dispersed units" (Davenport, 1998, p.127)	Davenport (1998); Hendricks et al. (2007)	ERPS
28	change in organization's power structure	e.g. "increased access to information at headquarters may be seen by divisional managers as an erosion of their power base" (Symons, 1991, p.206), employee empowerment (Shang and Seddon, 2002)	Shang and Seddon (2002); Symons (1991)	general
initial version:				
29	increased IT infrastructure capability	e.g. stable and flexible support of process and structure changes (Aalst and Hee, 2004)	Aalst and Hee (2004); Shang and Seddon (2002)	WfMS, general
updated version:				
29	increased IT infrastructure capability	e.g. stable and flexible support of process and structure changes (Aalst and Hee, 2004); provision of (improved) facilities for teleworking (C3)	Aalst and Hee (2004); Han (2004); Shang and Seddon (2002); C3	CMS, ECMS, WfMS, general
30	new or improved 'business' relationships	e.g. simplifying B2B e-commerce (Shang and Seddon, 2002) or by adopting a CRMS (Richard et al., 2007)	Richard et al. (2007); Shang and Seddon (2002)	CRMS, general

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	impact	description	source	type(s) of IS
31	improved external collaboration	"involving knowledge creation and sharing through digital content [...] among enterprises with commonly enacted practices" (Päivärinta and Munkvold, 2005, p.2)	Päivärinta and Munkvold (2005)	ECMS
32	improved branding	e.g. through "common look and feel to corporate materials" (H. A. Smith and McKeen, 2003, p.650) and reused templates (Päivärinta and Munkvold, 2005)	Päivärinta and Munkvold (2005); H. A. Smith and McKeen (2003)	ECMS
33	enhanced 'customer' integration	e.g. through giving external parties electronic access to documents	Sprehe (2005)	ECMS
34		e.g. through time savings on 'customer' side achieved by ECMS, generally simplified content access and inquiries (Sprehe, 2005)	Shang and Seddon (2002); Sprehe (2005)	ECMS, general
35	decrease in quality of external communication	communication not adapted to needs of consumers, but to business needs as e.g. streamlining and efficiency	Andersen (2008)	ECMS
new impact:				
36	change of work organization	Work organization is defined as "the way work is structured, distributed, processed and supervised [and it] deals with subjects such as the following: the scheduling of work (such as work-rest schedules, hours of work and shift work), job design (such as complexity of tasks, skill and effort required, and degree of worker control), interpersonal aspects of work (such as relationships with supervisors and coworkers), career concerns (such as job security and growth opportunities), management style (such as participatory management practices and teamwork)" (Carayon and Smith, 2000, p.649). Examples are a simplified and more flexible vacation planning (C2), the use of information gathered by the BI component for planning of work by staff members (C3), and new job descriptions due to disappearance of paper files (C2, partly C3).	C2, C3	ECMS

Table A.2: Potential impacts of implementing ECMSs.

Appendix B

Interview questions

General introduction

- [introduction of myself]
- [reasons for interview]

Research model

- Please describe your organization.
- What was the trigger for introducing the ECMS?
- What were the goals for introducing the ECMS?
- What was your role during the implementation?
- Which processes are supported by the ECMS? How would you characterize these processes?
- What specific activities are performed as part of these processes? How does the ECMS support them?
- How was the system introduced? (top-down etc.)
- What effects did the introduction have on your organization? (e.g. cycle times, head count, BPR, customer satisfaction, employee satisfaction, costs, compliance, organizational culture, productivity, chain integration)
- Do you see any risks of having the ECMS?
- Did you measure these effects?
- Were there also impacts for which do you didn't plan? (i.e. unwanted or negative)
- How would you assess these consequences? (e.g. positive, negative, wanted/planned, unwanted/unplanned)
- if goals were defined: Did you achieve your initial goals?

Closing

- [present research model]Any more ideas?
- Do you have any other comments?
- [thank respondent(s) and appreciate input, perhaps clarification of some issues needed, in case interested results of research in the end]

Appendix C

Case study evidence

C.1 Case study database

All evidence collected during the three case studies has been summarized in the case study database depicted in table C.1 on page XXXII.

case	data type	location
Org. A	summary of interview with product champion	C.2.1
	summary of interview with project leader	C.2.2
	summary of interview with partner	C.2.3
	field note	C.2.4
	internal e-mails regarding CEM/A&C and map	not declassified by respondents
	annual report 2007/2008 from Organization A	Organization A (2008b)
	Results of surveillance visit ISO 9001:2000 of Org. A	not declassified by respondents
department WCI	summary of interview with WCI employees (head of the DIV group, a process engineer, and a system administrator)	C.3.1
	summary of interview with consultant	C.3.2
	proposal document from the system integrator	not declassified by respondents
	results from survey among client from the department	not included as it would reveal the identity of the organization
Hoge Raad	GlobalStar Enterprise Award 2008 application	not declassified by respondents
	summary of interview with Hoge Raad staff (operations manager of the implementation project and assistant director of the OMD)	C.4
	fact sheet with general information about the Hoge Raad	Hoge Raad der Nederlanden (2007a)
	fact sheet with technical background information about C@sus	Hoge Raad der Nederlanden (2007c)

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case	data type	location
	fact sheet with information about the implementation project	Hoge Raad der Nederlanden (2007b)
	fact sheet with information the IT-infrastucture at the Hoge Raad	Hoge Raad der Nederlanden (2007d)
	article from the Dutch computer magazine Computable	Heur (2007)
	article from a juridical professional journal	Rhee (2008)

Table C.1: Case study database.

C.2 Case: Organization A

C.2.1 First interview with product champion

- Date: 2008-07-07

What were the goals for the introduction?
- not quite sure, probably improved process documentation and digital support of the primary work process

What is map?
- Proprietary development based on Lotus Notes
- it consists of three main parts
1) content/document management
2) workflow component
3) administrative functionalities: change general information, access rights, make local copy (work without internet connection), manage conflicts when working on documents

Ad 1)
- usually only required documents are stored, mostly the ones required for process documentation (for certification)
- different types of files can be uploaded
- no pre-defined format of pages, each page consists of a blank workspace. The workspace can be filled with content using standard notes functionality (e.g. upload document, insert table, insert text).
- e-mails can easily be imported as well
- clients cannot use the system

Ad 2)
- no digital signature, but scanned documents with signature
- notifications about needed signatures are usually not sent automatically, but other users can be notified at one's own discretion when their approval is necessary
- partner approval is often more implicitly given (not directly in map, but "manual") by just accepting proposal, drafts, and final reports
- notifications about creation of new documents etc. can be sent automatically
- no hard deadlines implemented
- mandatory completion of process steps only when project is closed. Closing of files is supposed to be monitored, e.g. by the engagement managers, the responsible partners or the board.
- no prescribed order of process steps (except for some logical links, e.g. . the client satisfaction cannot be assessed before the contract has been signed)
- especially during sixth phase "Deliver Excellence" steps can be chosen freely
- other features:

- overview of Notes calendars of all team members; does not really work due to the fact that many colleagues do not use the calendar in notes, but use a paper agenda instead.
- list of important project contacts; not handy to use, Excel file is mostly used instead
- tasks can be allocated to certain team members
- overview of tasks can be filtered, e.g. my tasks, open tasks
- linked with engagement management tool (glscem): when a new engagement is created, a file in map will be automatically created in the near future.

Process description
- small scope: project documentation/risk management, nine mandatory activities for every map file/project
- large scope: 42 steps (incl. the nine mandatory ones) of the complete primary work process, e.g. planning of interviews, customer satisfaction, knowledge management

Large scope is hardly used. Even activities of the small scope are often considered to be extra ones which do not add value to the actual consulting process. Therefore they are often done only at the end of the project. However, it is planned to link the completion rate of these activities with the annual bonus in order to increase the efforts spent on this.
Reasons for the limited usage are:
- lacking user-friendliness
- very limited training of users and product champions, insufficient documentation
- missing or insufficiently implemented functionalities
- required time to change already existing process of working
- certain change resistance, although that is declining
- does not suit the current work process very well
- no obligation to use system

Consultants also keep track of their work hours (which is not supported by map and done in SAP) and at the end of the project (sometimes also in between for larger projects), an invoice is sent (also done with a different system).
More extensive usage of system (e.g. for concurrent document editing) not possible because of not or insufficiently implemented features or high bandwidth requirements.
System not meant to be completely imperative, only the project documentation/risk management activities are mandatory because these are required for passing certain audits, such as the Lloyds audit (which, to the respondent's knowledge, are not mandatory, but used as a selling point in proposals).
According to the respondent, map should be able to support the primary work process, but there either should be force that one has to use it, or it should contain better functionality than currently available options (excel, e-mail).

Impacts
- system has been introduced in January 2008, first impacts get only visible by now
- in the long run probably more structured risk management within the group of the respondent, at the moment the degree to which the system is used often depends on the personality of the users and the habits within different groups. Expected to undergo a major change when linked with bonuses.
- at the moment hardly any changes within the actual work processes, because of limited functionality
- several colleagues dissatisfied, because the system requires additional work steps next to the regular work
- though it is necessary for the company as a whole, there is limited added value for the actual project
- impact on productivity:
- for product champion not a lot of extra time
- users: first time getting to know system, then it usually goes faster
- would be interesting research

Are there any risks?
- a large compulsiveness (i.e. how a large number of steps of the consulting process have to be executed) would probably result in a reduced employee satisfaction.
- potentially a reduced productivity
- potentially a reduction in quality of the assignments because of extra time needed for administrative work (time is the critical factor in assignments)

Additional comments
- regular feedback meetings, however, it seems as if suggestions do not always get implemented
- has been introduced top-down

Potential factors
- way of introduction: top-down vs. bottom-up, if people at the work floor have asked for a system, the acceptance rate is higher
- role of own interests
- role of user education

Miscellaneous
- main functionalities of available standard packages?
- how will factors and impacts be measured?

C.2.2 Second interview with project leader

- Date: 2008-07-14

Short introduction: goal of research, presentation preliminary research model, research plan

What was the trigger for introducing the ECMS?
In the past, project dossiers mainly had been kept on paper, even if documents were electronically available. This situation should be optimized through an electronic dossier system, so that e.g. the access to the dossiers is not bound by time or physical location any longer. In addition, other lines of services within Organization A had been using a similar application for ten years and map is also already used within a large number of offices from Organization A in other territories worldwide. Therefore, the decision to implement the ECMS was made in July 2006.

What were the goals for introducing the ECMS?
The ECMS should support the engagement lifecycle, an internationally defined process model for doing projects within Organization A. (for more information on the engagement lifecycle see below) There was a need to manage and monitor the acceptance of clients and engagements more strictly. This requirement stems from the fact that Organization A also is an accountancy company for (amongst others) large MNEs and therefore falls under U.S. and SEC legislation (Sarbanes-Oxley Act). These steps with regard to compliance and risk management procedures are done with a system called CEM/A&C. Only some related information is additionally stored in map.

What process does the ECMS support?
The engagement lifecycle supported by map is the primary work process of Organization A, which is about giving advice to clients. (An overview can be found in the paper handout.) This advice is usually given in the form of a report, yet the exact content of the report is usually not known in the beginning. Actually, the majority of projects has a broad scope. Therefore, the teams make a general plan in the beginning, which often needs to be adapted or extended during the course of the project.

The nature of the engagement lifecycle is that it does not exactly define how the engagement is done. The engagement manager and the team are encouraged to have their own way of coming to a result. Map itself does not support the actual advice work, it usually rather captures the results of certain process steps at a moment chosen by the user in order to indicate that they have been fulfilled. The processing of the individual steps has to be done by the users: general instructions about the goals of a certain step are given, but the way how they are done is more or less left open.
A small number of steps (9 out of 23) is mandatory to be done by all projects (marked in red in the handout). The other steps are optional. The reason for this freedom is that Organization A deals with many different projects; different with regard to objectives and size. However, all projects have to use map for documentation purposes, so that only the most essential steps are declared mandatory.

How does the system exactly support the process?
Map is a "dossier-system" and there is a link between CEM/A&C and map: After a project has been accepted in CEM/A&C, a "map file" (i.e. an electronic project dossier) is automatically created specifically for this project. This map file has a name which is similar to the name used within the SAP billing system and these two systems share the identification code. There is a central process definition with all phases, steps, and tasks of the engagement lifecycle. For each task, there is an individual "page", which is separated into five parts.
1) The first part is file upload area for the members of the project team. The documents produced in this particular process step are uploaded here.
2) A mini-questionnaire forms the second part. The questions refer to the completion of certain activities and the answers can be monitored.
3) The next part is the description of the particular task from the quality manual (the handbook of the engagement lifecycle), so that members of the project team do not need to consult the written documentation if they need an explanation of what needs to be done. Another advantage is in case of changes to the manual, they can easily be disseminated.
4) Administrative information as for example roles and reference numbers are displayed as well. However, they can only be edited by administrators and are usually only interesting for them as well.
5) A change history over which changes have been done by whom is the fifth part. However, only the fact that something has been changed is recorded which means that there is no versioning of files which have been uploaded.

When a task has been completed by a member of the project team, he/she can decide whether an approval by a director/partner is necessary. In case an approval is considered to be necessary, a notification is sent to the appropriate person. However, the director/partner can also configure a map file in a way that his/her approval is required for completing certain tasks. It is for example possible to not require any approvals at all for small projects, just one approval of the final report for medium projects, but several approvals in between for large projects. Determining how these controls should be set in practice takes some experience as well as communication between the project team and the director/partner.

It is possible to display the so called portfolio, a report about a number of map files, e.g. presenting per project (i.e. map file) which tasks have been completed and reviewed separately. The reports are for the management and can be filtered by engagement manager, director, or partner/BUL (Business Unit Leader). In addition, the board can also produce an overview for whole Organization A. The board and the partners should/do also monitor if projects are timely closed.

There is rights management in map. The responsible responsible engagement director/partner and the engagement manager have to be defined in CEM/A&C and are automatically assigned the respective roles in map as well. The right to approve something is only with partners/directors. Next to these two roles, there is also an owner (a member of the project team) who actually manages the map file. Finally, there are members of the project team who are added after the map file has been created. The access to a map file is limited to the members of the project team and the responsible responsible director/partner.

Since map is a Lotus Notes application, its archiving is done through Lotus Notes about which the respondent does not have precise information. However, the last months have shown that the number and the size of the backups have increased.

Are there more possibilities for having a workflow?
The possibilities for workflow management are limited. The reason for this is that besides some logical dependencies, there is neither a prescribed order of the steps of the engagement lifecycle nor are all steps mandatory for all projects.

How user-friendly do you think the system is?
In general, the system is considered to be user-friendly. There are still certain features which are missing or which can be improved, but are being worked on. When users get more used to the system itself, they will probably also use more of its features.

How about the impacts? Is it already possible to say whether the introduction of the ECMS has changed something within Organization A?
The implementation of the ECMS (in particular of map) started with precisely defining and structuring the engagement lifecycle, which used to be performed in a relatively ad-hoc way. During the definition, several shortcomings such as unclear definitions etc. have been discovered. Solving these issues lead to a clearly defined and customized process which is a major impact of the ECMS.

Are there any other outcomes?
The discipline of following the engagement lifecycle has increased because of the monitoring which can be done easily now. This is important also towards the outside world, because it can be shown that the defined and accepted process is clearer and followed in a more stringent and more consequent way.

Are there also differences in for example speed, that projects can be done faster or that they last longer?
Projects are done better with regard to quality, i.e. following the structure. However, it is not clear whether this leads to a better project performance... “If I listen to the signals, in general yes”. On the one hand, people have to do activities now which they have not often done before. On the other hand, it forces them to think about the impact of steps they take.

How about employee satisfaction?
In general map is considered to have a positive effect. Map can be used independent of time and place. Besides that it helps to structure the engagement process. There is a need for sharing knowledge between teams, a feature that is not integrated in map but has to be done in Knowledge Exchange (an intranet portal).

But you have mentioned as well that one has to perform extra activities?
Mandatory steps are extra activities, although they should been done in the past as well. Now that they are made mandatory through the system, employees really have to do the required tasks. However, this enlarges the compliance.

Who needs the compliance?

It is necessary for Organization A as a whole. Depending on the type of client (listed on a stock exchange or not), there are a number of restrictions. At the start of an assignment there are for example numerous independence-requirements which have to be fulfilled before the engagement can be accepted.

Is the compliance also necessary for process audits?
There are actually three types of audits for which the compliance is necessary:
1) internal audits which control whether the process defined quality manual is followed
2) internal audits which focus on the produced content. They are also performed on a European level.
3) ISO 9001 audits (done by Lloyds)

Is it possible to assess the ECMS's influence on productivity?
This issue has not been researched yet. It would be hard to do so, since e.g. the number of projects is not only influenced by the system. Since too little map files have been closed since the introduction of map, it is too early to make a statement about the actual usage. However, it is expected that despite the fact that employees have to get used to using the system and to doing the mandatory steps, the actual time needed for keeping dossiers will decrease (in comparison with the paper version).

Is the system also used by support staff?
Map is occasionally also used by support staff.

What are the costs of the ECMS?
The respondent does not have this information available at that moment.

Are there risks?
The core of how a project is done (i.e. how the team gets to its conclusion/piece of advice), is not included in the system. Therefore, there is a certain workflow included into the system on the one hand. On the other hand, there is the way of how engagements are actually executed. The risk exists that these aspects are not aligned. This would decrease the added value of map.

How has the system been introduced?
Map has been introduced both top-down and bottom-up: pilots have been used and product champions support the different groups. There is a quick reference card how to use the map system in the different phases.

Feedback on the research model:
- User-friendliness and monitoring could be part of the functional scope.
- Since the functional scope is about the system itself and the process type about the internal structure of the implementing organization, an element about the environment is maybe necessary as well? For example "What is available elsewhere? And do we have in house?"

C.2.3 Third interview with partner

- Date: 2008-08-14

What were the goals for introducing the ECMS?
Org. A has been founded in 2005 and attracted not only people of different former groups within the broader Organization A, but also of people from other companies changed jobs as well. Because of the different backgrounds, there had not been a uniform way of putting projects into execution and also the project documentation had differed a lot. In order to overcome this situation, a standardized process for consulting projects has been developed, described (in the so-called quality manual), and introduced.

However, an ISO9000 audit showed in 2006 that despite the fact that the process had been described, it was put into execution in many different ways: tenders were created with different structures, client evaluations were not done the same way etc. In addition, there is the aspiration that all Organization A consulting organizations worldwide follow more or less the same process what is ensured by internal reviews. The non-standard practice did of course not meet the criteria for a successful review.
The board of Org. A considered that is was necessary to implement a tool to support and standardize consulting projects. Map was considered to have the advantage of providing a standard way for keeping dossiers for whole Org. A, which is not possible with regular Notes databases and myclient (a similar application mainly used within the Assurance practice). Another fact which needed to be taken into consideration was that map is also the international standard of Organization A for keeping dossiers. All in all, it was decided to implement the ECMS for Org. A in 2006.
Why is the ISO-certification necessary?
The first reason is that pan-European calls for tenders include a question whether the applying company has been certified. Negating this question requires many explanations and decreases the chances of winning projects. In addition to this reason, Organization A wants to be an excellent consulting practice. Part of this is that there exists a standardized process for delivering high-quality results. A certification helps to communicate this fact of uniformity towards the market. However, the various ways of how projects were put into execution both did not come across professionally and hindered a certification.

What was role your during the implementation of the ECMS?
I have not been involved in the implementation. Another partner has overseen the introduction of the ECMS and kept the other partners roughly informed about the developments.

How was the system introduced?
It took quite a while before map could actually be implemented, e.g. the language used of the user interface needed to be discussed. There has been no requirement elicitation with the stakeholders. Since map had already been used internationally, only slight modifications were considered to be necessary.
The roll-out to users was done decentrally, mainly through two presentations about map and how to use it. The first one was part of a general training about the Organization A way of working which has been quite short and vague. Part of the decentralized approach was also to appoint per group a so-called map champion. The group's product champion gave a second introduction during a group meeting. However, not all group members were able to attend this meeting and have therefore not received the same information as the rest of the group. In addition, it seemed as if the map's creators (within Org. A) have not given elaborated thought how to actually use the system in practice and how to adapt it to the work process before the implementation. In summary, the support could have been much better, especially during the introduction.
This approach contradicts the idea of map being a tool for standardizing the work process across whole Organization A, since the way how it has been presented in different groups neither has been standardized, nor was adequate for the ambitious goal. A different way of introducing has been chosen for CEM/A&C, where - next to appointing product champions and distributing information material - several mandatory information meetings have been centrally organized.

Who was the sponsor for introducing the ECMS?
The board.

How do you use the ECMS?
The usage of CEM/A&C is mandatory and it is the only way to create a WBS code in SAP. When I receive a notification that my input is required, I perform the required steps in CEM/A&C. This is very comfortable in comparison with the old situation when paper forms had to be mailed, which were sometimes incomplete or got lost in the mail. All in all, CEM/A&C has been adapted well to the needs of its users.

With regard to map: although the members of staff are trusted, it should be possible to check concept reports before they are sent out to the client, e.g. in order to check whether the results captured in map also appear in the report. There should also be a management overview of all dossiers so that the actual usage of map can be assessed and actually be managed. However, this functionality has not been implemented yet. The workflow capabilities are not used yet because it still needs to be figured out how they should and can be adapted to the group's needs. "In general, I have the feeling that the technology [map, ed.] has been tossed into the organization without really thinking how it should be adapted to the work process."

How do you asses the impacts of the ECMS?
Impacts are not hardly visible yet, it is probably too early. As mentioned earlier, CEM/A&C does indeed simplify my work and the abandonment of physical mail has greatly speed up the acceptance process. However, there is the feeling that map does not simplify, but rather complicates things. For example, there are several items which are already part of the tender document, but which have to be captured again in map. This is extra work for the project teams. So hardly anybody sees the advantages for the daily work.
In addition, map brings a massive change in work practice for some members of staff. Some of them only used a stack of paper as their project dossier, some even only in a relatively sloppy way. Now, they are required to electronically keep a very detailed dossier. There are also some people who used myclient, for them the change is less extreme.

Does the ECMS have an impact on the culture within the group?
There are some people who love to focus on the content of a project and have an aversion against paperwork since it keeps them from being active for the client. They can get the idea that there are constantly more rules to be followed and that they are also monitored on how they keep their dossiers. In general, the fact that staff members can be closely monitored on how they keep dossiers may create an repressive sphere.

What do you think about the idea of linking the completion of map-files with the bonuses?
In order for this to be applicable, it has to be possible to get an accurate overview of how the dossiers are kept within the group. This way it would become clear which members of staff need more guidance. However, the management overview is not ready yet so it cannot be monitored. Since this group does many projects at a time, it is not possible to manually control map files on a regular basis.

How should the ideal file system look like?
All members of staff put all documents in the system on time. The system should not only focus on making the organization meet its compliance goals, but should also support the work process with well-thought-of features. Employees would also see the system as advantageous and not so much as a hurdle.

Ideas for research model:
- difference in change of work practice
- probably more factors are needed

C.2.4 Field note of informal discussion

- Date: 2008-08-21

A large deal from to the mentioned compliance (and in turn the quality of the process) stems from CEM/A&C. Map 'only' helps to ensure compliance with regard to documentation requirements. Both systems provide information about a process which could hardly be monitored before.

The process how projects are started and the role CEM/A&C and map play is roughly the following:

- A so called lead for a new project can be triggered in several ways: a client can ask for a specific consulting service (in the form of an official tender or informally) and gives a description of what needs to be done during the project. Normally these triggers are followed by an intake-meeting where consultants and client(s) sit together to investigate the specific business issue.
- The responsible partner assigns a consultant the role engagement manager who enters client information in CEM/A&C (including for example (scans of) the project description). Several backoffice departments (data quality, compliance etc.) check the input of basic client and engagement data. They also perform a structured risk assessment. The partner and a second review/risk partner check the risk assessment and the client/the project is accepted (or not) and only afterwards
- both a map file and a WBS code (work breakdown structure code in SAP which are required for being able to book one's working hours) are created. Before the introduction of CEM/A&C, WBS codes needed to be created manually in SAP.
- Then the proposal is manually created and can be manually uploaded into the map file.
- The client accepts the project (or not).
- The team enters the actual work phase etc.
- After projects have been created in CEM/A&C, it continues to monitor the respective client and sends an e-mail to the engagement manager(s) of old project(s) if a new project is started at that client.

In summary, map supports the process (mainly with regard to record keeping) but most of the coerciveness of the new 'way of working' (i.e. strict acceptance procedure, also with regard to WBS codes in the SAP system) stems from CEM/A&C.
However, map also simplifies the cooperation for projects where a lot of documents have to be shared since it provides a central and secured document storage.
Map is meant to support the whole process of delivering consulting services in compliance with the quality system, but only does so partially. Work hours and travel expenses for example (which have to be recorded during the project) are to be recorded in the SAP system, using a different interface. The same is true for the billing activities.
The respondent noticed also the following fact: Once a project is finished, the related map file is closed ("wrapped up") and afterwards, only administrators can access or change it. In case regular staff members need access, they can be granted temporary access privileges.

C.3 Case: department WCI

C.3.1 First interview

- Participants from gemeente Anoniemstad: Respondent 1 (voormalig unitleider DI; joined the interview at ca. 16:00), Respondent 2 (AO-medewerker), Respondent 3 (functioneel beheerder DIS)
- Absentee: Respondent 4 (senior beleidsmedewerker O&I-beleid) was not able to attend
- Date: 23 september 2008, 15:00 - 17:00

Introduction
The combination of DIS (Document Informatie Systeem) and GWS4all (Geintegreerd Welzijn Systeem from Centric, Integrated Welfare System) forms the ECMS used at the department WCI (Work, Care, and Income) of the Municipality Anoniemstad. The department WCI is responsible for a number of areas within the field of social welfare. The employees oversee the processes of directing several governmental benefits to citizens, as e.g. unemployment benefits, support of low-income citizens, or home care. They also co-operate with the local employment office. Respondent 1 led the IT-team during the implementation of DIS and now heads the DIV team. Respondent 2 joined the organization after the implementation of DIS and is currently responsible for the design of the business processes (Administrative Organisation) within the department WCI. Respondent 3 became part of the project team during the implementation and is now part of the team of DIS-administrators. Respondent 4 was head of the DIV team before DIS was implemented and was also the project manager of DIS' implementation.

Goals for introducing DIS
There were three main goals for the introduction of DIS:
1) The relocation to a new office building less space and no assigned workplaces should be taken as a chance to introduce a completely paperfree office: each workspace should have digital access to all documents.
2) An organizational change towards a more 'modern' organization should take place, so that
a) the frequently occurring changes in legislation can be put into practice more easily (flexibility) and
b) the number of fines to be paid due to reasons as e.g. exceedance of deadlines can be reduced considerably (compliance).
3) The department WCI wanted to increase customer satisfaction and efficiency through implementing the system because it would enable them to always have access to all records. Previously, records would sometimes be lost, for instance because staff members would store them in their desk drawers or records were not available because they were used by other staff members.

Structure of work processes
As described earlier, the department WCI is responsible for deciding whether certain social benefits are to be given to entitled citizens. Therefore, the processes start with an incoming request for a certain service. Depending on the request, a case is assigned to a case manager who performs a number of checks and in the end, the request is accepted or declined. The processes are clearly structured so that the order of activities is defined and deviations are usually not possible. There are no dependencies among the main work processes as this has been deliberately avoided during the process definition. The main processes only share a common complaint/appeal procedure, which is the only dependency with regard to executed activities. When an appeals procedure is started, the process that led to the appeal is 'paused' until the appeals process finished.

The information system DIS

This ECMS is formed by the GOTS application GWS4all and the COTS application DIS. The latter actually actually consists of three systems: an Oracle database, IBM FileNet, and OIS DossierWeergave ('record presentation' from Olveco Informatica Services). They have been integrated by Integratie who won the EU-tender.
All incoming documents are scanned by the DIV group, tagged with the appropriate metadata, and stored in DIS. Internal and outgoing documents are usually edited in Word or the respective specialized application. Whenever a final document is created in these applications, a TIFF-document of this version is automatically created and all images are archived for the long-term in DIS. In addition, the system offers a search function.
Workflow functionalities are not implemented in DIS, but rather in the system GWS4all (Geintegreerd Welzijn Systeem from Centric, has been used already before the implementation of DIS) which also stores most information about clients, as e.g. the client number (which is also used as a key in DIS). When a document is stored into DIS, the information from GWS4all is not exchanged automatically, but extracted via screen scraping. GWS4all is also used to monitor the performance of the department and this information is used for managing the department.
At the time of the interview, the municipality is busy preparing an EU-tender for a municipality-wide DMS. Although DIS could probably be extended so that it can be used by the whole municipality, it will probably have to be migrated to the new system. The reason is of legal nature, namely that DIS was defined to be used by the department WCI only in its request for proposal and thus a new EU-tender has to be executed for the new system.

Introduction of DIS
The decision for introducing DIS has been made by the former head of the department WCI in 2002. She saw DIS as a way to achieve the goals mentioned above. Although the general trend in the municipality was to wait for the introduction of a central, municipality-wide DMS, it was decided that DIS has to be in use by the time of the relocation (in 2003).
The implementation was prepared in a number of workgroups, which e.g. carried out extensive process re-engineering and defined all types of documents used in all process steps (the so-called 'Document Structuurplan', document index). After an EU-tender, DIS was implemented and then rolled-out per unit (a unit is a group of staff members working on more or less the same tasks).

Challenges
Right after the relocation and the initial roll-out, it turned out that DIS' introduction had not been explained well to the DIV group. The new location and the new procedures caused much confusion in the group so that a four week long backlog of not scanned and registered documents occurred. Consequently, backlogs in other departments of WCI occurred so that extra efforts were needed to catch up.
Halfway during the final roll-out, response times also increased significantly, even up to ten seconds for simple activities. Since the error could not be located exactly, the responsibilities for fixing it were not clear. Integratie blamed the fault on the network, which is managed by the municipality. The system engineers of the municipality blamed the fault on the hardware delivered by Integratie. Therefore, it took almost six weeks to normalize response times.

Impacts

Archiefwet Governmental institutions in the Netherlands are required to obey the regulations of the 'Archiefwet' of 1995 (archiving act). The archive of the municipality Anoniemstad is managed by the Regionaal Historisch Centrum Anoniemstad (RHCA), the institution which is responsible for the archives of the region. The activities of the department WCI and for this reason also the records stored in DIS fall under the supervision of the RHCA. Therefore, DIS has to comply with certain legal requirements. The Archiefwet not only requires institutions to archive certain information but also obliges them to destruct documents after a certain period of time. This is why the document index contains a minimum retention time for every document category, starting at the point of time when a case has been closed. When this retention time has been reached, a list of documents which have to be destructed is created. This list is checked by the affected department heads so that for example records from ongoing law suits can be excluded. It is then forwarded to the RHCA where it is checked for correctness and accepted. Finally, the list is given to Integratie so that they can destruct the documents. Since the retention time is defined per document, DIS allows destructing only specific documents from a record. This is an advantage to the old situation with paper records when the whole record was archived for the longest individual retention time of all documents contained since managing the destruction of single documents was too time- consuming. However, no documents are destructed at the moment. The scan-software was configured to capture only the used page from single-sided pages when it was certain that the second page contained no pieces of information. The RHCA does not fully accept this DIS' mode of operation, but this view is currently under discussion.

Paperless office The original ideal of using no paper at all has not been achieved. However, the department is using much less paper: documents may be printed for personal use, but transfers of records or information between staff members is only allowed to occur digitally.

Ergonomics Since the introduction of DIS, staff members spend a lot more time in front of the computer. Therefore, special attention had to be given to the proper organization of the work places: each workplace is equipped with two 15" LCD-screens. One of them is tilted by 90°and is used for viewing documents from DIS, whereas the second one contains the other applications. The former one needs wide viewing angles from all directions. The first generation of LCD-screens used at the department did not fulfill this requirement and their replacement was costly. Another measure against RSI-related symptoms is that staff members receive a massage twice a year. This produces an enormous amount of goodwill among staff members.

Document and process definitions As mentioned before, work processes have been defined and the document index has been created and both of them are implemented into DIS and GWS4all. Since these systems steer most of the work of the department, adherence to the defined processes is mandatory. The first impact is that staff members are now required to think in terms of processes, i.e. in a very structured way. Secondly, new national laws or requirements from the municipality can be implemented more quickly because the fact that staff members are used to processes, new processes can be adapted more easily. Finally, a strict change procedure (with regard to data, documents, processes, and corresponding functionality) has been implemented so that the definitions remain maintainable, also in the long-term. This more strict procedure pertains to DIS as well as linked systems of which changes could influence DIS, especially GWS4all.

Common language The document index also caused a discussion about definitions of documents used in the department. The members of the DIV group have to use the same expressions for describing documents as case managers. It took the department seven months to come to a common understanding being formulated in the document index.

Fines Before the implementation of DIS, the department had to pay large amounts of fines. This resulted from the fact that legally defined deadlines for answering requests had been frequently exceeded. This situation has completely changed already long before the implementation of DIS, but the implementation has further improved compliance. Now, no fines due to exceedance of deadlines have to be paid anymore and the department WCI is often referred to as an example for how a WCI department should be organized because of the quality of their work.

Role of the DIV group Before DIS' introduction, the DIV group had — roughly spoken — two functions:
a) distributing incoming documents (mail room) and
b) archiving the records after a case had been closed (main task).
The group was set up in a way that teams of usually two or three staff members were responsible for distributing documents belonging to one or more processes. Documents were given to the case managers. After they had finished the case, the documents were returned to the DIV group who archived it in a record. There was little hurry for archiving since other staff members hardly depended on its fulfillment (only when there was for example a law suit). Next to the usual disadvantages of working with paper records (e.g. misplaced documents), the group had the particular disadvantage that staffing was difficult due to the fact that at any point of time, members of each team needed to be present so documents for all processes could be registered. The introduction of DIS has changed the role of the group dramatically. First of all, the explicit archiving function has become obsolete since it is done by DIS now. Secondly, the DIV group is also not (formally) responsible anymore for keeping records properly, since this task has been taken over by the case managers. Finally and most important, the main task of the group has been moved from the end to the beginning of the process. All documents have to be scanned and tagged with the appropriate meta-data. On basis of the categorization, documents are automatically assigned to a certain process which in turn is the prerequisite before any case manager can start working on a case. Therefore, the whole organization depends on the work of the DIV group which has become 'mission-critical' which gives an increased feeling of self-esteem to the staff members. The members of the DIV group have truly realized their new role in the organization when the whole department suffered from 'their' backlog after the relocation. A respondent put it like this: "the structure of the organization has been turned upside down". Another consequence of the new process structure is that the speed of the categorization has become an essential requirement next to its correctness. The latter used to be the foremost guiding principle for the work of the group but the categorization can be changed by case mangers now. An additional change is that the introduction of DIS was taken as a chance to broaden the scope of the group's staff members. It took some convincing and intensive training to enable all staff members to be able to register all types of documents. This has increased the flexibility of the group since staff members can act as a substitute for each other more easily. The change process took three years in total. Meanwhile the staff members have experienced the advantages of the new task distribution (e.g. simplified and more flexible holiday planning) and support it.

Work of case managers The implementation of DIS also created new management possibilities for the case managers. Staff members kept the paper records at their personal desks. When a staff member dropped out unexpectedly, taking over the responsibilities was hard since e.g. deadlines were not easily identifiable and records were hard to find. Now, all records are visible to all staff members within DIS. Some files (the so-called kabinetszaken, e.g. records from family members of staff members) are excluded from this rule, but a department head can change the particular authorization if necessary.
The case managers, who have been already skeptical towards DIS from the very beginning, saw the six weeks with increased response times and the four week long backlog as a confirmation of their initial concerns. During this time, the atmosphere among the case managers was not very positive. However, after the error had been fixed, the atmosphere changed significantly and the case managers have been very satisfied with the system since approximately half a year after the introduction.

Changes in FTE distribution A reduction of at least one FTE occurred in the case manager group. In the DIV group, one staff member was asked to leave the department before the implementation of DIS because he was physically not able to read a computer screen. Two members of the DIV team left after the implementation because they could not cope with change in tempo. In total, a reduction of eleven FTEs occurred in the DIV group. However, five new employees have entered the DIV group of which one fills the newly created position of a scan team coordinator. In the beginning of the project, it has not been anticipated that the process descriptions and the document index needed to be actively maintained. Therefore, the position of an 'informatie consulent' (information adviser who manages changes of and additions to the document index) needed to be created within the DIV department. Thus the FTE-reduction did in total not lead to a decrease in costs.

Citizens The respondents did not notice a change in client satisfaction. In their opinion, DIS probably just fulfills their expectations how an organization should be able to react to inquiries from clients, i.e. have records available immediately. They also uttered the idea that there have been less troubles and potential aggression from the clients as a result of having every record available when needed.

C.3.2 Second interview with consultant

- Date: 21 October 2008, 15:45 - 16:45

What was your role during the implementation?
My main role was during the preparation of the project when I helped the staff members from the gemeente Anoniemstad to carry out a detailed process and document analysis. Most of the processes were already defined in GWS4all, but at that time, some were not supported (yet) by that system. The latter ones still needed to be described. In addition, all processes needed to be adapted to the new possibilities of the EDMS.
A major activity was the analysis of all used documents within the organization. Per process step, an overview of required, used, and produced documents was created and where necessary, the documents were consolidated. The final overview (called document structuur plan) is grouped according to law, main process, and document type.
For both analyses, interviews were held with relevant staff members and the results were checked by them as well. Eventually, the study made a link between the processes and the used documents and served as a blueprint for the following steps of the implementation. Actually, the analyses started before the tender and ended shortly after Integratie got the bid.

I also took part in creating the requirements for the EU-tender. This process started with setting up a pilot in a single department concerned with a single law. During a period of about three months, they could test how a work place should be set up and equipped and could gain experience about working in a digitized environment. It was also experimented how the processes should be adapted to the system and vice versa. Secondly, the functional requirements could be made much more precise.

During the first four months after Integratie started the actual implementation, I was project controller in order to support the project leader.

Which processes are supported by the ECMS?
All workflows are represented in GWS4all which is configured quite tightly. All operational process steps are defined and mandatory steps have to be done, otherwise a case cannot be passed on to the next staff member. Only the execution of some optional steps is left to the staff members, but these steps are also clearly defined and limited in scope. During all steps, staff members can consult the process description. The link between DIS and GWS4all is also strict: all documents which, according to regulations, have to be created for a certain step, also have to be present in DIS.

With regard to content, GWS4all/DIS is only used for all processes which deal with 'clients', i.e. no internal administrative processes are supported. The 'clients' are citizens which request certain social benefits. The clients only exist once in the system, to be precise: their data is managed by GWS4all. This allows that staff members can easily get an overview of all requested/granted/declined benefits of a given citizen, even if the information is spread across several systems (next to GWS4all, there used to be also several smaller systems). However, all documents are stored in DIS.

What were the reasons and goals for the implementation of DIS?
The old building used to be a mess, large stacks of files and single sheets of papers lying around. This had the consequence that files were lost or not available when they were needed. In the new building, this situation should be changed, also with regard to the required storage room. The former head of the department also had the ambition to create the most modern social service department of the Netherlands. A sustainable solution which makes use of the possibilities of IT should be introduced.

How was DIS implemented?
The staff members were very much involved in the project which is a success factor for this kind of projects. Next to the previously mentioned pilot, there were also user sessions for the detailed functional design with Integratie. The users were also asked how the work places should be set up: members of all organizational layers were asked to test both a work place with a 21" LCD screen and another one with two 15" LCD screens. They voted almost unanimously for the second option.
Integratie also studied in further detail how the users actually work with documents. The users were intensively trained in using DIS and a train-the-trainer approach was additionally used. The actual introduction of DIS started in the old building and happened in phases. The first department to work with DIS was the one were the pilot study had been conducted. There, DIS was fine tuned and then went into production. Afterwards, more and more departments switched over to DIS.
A pragmatic approach was chosen for the conversion of old paper files. First of all, only files from open cases and from cases from clients who also requested/were expected to request additional services were set into DIS. During the conversion, not all documents of these files were separately indexed with metadata, only relevant ones. The other documents were collected, scanned, and indexed as a whole. The document structuur plan was used for determining the relevant documents.

What are the impacts of DIS?
The staff members had to get used to constantly and heavily working with IT. In the beginning, many documents were still printed, but this has considerably decreased and when walking into their offices today, little paper is seen. Files are almost always complete now and information is available when needed, too.
The role of the DIV department completely changed. Before DIS, they mainly carried paper files through the building. Now, they have to scan documents and have to precisely index them which is a very different type of work.
Another change happened also at the group of IT administrators. They used to have a relatively relaxed attitude towards availability: if problems occurred, it took them a while to fix them and the solutions were sometimes not of high quality. However, DIS and GWS4all are critical to the whole organization; hardly any staff member can work without the systems. Therefore, availability and performance are crucial now and the administrators had to realize that. It also changed their role within the organization to a certain aspect, since e.g. also case managers depend on them now. The IT infrastructure needed to be updated as well, since Windows98 was not a stable enough operating system.
With regard to content, the processes themselves did not change since they are mostly defined by law and regulations. Juridical aspects with regard to archiving are obeyed more precisely now, e.g. storage times can be monitored and enforced more precisely.

C.4 Case: Hoge Raad

- Participants from Hoge Raad: Respondent 1 (former external consultant, who has meanwhile joined the Hoge Raad as the assistant director of the OMD) joined the interview at around 12:00), Respondent 2 (operations manager of the implementation project)
- Date: 16 October 2008, 10:15 - 13:15

Why was the infrastructure updated in 2001 and 2002?
In 2001, the Hoge Raad got the opportunity to organize their IT infrastructure themselves. Before that time, the IT infrastructure was managed both by a central unit for all courts in the Den Haag district and by ICTRO (national ICT center of judicial organizations). Back then, the infrastructure consisted of several servers in not properly equipped rooms and all personnel had individual PCs. This resulted in two main problems: there was no central file storage and the maintenance costs were high because individual PCs needed individual maintenance, sometimes even at private homes. Back then, the IT department was manned by 1.5 FTE. In 2001 and 2002, a server based computing (SBC) environment was installed and the servers were moved into two adequate separate server rooms.
Next to the outdated hardware, the software was heavily outdated as well. Four different registration systems were used for registering cases. The data of all case participants (e.g. addresses and names of lawyers, lower courts, plaintiffs, and defendants) was kept separately in each system. The software also did not work well in the new SBC environment. This created an immediate need for introducing a new registration system.

What were the goals for the introduction?
1) The old systems did not deliver suitable management information, since it was not process oriented at all and also spread over the four different systems.
2) A reorganization of the administrative department should take place so that staff members could be staffed more flexibly. The employees should also profit from it through job enrichment and job enlargement.
3) The main business processes should be supported through modern IT and its new possibilities.
4) If possible, cost savings should be achieved as well.

What is the general process C@sus supports?
The work of the Hoge Raad is started by incoming documents, usually from a lawyer representing a party or from a lower court. All relevant incoming documents are scanned by an administrative staff member and set into C@sus. During this activity, the relevant metadata is added, as for example parties concerned, lawyer(s), affected sector within the Hoge Raad etc. The staff members also check whether the case has been received earlier (e.g. as a fax). All documents get a sticker with a barcode, which e.g. helps to retrieve files. Afterwards, the physical documents are put into a paper file which is also labeled with a barcode. During the whole process, at least all created final documents are also placed in the paper file and - depending on the users - intermediate versions as well.
In general, a case belongs to one of the sectors of the Hoge Raad and all of the following content-related steps are performed by members of this sector. The following step is to assign the case to researchers from the internal research department who usually spend several months with searching for facts about the specific case in the juridical literature and summarizing them. After the researchers, the Attorney General or one of the Solicitor Generals commonly analyzes the case and writes a conclusion. Subsequently, a group of three or five Council Lords renders a judgment based on the previously created documents. Finally, the judgment is pronounced and its written version is sent to the parties concerned.

This is a simplified description of the process and it should be noted that there are a number of steps before the researchers start their work, as for example allowing the parties to react to documents of the opposing party etc. Some of these steps are mandatory, depending on the situation. Therefore, the staff members have to know the requirements well so that they can form case-based decisions.

How was C@sus introduced?
The implementation project was lead by the following attitudes: the content of files should not be changed, but only the way files are handled should be modernized. The same holds for the main processes of the parket and the raad (i.e. how the judicial work itself is executed), of which the mode of operation should not be changed (and for a great deal cannot be changed since it is defined by law).
Yet, main part of the implementation project was a detailed process analysis of the whole organization. One major result was that the activities for handling incoming and outgoing mail (these are activities performed by the administrative department) are very much alike which lead to their centralization. Another detailed analysis was performed, namely of the data of the old systems. All this data was transferred into C@sus. During the course of the project, it became clear that the detailed description of the processes should only be started after the general structure of the process landscape has been defined. The data conversion should also only be planned after the data model has been finalized. Although in retrospective, the description and conversion should not have been started while the functional design was 'still moving', the level of analysis was very deep in both cases and the prolonged duration increased the quality of the results.
During the actual creation/configuration of C@sus' software components, prototypes were heavily used. The project team came up with initial ideas which functionality would probably be necessary and tested the ideas with user and advisory groups. The user groups usually consisted of administrative staff members and researchers, whereas the advisory groups comprised members of the parket and the raad. Based on the feedback of these meetings, the next version of the prototype was developed and tested etc. In total, the process of building the application lasted about 2.5 years.
A noticeable side effect was that future users saw the prototypes and started having a lot of ideas. The project team was sometimes even "passed on the right lane" by the users who became extremely enthusiastic about C@sus' potential and asked for more and more features than currently available or planned.
In total, the project team stayed relatively small: the data analysis and conversion was done by two people over a period of approximately two years. During the whole duration of the implementation, about six to seven people worked on 'building' the application, i.e. configuring and integrating the standard components and creating the customized functionality. The other activities such as communication, process analysis and redesign, preparation of the re-organization, and user training were done by a team of four people, also over the whole duration of the project.

The system C@sus
How is Workflow Management implemented?
C@sus does not have a strict workflow management component. Two of the main ideas for the configuration were to leave as much freedom as possible to users and to trust in their individual responsibility. Although the process is in general clearly defined, exceptions have to be made from time to time. These are hard to capture in a strict workflow definition and therefore, C@sus only supports users, for example by reminding them that deadlines are approaching or have passed. However, they are not strictly enforced and a particular user can decide how to proceed in a particular case. Another example of the mere supportive role is that based on the current status of a case, the initial choice of activities which can be performed is limited to the ones which would in theory be most applicable. However, users can always choose to see the whole list of activities and may perform them as well (within the boundaries of their authorization).

What kind of BI is done with C@sus?
There are several layers for the analysis of transaction data: organization as a whole, sectors, groups, individual staff members (both active and passive). Many of these reports implemented in C@sus are used for monitoring risk factors which have been identified during the process analysis. In the different sectors, the number of cases per Council Lord/Attorney General/researcher is used for planning. The cycle-times of the whole process and specific steps are monitored in order to discover bottle necks and for staffing purposes. The same kind of analysis is performed in the different groups. In addition, the staff members of the administrative department can be monitored individually for productivity and this information is used during their personal annual assessment interviews. C@sus also provides audit trails and logs administrative information so that quality checks can be performed more easily. On the other hand, the staff members also use reports for the individual planning of their daily work (due dates etc.). In summary, considerably more information is available now, also about process steps which could not be monitored at all with the old systems. Next to the change in personnel policy, it cannot be said yet if this increase in available information will have an impact within the organization.
Several BI queries are used for arranging the list of trials of a specific day (in Dutch: rol). This list contains a short summary of each case and the barcodes of the cases' files. During the hearings, the barcode can be put under the scanner and the file is opened automatically.

How does the letter book work?
The letter book replaced 600 old letters and templates which have been consolidated during the implementation. It is integrated with a decision tree. When the user chooses to create a document in C@sus, a dialogue is started which ask questions such as 'What type of document?' and 'What kind of decision?'. Based on the answers, relevant text blocks are chosen and the final document respectively parts of it are created. In addition, the information about the case available in C@sus is set into the document as for example the addresses of the parties concerned. Outgoing documents are still always checked by personnel so that the quality of the document is still guaranteed and only their creation is simplified. Judgments are for example always checked by at least three Council Lords.

What functionality does the KM module provide?
At the moment, there is an improved full text search functionality with more Boolean operators. Depending on the user feedback, more features may be implemented.

How is the teleworking implemented and who uses it?
Telework is mainly used by researchers and members of the parket and the raad. They can use special thin clients or notebooks for connecting to the Hoge Raad's intranet through a VPN and accessing files from a distance (e.g. via UMTS).

What was implemented in .NET?
During the implementation, as much standard functionality as possible was tried to use in order to avoid customization. However, some functionality needed to be specifically created. The user interface (which makes use of the regular OpenText API) is custom made. The workflow components and to a lesser extent the BI component were customized for being able to create the rol.

With what other applications/systems is C@sus integrated and what functionality do they offer?
PROTOS has been used for the definition and description of the processes. This information is available from the C@sus-UI.
C@sus is integrated with Bistro, which is an IT infrastructure for the Dutch judicial system. Bistro contains, amongst others, a list of all active lawyers in the Netherlands and this information is used for the metadata of cases. In addition, the conclusions of the parket and the judgments of the raad are also sent digitally to the Bistro systems so that they can be made available to the public. The full list of integrated applications can be found in the paper case description (p. 23 et seq.).

What is the authorization concept?
The authorization concept is rather complicated and is amongst others based upon roles, functions, sectors and departments as well as statuses of cases and documents.

How is the record management done?
The Documentary Structure Plan (DSP) is a list of document types. Based on the relevant laws, the storage time is defined. This information is used by the OpenText RM module for determining dates for deletion or for producing a list of documents which need to be transferred to the National Archive. The latter does not accept digital documents yet, so that only paper files are transmitted at the moment.

What else?
C@sus does not comprise a WCMS. The functionality for electronic signatures (digital authorization) is implemented but not used yet. A detailed help system is available as well. There are also some ideas for the further development: make files anonymous automatically, create draft summaries automatically based on lexical technologies, do not use any paper anymore for outgoing documents, and provide 'e-paper computers' so that documents can be read and worked on more comfortably.

Impacts
How many FTEs are there in the IT department now?
There are seven FTE positions. The general policy is to mainly provide good day-to-day service to the organization and if problems get too big to be solved in-house, external experts are asked, as for example for quality assurance or auditing. That keeps the knowledge level of the IT department on a level which is required for solving the most common problems.

How was the situation with regard to the quality of file keeping before the implementation? How is it now?
Before the implementation, files were sometimes lost or it took at least a long time to rediscover them. With C@sus, this hardly happens anymore and although it is not used for keeping track of the physical location of files, this piece of information could be more or less precisely deducted from the current status of a case. Controlling for completeness of files is part of the primary process and both administrative staff members and researchers are responsible for this activity.

Did the implementation have an impact on compliance?
C@sus supports the Hoge Raad with ensuring that the Archiefwet and the resulting regulations are obeyed.

What are the effects of the data conversion?
During the conversion, the old data has been cleaned up (e.g. correction of spelling mistakes of names or changed addresses of lawyers) so that a clean data basis for all three sectors has been created. In the future, the uniformity of the information is tried to safe-guard because this kind of information is stored centrally for all sectors and needs to be chosen from a list. Before the introduction of C@sus, this information was entered manually.

What are the impacts of the re-organization of the administrative department?
As mentioned before, the staff members are now monitored and this information is used during their personal annual assessment interviews. Due to the uniformity of the system, it is easier for them to work in different sectors. They will be trained (with regard to the relevant legal situation) so that they can handle cases from all sectors and staff members who fulfill this requirement are placed in a higher wage group. For good performance, they can even get into the next higher wage group. In addition, staff members have clearly become more aware of cycle times and the current size of the case-pool. They use this information for prioritizing their work now.

Did the implementation lead to changes with regard to culture or attitudes among the researchers or members of the parket and raad?

The introduction of C@sus was one of the reasons for the installation of a knowledge management work group whose members have developed a number of pieces of advice. However, discussion sessions about interesting cases and judgments had taken place before as well.

Did staff members have to leave the organization due to the implementation?
Nobody was fired, that would take a long time with government officials. However, the data gathered by C@sus could be used as evidence in potential future cases.

How did the implementation change the primary process?
The logistical part of the primary process of physically moving files around is deeply engrained into the organization. C@sus did not change the nature of this process, but certain process steps can be skipped now. For example, it used to be necessary that the file of a case went back and forth between administrative staff members and researchers during the creation of a summary of that case. Now, the summary is kept in the digital file and changes are done electronically. Since it was not the goal to change the middle parts of the primary process (research, parket, raad), only the way how the file is handled has changed. As mentioned earlier, the first and last step were centralized.

How do the users like the system?
According to the respondents, the members of the OMD are pleased with C@sus. In the criminal and tax sectors, members of the parket and the raad use C@sus as well. Some are said to be quite positive about the system, but depending on personal preferences, other members let their administrative and scientific staff members take care of setting documents in the (C@sus- and paper-)files.

Appendix D

Potential notation for displaying dependencies among impacts

As mention in 6.3.6, a potential notation for illustrating the dependencies among direct and indirect impacts has been developed based on Macintosh et al. (1998). An example can be found on the following page.

annotation:

a: process awareness amongst staff members
b: Digital files are the only way of storing information and are therefore always up-to-date which removes need for searching for latest information.

etc.

category			#	impact
employees			1	
			2	social conflicts
			3	user satisfaction
			4	facilitating organizational learning
			5	concentration on core workcellcolorlightgray
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table D.1: Coded impacts of DIS and GWS4all including dependencies.[16]

[16] Annotation on the previous page.

Appendix E

Overviews for cross-case analysis

E.1 Functional scopes

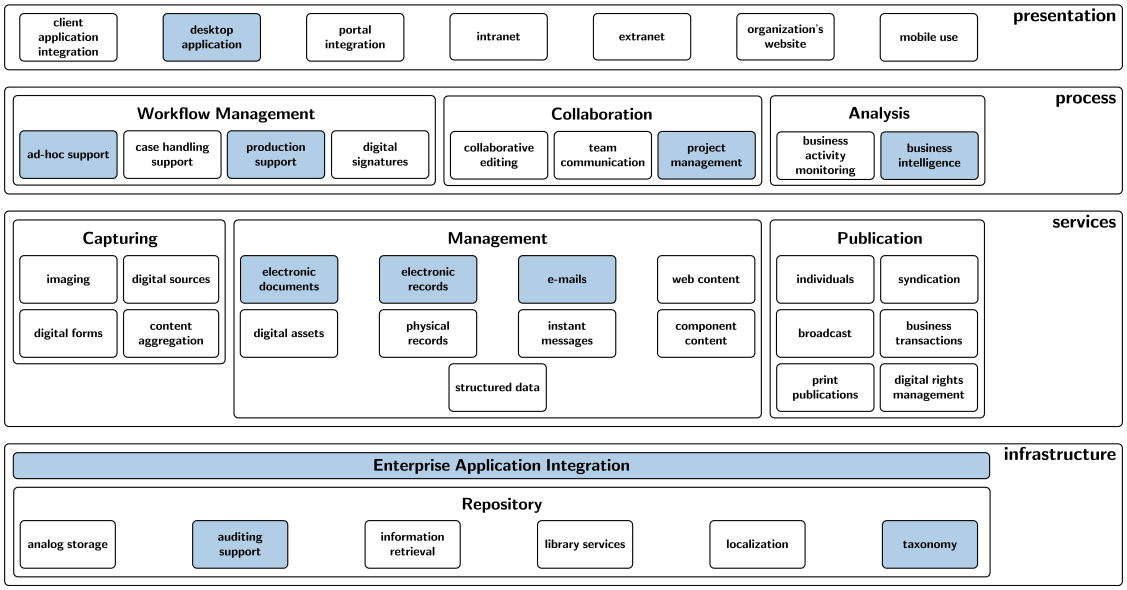

Figure E.1: Functional scope of CEM/A&C and map.

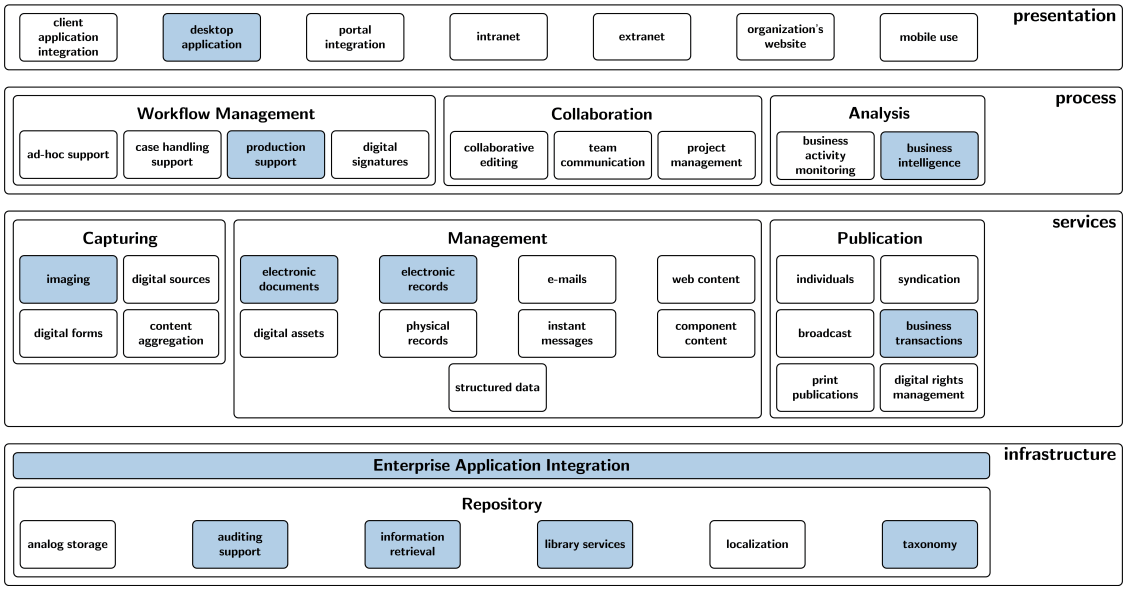

Figure E.2: Functional scope of DIS and GWS4all.

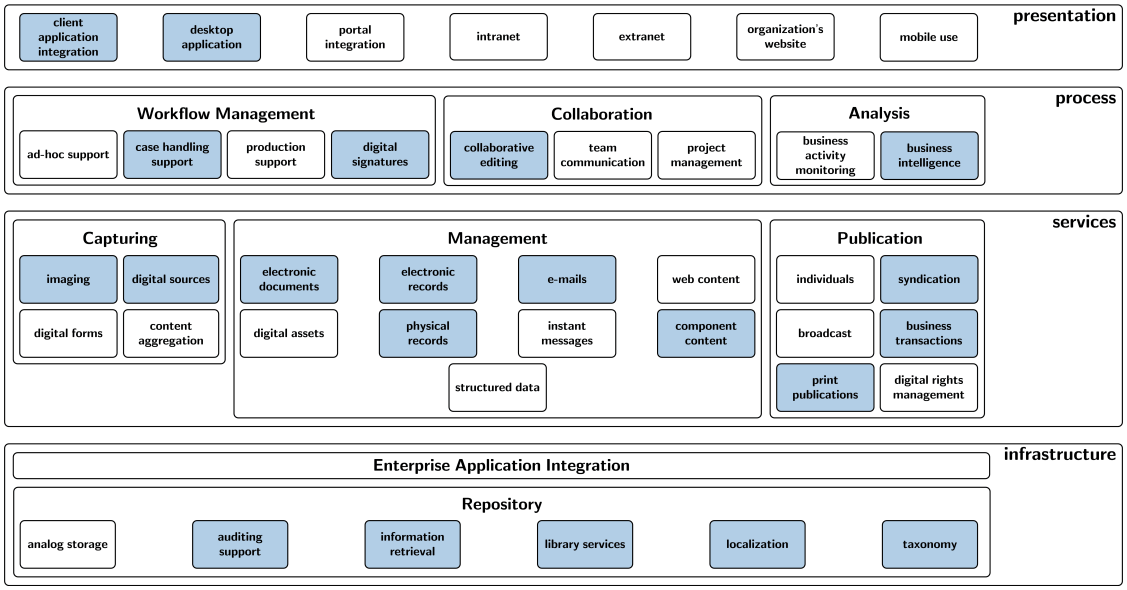

Figure E.3: Functional scope of C@sus.

E.2 Impact tables

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user dissatisfaction AND user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table E.1: Coded impacts of CEM/A&C and map.[17]

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table E.2: Coded impacts of DIS and GWS4all.

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table E.3: Coded impacts of C@sus.

[17] Impact 36 has been added for the cross-case analysis.

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	deteriorated business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table E.4: Coded impacts of CEM/A&C.

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user satisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational	6	improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	change in business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table E.5: Coded impacts of DIS and GWS4all.

category			#	impact
employees			1	change of organizational culture
			2	social conflicts
			3	user DISsatisfaction
			4	facilitating organizational learning
			5	concentration on core work
			36	change of work organization
organization	processes	operational		improved efficiency
			7	higher reliability, quality, and timeliness of content
			8	quality improvements
			9	'customer' service improvements
			10	change of business processes
			11	cost reductions
			12	compromise costs
		managerial	13	change of risk profile
			14	improved quality of management information
			15	improved decision making and planning
			16	increased compliance
		strategic	17	deteriorated business adaptability
			18	support of business growth
			19	building business innovation
			20	building cost leadership
			21	enabling worldwide expansion
	structures	horizontal coordination	22	improved and simplified access to authoritative content/organizational memory
			23	increase in content sharing
			24	improved internal collaboration
		size/scope/product domain	25	new or value-added products or services
			26	(additional) efforts are required for keeping content up to date
		vertical control	27	improved governance
			28	change in organization's power structure
		IT infrastructure	29	increased IT infrastructure capability
context	interorganizational relations		30	new or improved 'business' relationships
			31	improved external collaboration
	stakeholders		32	improved branding
			33	enhanced 'customer' integration
			34	improved 'customer' relations
			35	decrease in quality of external communication

Table E.6: Coded impacts of map.