On Enterprise Systems Artifacts: Changes in Information Systems Development and Evaluation

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Abstract: Enterprise Systems are one of the most important developments in corporate information systems during the last decade. These integrated information systems are characterized by a number of features which include a very broad scope and functionality, as well as being generic, master data, and business-process orientated. Together, these features make Enterprise Systems unique vis-à-vis other information systems and have a profound impact on information systems development and evaluation. For instance, analysis, design, and realization during traditional information system development is replaced by the selection of a system and the evaluation of an underlying reference model, as well as the setting of configuration parameters.

The focus of the study is the Enterprise Systems artifact and its impact on information systems development and evaluation. The aims are 1) to improve our understanding of the key characteristics of Enterprise System artifacts, leading to changes in information systems development and the increased importance of evaluation and 2) to develop methods and evaluation approaches for Enterprise Systems. The main research approach applied in gaining an increased understanding has been artifact evaluation, belonging to constructive research. The research reported upon in the thesis is presented in two parts. The first part synthesizes the text of part one with the seven included papers. The included papers address Enterprise Systems, information system development and evaluation in complementary ways leading up to the conclusion of part one.

The concluding output of the thesis is an integrated framework addressing the implications of Enterprise System artifacts for information systems development and evaluation. The framework includes several causally-related components, including the Enterprise System artifact and its key characteristics, an Enterprise System life cycle (including the four interrelated tasks of selection, configuration, implementation and use & operation), COTS implementation methods, and the changing purpose of evaluation. In a sense, the conclusion is a theorizing of the nature of Enterprise System artifacts. Despite the fact that this thesis provides insights into the nature of Enterprise Systems, it is evident that more research is needed.

Key words
Enterprise Systems, ERP Systems, information systems development, evaluation, artifact evaluation, artifacts

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Höör, September, 2003

Jonas Hedman

Dedicated to the memory of my father and brother

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Figures and Tables

Chapter 1

Introduction And Overview

This is a study of complex information systems and the focus is on the phenomenon Enterprise System and its relationship to information systems development and evaluation of information systems.

The chapter is organized as follows. The following section presents the background. The next section presents some of the terms used. Thirdly, the overall context of Enterprise Systems is presented and the purpose of the study is outlined. The chapter concludes with a presentation of the chosen structure.

1.1 Background

In 1998, the School of Economics and Management at Lund University (LUSEM) decided to install SAP R/3 version 3.1h for educational and research purposes. The main argument put forward by the department of Informatics was that the Enterprise System reflects an alternative approach of developing information systems in organizations.

In order to use the system, it had to be installed. There was no particular need for configuration, since LUSEM would be using the IDES (International Demonstration and Educational System) client. This version of R/3 contains a fictional corporation, including data such as customers, suppliers, employees, materials, inventory, divisions, cost centers, and orders. The IDES client supports about 50% of the more than 1000 processes (Curran and Ladd 2000) supported by R/3. IDES is used for training courses and is 'well' documented with exercises, which the intention was to use. The role of LUSEM was to use and maintain the system. The first attempt to install the system failed. Due to a lack of internal expertise, LUSEM had to rely on external consultants for the installation. However, as it turned out, they were not so knowledgeable. For instance, the first installation did not include all data to be used in the IDES client and the server did not have a proper operating system. The consequences of these matters lead to failure and

difficulties in maintaining and using the system. Initially, we thought we were less than intelligent, since nothing worked, but slowly we begun to questioned the installation. During the second installation LUSEM changed consultants to SAP's own consultants and switched to version 4.0b of R/3. Later we have upgraded to version 4.6b. When the installation was completed LUSEM would only have to maintain and use the system.

Maintaining and using an information system such as R/3 is challenging. Maintaining the system in this context was to keep it running. Meanwhile attempting to use the system we encountered several problems, including "out of factory calendar" and not enough hard disk. The problem "out of factory calendar" occurs because the system's clock keeps on running and creates the need for periodical closings. If this is not done, some operations will be impossible to perform, e.g. placing an order and subsequent shipments of goods. The problems had to be managed and solved. It took "days" of trial and error to figure out and solve the problems, including configuring new factory calendars and conducting periodical closings. In principal, the "out of factory calendar" problem is a financial accounting issue to ensure that revenues and costs are allocated to the right financial period. This and other problems provided incentives and forced me to learn the system, which is the basis for my understanding of the Enterprise Systems artifact.

The position of R/3 on the Enterprise System market was a fascinating and intriguing phenomenon. SAP AG is today the third largest independent software vendor, behind Microsoft and Oracle. SAP's main product, R/3, has over 30% of the Enterprise Systems market. And, in some segments of the market, e.g. multi national corporations, their position is even stronger. For instance, 400 of the Fortune 500 corporations have implemented, or are in the process of implementing, products from SAP. SAP AG claims even higher numbers in its annual report for 2002, that SAP has a 51% market share more than the five largest competitors together (SAP 2003). Meanwhile, in 1998, reports began to emerge of problems related to Enterprise Systems and in particular related to R/3. For instance, the bankruptcy of Fox Meyer Drugs (Davenport 1998; Austin, Nolan, Westerman and Cotteleer 1999) and the termination of Dell's R/3 implementation project (Cotteleer 2002). In Sweden, there were claims that Ericsson's problems were linked to the implementation of R/3 (Ekstrand 1998). Note: this claim was made by people outside Ericsson and never commented by Ericsson.

The interest in and fascination for the phenomena of Enterprise Systems, and in particular R/3, triggered the process of commencing this study. The process from 1998 has not followed the ideal doctoral study, with a clear

research question, the proper selection of methodology, and carrying out the study and presenting the results. On the contrary, this process has been quite different, including a number of disappointments and drawbacks. For instance, my contact persons in two empirical cases left their positions due to sudden reorganizations. Nevertheless, the object of investigation has been the Enterprise System artifact in order to improve our understanding of the types of characteristics that independent or interdependent differentiates Enterprise Systems for other types of information systems.

In the process of gaining an increased understanding of the artifact new issues and questions has emerged. The first issue was consequences and changes regarding requirements specifications. The text that got me to reflect upon requirements specification was a quote in Jackson (1995):

> We have a tendency to focus on the solution, in large part because it is easier to notice a pattern in the systems that we build than it is to see the pattern in the problems we are solving that lead to the patterns in our solutions to them (Ralph Johnson in Jackson, 1995, p. 2).

Besides requirements specification, the following issue, which attracted my attention, was the role of evaluation during the selection and configuration of Enterprise Systems. This became a pertinent issue when analyzing the methods used to configure and implement Enterprise Systems. The final issue is focused on improvements of Enterprise Systems, which is a logic synthesis of ISD and evaluation. Improvements are related to the latter stages of Enterprise System life cycle and evaluations can be a mean to improvements. These interrelated topics have guided the process. Figure 1.1 illustrates how the issues and the process (changes in requirements specification, role of information systems evaluation and improved use) have emerged. The arrows in Figure 1.1 illustrate the chronological evolution of issues as they have emerged. The initial focus was on the Enterprise Systems artifact, which originated from the attempts to use Enterprise Systems in education and the fascination of the phenomena of R/3. In the process of gaining an improved understanding the artifact consequences for ISD became an issue. Initially the ISD interest was focused on requirements specification and later on commercially off the shelf (COTS) methods. Information systems evaluation is a major issue in information systems (Walsham 1993) and became important when analyzing COTS methods. So, the process of the thesis has been guided by a broad interest in the phenomena of Enterprise Systems followed by ISD and information systems evaluation. Hence, the material is presented as a post-constructed logic.

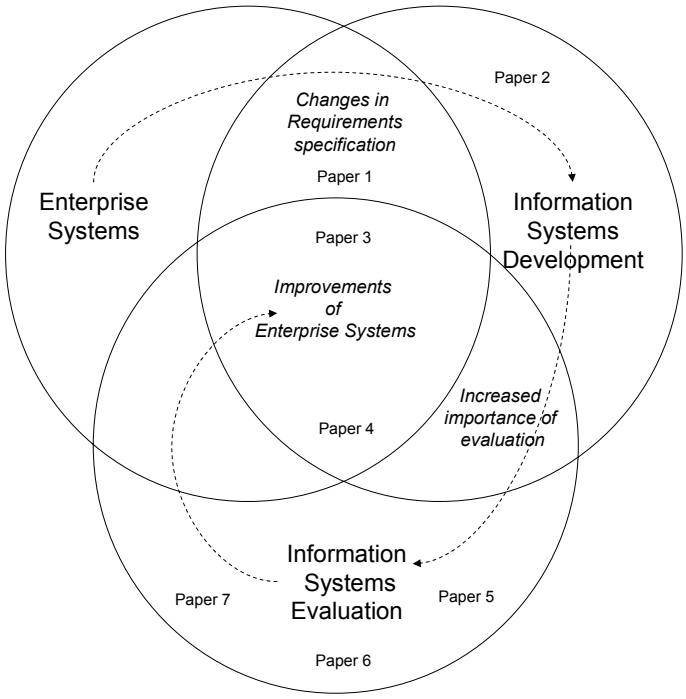

Figure 1.1. Evolving topics and issues

1.2 Clarification of some Terms

A number of specialized terms are used in the study. This section defines and describes the central ones.

COTS systems are computer-based information systems acquired from software vendors (Maiden and Ncube 1998). Brandt, Carlsson and Nilsson (1998) describe a number of software applications in order to illustrate COTS systems, e.g. accounting information systems, material requirements planning systems, inventory systems, sales support systems, decision support systems and integrated systems. There are two broad categories of COTS systems. The first consists of standalone applications supporting individuals or specific functions on various hierarchical levels, such as accounting information systems. The second category is integrated systems providing support to several functions and hierarchical levels (Brandt et al. 1998). Enterprise Systems belong to this category. Integrated systems entail that data only has to be entered at one point and that it can then be used across functional and hierarchical boundaries. In addition, Enterprise Systems comprise information processing of core administrative and operative data, such as order entry, production planning, procurement, and controlling. The integration of both transactional and controlling data is what can be seen as a prerequisite for

labeling an information system as an Enterprise System, cf. e.g. Rehnman (1970) for a discussion on transactional and controlling data and information. One research implication of this being that if an organization acquire and utilize only the accounting part of an Enterprise System, then it should not be defined as an accounting COTS system and not as an Enterprise System *per se* but.

Besides being acquired, COTS systems are generic information systems developed for the use of many organizations. The implication of generic information systems is the acceptance of someone else's interpretation and knowledge of how to do things. The knowledge and perception of how to do things might vary from vendor to vendor. For instance compare Outlook Express with Netscape Communicator, the same end functionality, but not exactly the same procedures. The implication of the differences between e-mail systems might not affect organizations so much. However, other information systems can have major consequences for organizations. Consider two accounting systems where one system supports the United States' generally accepted accounting principles (U.S. GAAP) and another supports Germany's generally accepted auditing standards as laid down by the *Institute der Wirtschaftsprüfer*, both supporting accounting but under different legal systems (Keller and Teufel 1998). Another aspect of being a generic system is that these systems have to be adapted to user requirements. The term user can refer to individuals, groups or organizations. For example, when installing a word processor, the user might want to change the initial font and font size to comply with personal preferences or corporate requirements. In the case of Enterprise Systems, the adaptation involves deciding on an overall control structure, a production mode (make-to-order versus make-to-stock) for manufacturing firms, a reporting structure, invoice and article numbering, etc.

COTS methods are ISD methods developed to support the process of implementing COTS systems. Single application COTS systems, e.g. e-mail or accounting systems for small businesses, usually only require instructions to install the system. However, more complex COTS systems require implementation methods. COTS methods may cover different parts of the system's life cycle; some support the whole process from selection to use and maintenance, while others cover the adaptation process. In principal, COTS methods are the same as ISD methods, but are specific to COTS systems. Furthermore, COTS methods may be generic or specific. Generic COTS methods, such as the SIV method (Standardsystem I Verksamheter – COTS systems in Business, my translation, Nilsson 1991) can be used independently of the system, whereas specific COTS methods are designed to implement

specific information systems, for instance AcceleratedSAP (ASAP) (SAP 1998; 1999).

1.3 Purpose

Enterprise Systems are integrated computer-based information systems constituting one of the most important developments in corporate information systems during the last decade (Davenport 1998; Upton and McAfee 2000).

The cost of implementing Enterprise Systems can reach USD 700 million and take more than five years to complete, involving thousands of people (Worthen 2002). Their implementation and use affects every aspect of the adopting organization, including its structure, processes, culture, workflows, and activities (Davenport 1998). Potentially, they can integrate the main information processes into one seamless information system (Klaus, Rosemann and Gable 2000). The use of Enterprise Systems could lead to strategic, organizational, tactical, operative and IT infrastructural improvements (Shang and Seddon 2002). On the other hand, many implementations fail to deliver the expected improvements, and in some cases Enterprise System are said to cause bankruptcy (Larsen and Myers 1998; Scott and Vessey 2000).

The implementation and use accounts for many of the problems and benefits (Scott and Vessey 2000); but some of the problems and benefits stem from the embedded characteristics of the system (Klaus et al. 2000; Lucas 1997). For instance, Enterprise Systems are extremely complex and comprehensive information systems (Davenport 1998). They are often generic systems (Klaus et al. 2000), based on reference models (Rosemann 2000; Scheer and Habermann 2000), which has to be adapted to organizations or the organization has to change in accordance to the logic of the generic system (Davenport 1998). Enterprise Systems are acquired from software vendors (Klaus et al. 2000) and generally implemented by consulting firms instead of being developed in-house (George 2000; Markus and Tanis 2000). The characteristics are thus important to understand (March and Smith 1995).

The importance of information system characteristics has March and Smith (1995) argued by stating "IT research must explicate those characteristics of the IT artifact operating in its environment that make it unique to IT" (p. 259). If there were no differences between Enterprise Systems and information systems, there would be no "scientific" reason to study

Enterprise Systems (Alter 1999). During one session, at the Americas Conference on Information Sysems in Long Beach, CA, 2000, Steven Alter challenged each presenter with the following question: What are the differences between Enterprise Systems and information systems that justify research under the label of Enterprise Systems? Research into Enterprise Systems seldom addresses the artifact, e.g. Enterprise Systems are often just described as an Enterprise System without any references to what part of the system or whether the entire package is implemented. Consequently, Enterprise Systems are treated as a 'black box' (Orlikowski and Iacono 2001) said to cause bankruptcy (Davenport 1998) and changes in productivity (Hitt et al. 2002). The lack of focus on the artifact, regardless of information technology, has Orlikowski and Iacono (2001) described as a lack of theorizing specifically about information system artifacts. Thus, one aim of the study is to improve our understanding of Enterprise Systems artifacts and in particular the types of characteristics making a difference that makes a difference.

Along the process of gaining understanding of Enterprise Systems other related issues became of interest. Requirements specification is one such aspect and is affected by the Enterprise Systems product specific implementation methods (Rosemann 2001; Esteves, Chan, Pastor and Rosemann 2003). These methods are labeled as COTS methods and include tasks and procedures different from those in classical ISD and include a fundamentally different logic of the process (Rosemann 2001). The different logic is described in the first appended paper as:

> Instead there is evaluation of the reference model and the functionality imbedded in the ERP system considered, followed by a selection process. For each ERP system (or part of a ERP system) considered, there are three basic options: accept, accept with changes, or reject - all with different organizational consequences. The accept option will lead to that organizations would align their business processes to the embedded ones. The "accept with changes" option may lead both to changes in the organization and the system. The last option will lead to a new evaluation process. These options should be considered compared to a requirements specification, which in turn has to reflect this (Paper 1, p. 576).

This implies that analysis, design and realization in traditional ISD approaches such as structured analysis, rapid application development, component-based software development, or participatory design (George 2000) are replaced by selection of system, evaluation of the reference model, and configuration of system parameters. Hence, the COTS methods include implicit and explicit assumptions which guide the implementation process and are important to

understand for information system research (Iivari and Hirschheim 1996). Thus, the changes in ISD and the increased importance of evaluation, along the Enterprise Systems life cycle, instigated by COTS methods and the key characteristics lead to the second area of concern.

To summarize, the general area of inquiry entails consequences for ISD and evaluation related to the characteristics of Enterprise Systems and the COTS methods. Thus, there are two types of artifacts which are of interest. The first is Enterprise Systems while the second is COTS methods. The overall perspective applied in the investigation is a system development life cycle (SDLC). In relation to Enterprise Systems, there are several life cycles. Two interrelated life cycles are presented to frame and delimit the study.

The first life cycle takes place at user organizations. This process involves four phases, including selection, configuration, implementation, and use & operation. The logic is illustrated in Figure 1.2 and is as follows: Organizations select, configure, implement, and use & operate Enterprise Systems. Each phase can involve iterations and there can also be iterations between phases. For instance, during selection, several systems can be evaluated until one system is selected. Another example could be a failed implementation leading to reconfiguration of the system. And a final example is use & operation, which should be continuously evaluated and improved. The tasks and procedures of each phase are described (section 5.1). Along the life cycle, there will be changes into the artifact, e.g. during configuration, the system is configured according to organizational requirements, such as how to process incoming orders.

The second life cycle, illustrated in the shaded area of Figure 1.2, occurs at the developer of the Enterprise Systems and consists of four phases, including analysis, design, realization, and offering. This life cycle occurs at each Enterprise Systems developer and for each version of the system. However, this life cycle lies beyond the scope of the thesis. One of the interaction points between these two life cycles is the developer's offering which is the adopting firm's selected solution, i.e. the Enterprise System artifact. The artifact is in the centre of Figure 1.2. Another interaction points, not shown in Figure 1.1, are 'based on best practice', i.e. existing offerings are designed in accordance to bench-market business processes from leading organizations (Curran and Ladd 1998). User groups and key account customers are participating and influencing the process of developing new functionality, deciding on future technological choices, and continuous improvements of the existing offerings (ASUG 2003; Paper 4). These are important processes, but are beyond the objectives of the thesis.

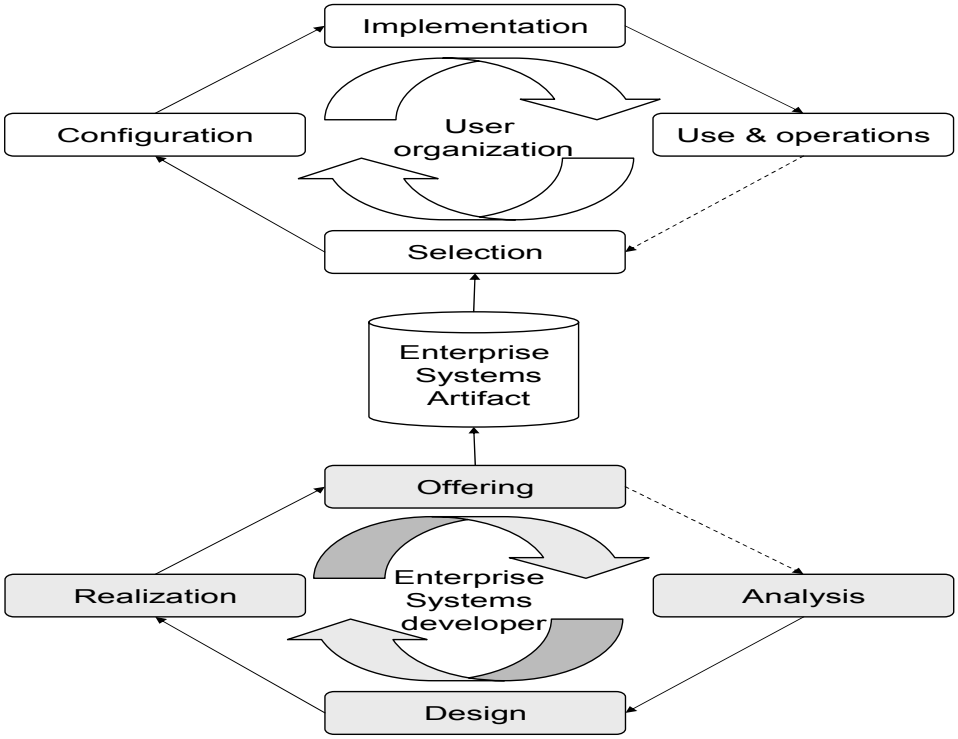

Figure 1.2. The life cycles of the Enterprise System artifact

The COTS methods are not depicted in Figure 1.2, but they are related to the whole life cycle, but mostly to configuration and implementation phases. The goal of the COTS methods is to ensure the quick and cost-effective installation of the system (Paper 1 and 2). Evaluation, illustrated by the two arrows in the middle of the upper life cycle, is a process occurring along the user organization's life cycle. During the various phases, evaluation has different purposes (section 5.6). The arrows between each phase of the two life cycles indicate that life cycles are process models, where each phase has to be completed prior to commencing a new one. For instance, a system has to be selected prior to configuration. However, the focus is not on the life cycle as such or the causalities between phases, but on the consequences arising from the Enterprise Systems artifact and the COTS methods used during the life cycle. The broken line arrow in the user organization's life cycle attempts to illustrate that use & operation ends with the termination of the system, and potentially leading to a new life cycle – if a new Enterprise System is selected. For the developing firms, the broken line illustrates the replacement of offerings with new ones, e.g. the replacement of R/3 3.1h with R/3 4.0b.

Table 1.1. Enterprise Systems research areas and selected contributors

Research areas	Contributors
Implementation issues	Adam and O'Doherty (2000), Alvarez (2002), Brown and Vessey (1999), Cooke and Peterson (1998), Davenport (1998), Markus (2000a), Robey et al. (2002), and Ross and Vitale (2000)
Critical success factors	Akkermans (2002), Chen (2001), Holland and Light (1999), Hong and Kim (2002), Parr and Shanks (1999), Shanks, Parr, Hu, Corbitt, Thanasankit and Seddon (2000), and Somers and Nelson (2001)
Enterprise Systems lifecycle	Brehm and Markus (2000), Markus and Tanis (2000), and O'Leary (2000)
Reasons for implementation failures	Al-Mashari and Zairi (2000), Ekanayaka, Currie and Seltsikas (2002), Hong and Kim (2002), Scott and Vessey (2000)
Maturity of Enterprise Systems use	Holland and Light (2001), Holland Light, Beck, Berdugo, Millar, Press and Setlavad (2000), Rajagopal (2002), and Skok and Legge (2001)
Impact on business and organization	Davenport (2000a), Francalanci (2001), Gattiker and Goodhue (2002), Hitt et al. (2002), Kennerley and Neely (2001), Markus (2000a) and Poston and Grabski (2001)

Despite the growing business interest in Enterprise Systems, research into Enterprise Systems has been neglected (Klaus et al. 2000; Hitt, Wu and Zhou 2002; Robey, Ross and Boudreau 2002). Research into Enterprise Systems has been called for by researchers (e.g. Boudreau and Robey 1999; Davenport 1996; David, Dunn and McCarthy, 1999; Gupta 2000; Holland and Light 2001; Krumbholz, Galliers, Coulianos and Maiden 2000; O'Callaghan 1998; Rosemann 2000). The need of academic research has George (2000) formulated as:

> To date, there have been few academic studies of enterprisewide system, the decision to acquire them, their implementation, and their success or failure (George, p. 283).

Not until 2001 and 2002 has a substantial body of research work, both quantitative and qualitative, been published that is related to Enterprise Systems. This research has mostly been descriptive with the goal of understanding the practical implications of Enterprise Systems (Gattiker and Goodhue 2002), in the following areas: implementation issues, critical success factors, system lifecycles, implementation failures, maturity levels of Enterprise Systems use and impact on business. Table 1.1 presents the main Enterprise Systems research areas and some contributors – a more in-depth review of Enterprise Systems research is presented in Chapter 5 and Paper 4.

One shortcoming is the lack of a description of the artifact. For instance, an Enterprise System has x and y impact on organizations, but there is no description of the artifact or it is simply stated that the implementation of an Enterprise System causes x and y impact, see for instance Ezingeard and Chandler-Wilde (1999) and Martin and Cheung (2000) for papers with no conceptualization of the artifact. The importance of understanding the nature and the characteristics of information technology are stressed by Hanseth (1996) and March and Smith (1995). Orlikowski and Iacono (2001) summarized the problems of a lack of a description of the artifact thus:

> …the field has not deeply engaged its core subject matter-the information technology (IT) artifact. Instead, we find that IS researchers tend to give central theoretical significance to the context …, the discrete processing capabilities of the artifact …, or the dependent variable. The IT artifact itself tends to disappear from view, be taken for granted, or is presumed to be unproblematic once it is built and installed…we propose a research direction for the IS field that begins to take technology as seriously as its effects, context, and capabilities. In particular, we propose that IS researchers begin to theorize specifically about IT artifacts, and then incorporate these theories explicitly into their studies (Orlikowski and Iacono 2001, p. 121).

In addition to the lack of theorizing about the Enterprise Systems artifact, other shortcomings can be outlined. There is a lack of research related to COTS methods (e.g. Davis 1988; Nilsson 1991, Rolland and Prakash 2000; Rosemann 2001). This is surprising considering that ISD is the core of the information system discipline (George 2000; Iivari and Hirschheim 1996).

There is a lack of prescriptive research, even though this has traditionally been the strong side of information systems research (March and Smith 1995). For instance, in the Scandinavian research tradition, the development of ISD methods is a key issue (Andersen 1991; Bansler 1989) illustrated by examples such as ISAC (Lundeberg, Goldkuhl and Nilsson 1979a; b), Object Orientation (Jacobson, Ericsson, and Jacobson 1994), socio-technical participative design (Chatfield and Andersen 1998), critical system development (Bansler 1989; Bødker and Kensing 1994), and COTS methods (Nilsson 1991).

Considering the impact on business and organization, another weakness is a lack of research related to the evaluation and improvement of Enterprise Systems (see for instance Borell and Hedman 2001; Murphy and Simon 2002a; b; Stefanou 2001). Two exceptions are constituted by Stefanou (2001) who proposes an *ex ante* evaluation framework for Enterprise Systems

evaluation and the proposed use of narratives in Enterprise Systems evaluation in Paper 7.

Five shortcomings have been identified in the research into Enterprise Systems: 1) the focus on practical issues; 2) the lack of theories regarding the information systems artifact; 3) the small amount of prescriptive research aimed at improving Enterprise Systems and their use; 4) the remarkably small amount of interest paid to COTS methods; and 5) the lack of research into evaluation of Enterprise Systems.

The lack of conceptualization of the Enterprise Systems artifact, including changes in ISD, the subsequent consequences for evaluation instigated by COTS methods and the lack of prescriptive research all lead to the purposes of this study; *to improve our understanding of Enterprise Systems artifacts and the key characteristics leading to changes in ISD and the increased importance of evaluation* and *to develop methods and evaluation approaches for Enterprise Systems*.

1.4 Structure of Thesis

The remainder of the thesis is organized in two parts. The first part provides an introduction to and a synthesis of the study, while Part two consists of seven papers. Figure 1.3 visualizes the structure of the thesis. Chapter 2 presents the papers and the relationship between them. The reason for introducing them early in Part one is that they are referred to later in Part one. The next chapter presents the research approach. In addition, this chapter provides a review of and a discussion about the Competing Values Framework (CVF). Chapter 4 presents the artifact and its key characteristics. In addition, this chapter provides a discussion and motivation of the term Enterprise Systems and the evolution of COTS systems into Enterprise Systems. Chapter 5 provides a literature review of Enterprise Systems research. The following topics are addressed; lifecycle, selection, configuration, implementation and use, and the evaluation of Enterprise Systems. The review justifies the need for research into Enterprise Systems in general and the principal interest related to COTS methods and information systems evaluation. The final chapter of Part one synthesizes and presents the overall conclusions and directions for further research.

The second part consists of seven papers addressing different, but complementary, aspects of Enterprise Systems, ISD and evaluation. These

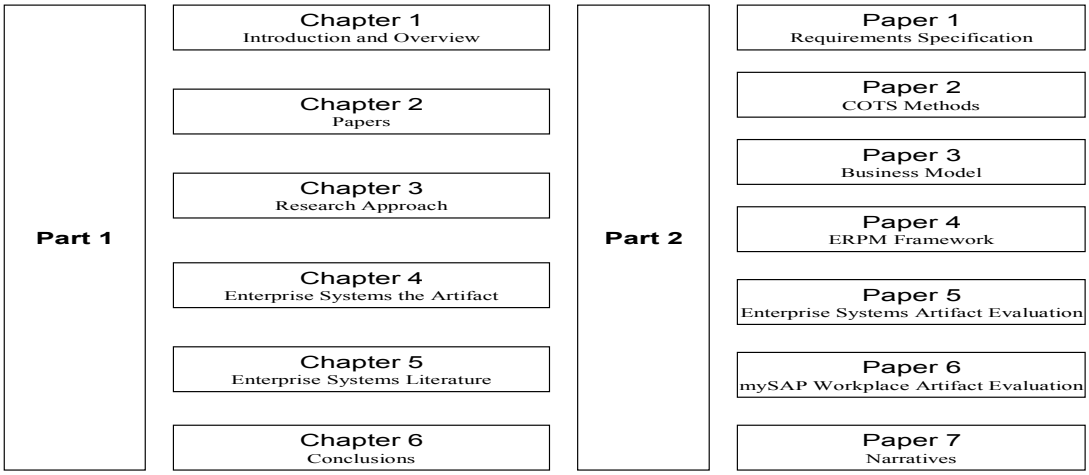

Figure 1.3. Thesis disposition

papers can also be seen as the process leading up to the conclusions of the thesis, which is presented in Chapter 6.

Chapter 2

Papers

The first chapter described the background, the area of inquiry and the purpose of the study. This chapter presents the individual papers included in Part two of the thesis. The common denominator is Enterprise Systems and the focus of this chapter is on the contributions and the relationships between the papers. In addition, the status and review process for each paper is described. The papers have been organized in relation to ISD and information systems evaluation. The chapter concludes with a summary.

2.1 Papers Related to Information System Development

Four out of the seven papers are classified as being related to ISD. These papers cover the life cycle of Enterprise Systems from the selection, configuration, implementation and use & operation.

2.1.1 Paper 1: Requirements Specification

The problem addressed in Paper 1 "CVA Based Framework for ERP Requirements Specification" (Borell and Hedman 2000) is changes in ISD and in particular related to the requirements specification. The changes in the requirements specification are linked to the COTS method used to implement Enterprise Systems.

The paper argues that the COTS method changes the relationship between designer and user. Users are not involved in the requirements specification due to the time constraints and the numbers of users involved in the project. This is a fundamental difference regarding, at least, how the Scandinavian approach has portrayed the role of users and their involvement in the process.

The solution presented, or artifact, is a requirements specification framework based on the CVF (Quinn and Rohrbaugh 1981; Rohrbaugh 1981). The framework is conceptually illustrated through analyzing an Enterprise System which is used to derive organizational requirements regarding Enterprise

Systems. In addition, a central point made in the paper is that requirements should be focused on the goals of the system – not on the well-being of the implementation project, i.e. requirements should be focused on long-term goals. This can be contrasted with the traditional focus on functional requirements found in contemporary ISD approaches (cf. Iivari 1991).

The paper was presented at the 23rd IRIS Conference in Uddevalla, Sweden. The paper was reviewed by three anonymous referees prior to acceptance.

2.1.2 Paper 2: COTS Methods

Paper 2, "Understanding COTS System Implementation Approaches and Methodologies: The Case of ASAP" (Hedman 2003), specifically addresses the COTS methods. The focus of the paper is to investigate the underlying assumptions of COTS methods, not changes in the relationship between designer and user (cf. Paper 1). The COTS method analyzed is AccelratedSAP (ASAP).

The paper applies a paradigmatic analysis to discover the assumptions or essential characteristics of the method. The analysis is based on Iivari's (1991) paradigmatic framework for analyzing ISD approaches, including ontology, epistemology, research methodology, and research ethics. Furthermore, the paper stresses the inherent view of information requirements. An issue stressed by Iivari and Hirschheim (1996). The view of information requirements was found to be the main difference between COTS methods and other ISD approaches. The underlying assumption of information requirements can be summarized as predetermined. The interpretation of information predetermination is that the method "knows" what information requirements an organization has. This may potentially explain the alleged deterministic perception of Enterprise Systems, i.e. they impose their own logic on businesses and organizations, see for instance Boudreau and Robey (1999) for a discussion on the deterministic nature of Enterprise Systems. In relation to ontology, epistemology, research methodology and research ethics, ASAP showed clear similarities to contemporary ISD approaches, e.g. the infological approach, information modeling and the socio-technical approach.

A version of this paper has been submitted to the Information Systems Journal.

2.1.3 Paper 3: Business Model

The third paper "The Business Model: A Means to Comprehend the Management and Business Context of Information and Communication

Technology" (Hedman and Kalling 2002a) presents a conceptual model of businesses and the relationship between business and information technology. The business model consists of six causally related components (customers, competitors, offering, activities and organization, resources, and factor and production input) and one process component addressing the evolution of the business model (including, for instance, management processes, cultural, learning, cognitive and political constraints). The six first components are cross-sectional and can be investigated at a given point in time, i.e. causal models, whereas the process component is based on process models.

The paper relates to the thesis in three ways. Firstly, Enterprise Systems are viewed as a resource and relates to ISD in the following way: Enterprise Systems have to be acquired, i.e. the selection of a solution, on the market from a supplier. Then the system has to be adapted to the particular business, i.e. configured. The final step is implementation and utilization of the system, i.e. diffusion and adoption.

Secondly, the business model concept is also related to evaluation, since it provides a unit of analysis which could be contrasted with the CVF. The evaluation of Enterprise Systems is argued to be a difficult and complex task, and one of the problems is the unit of analysis and the problem of operational definition, see for instance Borell and Hedman (2001). The business model concept provides a conceptual linkage between Enterprise Systems and the context which the Enterprise Systems is related to.

The third way in which this paper relates to the thesis is through providing an alternative perspective. The main contextual frame of reference stems from the information systems literature. The business model is based on strategy theory, which is grounded in an economic view of organizations and their behavior. The complement provided with the business model is that it provides alternative constructs, e.g. factor and product market, resources, and offering. These three sets of constructs are not traditionally used in information systems research.

This paper was accepted by four reviewers and presented at the 10th European Conference on Information Systems in Gdansk, Poland. The paper has subsequently been enhanced with empirical illustrations and published in the European Journal of Information Systems (Hedman and Kalling 2003). Furthermore, the business model concept is described, discussed and analyzed in depth in Hedman and Kalling (2002b). In addition, the business model concept has also been used to analyze the emergent body of e-business models (Hedman and Kalling 2002 c; d).

2.1.4 Paper 4: ERPM Framework

The fourth paper included, "Enterprise Resource Planning Systems: Critical Factors in Theory and Practice" (Hedman 2003). The perspective in this paper is the process perspective from Paper 3 and explores several aspects addressed in the thesis. Requirements specification (Paper 1) where found to be problematic due the lack of understanding the characteristics of Enterprise Systems and shortcomings in theoretical concepts. An unreflective use of COTS methods was found perceived as having negative impact on utilization, cf. Paper 2. The varying role of evaluation is stressed as a factor in improved use of Enterprise System; cf. Paper 7 which discusses the purpose of evaluation also discussed in Chapter 5. The result presented in Paper 4 is an Enterprise Systems resource management framework (ERPM), including factors and issues affecting the utilization of Enterprise Systems.

The framework includes four interrelated tasks, selection, development, internal distribution, and usage, and is based on an IT resource management framework (Kalling 1999). The framework addresses the management of resources, including organizational, project and technical factors. The main contribution of Paper 4 is the framework, which is enhanced through a survey of seven Enterprise Systems experts and 200 pages of written material provided by the consultants. Another contribution of the paper is the theorizing of Critical Success Factors (CSFs), which previously have been to a little extent theorized (see Robey et al. 2002).

The paper has not been submitted to any journal or conference, but has been discussed internally at the Department of Informatics.

2.2 Papers Related to Information System Evaluation

The importance of Enterprise System evaluation derives from 1) the need for evaluation *per se* and 2) the increased importance of evaluation during the life cycle of Enterprise Systems. Three papers address information systems evaluation specifically.

2.2.1 Paper 5: Enterprise Systems Artifact Evaluation

Paper 5 is actually a book chapter entitled "The impact of Enterprise Resource Planning Systems on Organizational Effectiveness: An Artifact Evaluation" (Hedman and Borell 2002). The paper evaluates the potential

impact of Enterprise Systems (SAP R/3 version 4.0b) on organizational effectiveness. The founding problem of the paper is the contradictory findings concerning the impact of Enterprise Systems on organizations; see for instance Boudreau and Robey (1999) for a discussion.

The approach taken is an artifact evaluation of Enterprise Systems, i.e. it is the system as such that is evaluated. The evaluation uses the CVF. The outcome of the evaluation shows that the potential impact of Enterprise Systems is primarily related to external and internal stability, e.g. increased control and productivity through enforcing better communication and planning. The result is presented as a number of hypotheses regarding the impact of Enterprise Systems on organizations.

The book chapter was written as a response to a call for chapters. Initially a four-page proposal was written, which was reviewed by the editors. Following acceptance, the chapter was submitted. This was then followed by a double blind review wherein the paper was accepted subject to changes being made. The chapter has been updated at the request of the publisher and is to be published in a new book in 2003 (Hedman and Borell 2003).

2.2.2 Paper 6: mySAP Workplace Artifact Evaluation

The sixth paper "An Assessment of a Role based Information Portal" (Carlsson and Hedman 2001a) was presented at the 8th European Conference on Information Technology Evaluation, Oxford, UK. In this paper, mySAP Workplace was evaluated. mySAP Workplace is a software program belonging to a category labeled Information Portal (IP). An IP is a software program which is used to manage and control access to information systems, e.g. Enterprise Systems, e-mail, SCM systems, and CRM systems. The particular artifact is strongly linked to Enterprise Systems. The artifact is developed by SAP AG and is intended to be used as gate way to other SAP products and other systems. The evaluation applies the CVF, but uses the management version instead of the organizational effectiveness framework used in Paper 5. To incorporate managerial functions and tasks the CVF is enhanced with Mintzberg's (1979) five basic components, including strategic apex, technostructure, support staff, middle line, and operating core. The management and organizational version of the CVF is presented in Chapter 3. The result of the evaluation shows a strong resemblance to the one presented in Paper 5. However, there were some minor changes. For instance, the IP had a stronger linkage with flexibility than with the Enterprise Systems. The result was, in any event, a little surprising, since the developer's main sales argument for this artifact was flexibility. One possible explanation for this is

that the vendor has interpreted flexibility as technical flexibility, which is not the same as organizational flexibility, which the CVF address.

This paper was accepted on the basis of an abstract submission. A previous version of the paper (Carlsson and Hedman 2001b) was presented at the 7th Americas Conference on Information Systems, Boston, USA in 2001, and another version (Carlsson and Hedman 2001c) at the 6th INFORMS Conference on Information Systems and Technology, Miami, USA, 2001, where the full paper went through a double blind review process.

2.2.3 Paper 7: Narratives

In Paper 7, "Narratives in ERP systems evaluation" (Hedman and Borell 2004), narratives are suggested as a means of Enterprise Systems evaluation. One of the assumptions stressed in the paper is that evaluation should form the basis of action, i.e. do not measure if you cannot act on the measurement. The purpose of evaluation ought to be to improve the system and the activities along its life cycle, including selection, development, implementation and use & operation. In the paper, narratives are proposed as a means of improving Enterprise Systems and should be viewed as a complement to traditional evaluation methods, such as Total Cost of Ownership and Return on Investment. The potential of narratives is that they can convey meanings, interpretations, and knowledge of the system, which may lead to action and in the prolonging improved utilization. Even though narratives belong to an interpretive research tradition, the paper takes a pragmatic view of evaluation based on three assumptions about evaluation: 1) evaluations should form the basis for action; 2) narratives can make evaluation more relevant; and 3) evaluations should be done with the purpose of improving the selection, implementation and use of the system.

The paper proposes a framework addressing the purpose and issues related to the evaluation of Enterprise Systems. The conclusion of the paper is that narratives can advance evaluation practice by providing a richer evaluation picture which conveys meanings not included in traditional evaluations.

This paper has been submitted and accepted for publication the Journal of Enterprise Information Management, 2004. The paper was written as a response to a call for papers to a special issue on information systems evaluation. The paper went through a double blind review wherein the paper was accepted subject to changes being made.

2.3 Summary of Papers

The papers address Enterprise Systems and the two interrelated topics of information systems development and information systems evaluation. Table 2.1 summarizes the papers. A short title is provided to highlight the content of each paper. The research approach of each paper is summarized, see also section 3.3, including idiographic, nomothetic, and constructive. The two first categories are drawn from Burell and Morgan (1979), whereas the last category can be traced to Simon (1996) and March and Smith (1995). In column four the papers are classified along the Enterprise Systems life cycle (including selection, configuration, implementation and use & operation) and in relation to evaluation; cf. Figure 1.1 and section 5.1. The last column provides the main set of frame of reference.

Table 2.1. Summary of papers

Paper	Short title	Research approach	Part of the life cycle	Frame of reference
1	Requirements Specification	Constructive approach leading to the development of a framework	Selection and configuration.	ERP systems literature and CVF.
2	COTS Methods	Constructive approach analyzing COTS methods	Configuration and implementation.	Paradigmatic analysis.
3	Business Model	Idiographic approach conceptually illustrated	Use & operation.	Strategy theory, information systems and business model.
4	ERPM framework	Nomothetic approach survey data	Focus on use & operation and the relationship to previous phases.	Management of resource and CSFs.
5	Enterprise Systems Artifact Evaluation	Constructive approach	Evaluation.	Information system evaluation and the CVF organizational.
6	mySAP Workplace Artifact Evaluation	Constructive approach	Evaluation.	Information portal and the CVF management.
7	Narratives	Idiographic, conceptually illustrated	Evaluation during the entire life cycle, but a focus on use & operation.	Action theory and information systems evaluation.

Chapter 3

Research Approach

In the previous chapter the papers of Part two were introduced and related to each other. This chapter addresses the research approach. The following section describes the methodology and the final section discusses the Competing Values Framework (CVF).

3.1 Methodology

The goal of this section is to describe the chosen approach. As described in the first chapter of the thesis the study has not involved one research question followed by the selection of scientific approach, carrying out the empirical investigations and reporting the result. This can be perceived as problematic. This type of problem others have encountered as well. For instance, Hanseth (1996) and Nilsson (1995) describe similar problems in their doctoral studies. Nilsson (1995, p. 3) described his studies as a "random walk" and Hanseth (1996, p. 6) summarized his approach as a "theoretical inquiry into the nature of IIs" and described his research process as "following a phenomenon" (Hanseth 1996). Nilsson (1995) motivated his study as "being interested into a concept". Their experiences seem to be similar to my own. Consequently, in the papers I have applied a variety of methods depending on the research objectives and settings.

The overall approach taken is explorative and very broad, which I have labeled it artifact construction approach. It is mainly based on my experience of managing R/3 at LUSEM and systematically analyzing three artifacts, namely R/3 (mySAP.com 1999-2000), mySAP workplace (mySAP.com 2000) and ASAP (SAP 1998; 1999). In addition, four 'theoretical' fields have been explored – mainly Enterprise Systems research, information systems development and evaluation, organizational effectiveness and management of information technology resources. The role of the theoretical fields has been to provide a broad conceptualization of the phenomena and to position the presented contributions.

The scientific interest in information systems is the belief or expectation that science can explain and improve the understanding of the phenomena and hopefully improve information systems and practice (March and Smith 1995).

March and Smith (1995) describe two different scientific interests in information systems. The first interest is knowledge creation, corresponding to natural science, with the goal of increasing our understanding the nature of the phenomena. Natural sciences, in this particular context, refers to sciences such as physical, biological, social, business, and behavioral, aimed at understanding reality (March and Smith 1995). Note: As I interpret March and Smith (1995) they use the term natural science in an untraditional way. They do not use it to distinguish between natural science and social science, but to distinguish between research traditions focusing on natural phenomena versus artifacts. They build upon Simon (1996, p. 3) who defined natural science as "knowledge about the natural objects and phenomena". Natural science aims to understand reality by constructing sets of concepts, characterizing the phenomena under investigation. The concepts are used to make claims about the nature. This is formulated as models, frameworks, or theories and is evaluated against norms of truth or explanatory power (March and Smith 1995). The process of evaluating or justifying scientific claims is, in most information systems research is based on a hypothetic deductive method (Remenyi et al. 1998). According to Hansson (1992), this is in turn based on falsification (Popper 1963). In natural science, the knowledge creation process is based on idiographic research approaches (such as case studies and action research) or on nomothetic research approaches (such as formal-mathematical analysis, experiments, field studies and surveys), to use Burell and Morgan's (1979) two extremes. Paper 3, Paper 4 and Paper 7 can be classified as belonging to natural science.

The other scientific interest in information systems stems from the design sciences, e.g. information systems, architecture, and engineering. Design sciences are concerned with a knowledge-applying process, with the explicit goal of improving the performance of artifacts or of developing artifacts (March and Smith 1995; Walls et al. 1992; Markus et al. 2002). Artifacts can be constructs (concepts), models, methods, techniques, or information systems (Iivari and Hirschheim 1996). Simon (1996) argued for the need for sciences and research approaches explicitly addressing artifacts, since the world is a much more artificial one today with more man-made products than natural ones. He defined artificial as "Produced by art rather than nature…" (p. 4). Bunge (1979, p. 209) described artifacts as heart of society and "constituting a whole new level of reality, namely the artiphysis". Besides Burell and Morgan's two research approaches, idiographic and nomothetic, a third research

approach is constructive research which addresses design science (March and Smith 1995; Iivari and Hirchheim 1998, Järvinen 1999). Constructive research approaches are concerned with artifacts created by humans to be purposefully used by humans and organizations (Simon 1996). Four papers (Paper 1, Paper 2, Paper 5 and Paper 6) are based on constructive research approaches. Constructive research is the main approach of this thesis and has been used to understand the artifacts of concern.

Constructive research involves two activities, namely artifact-building and artifact-evaluation (Järvinen 1999; March and Smith 1995). Artifact-building research or the design of artifacts is of constant interest to the information systems community (Markus, Majchrzak and Gasser 2002). The questions addressed are: Is it possible to build a certain artifact?; How should a certain artifact be designed? (March and Smith 1995). One of the appended papers belongs to this category of constructive research, namely Paper 1. In Paper 1, an Enterprise Systems requirements specification framework is developed. This paper is prescriptive in its nature through suggesting steps and procedures to follow. It draws on knowledge in order to create and develop better artifacts, not to produce knowledge *per se*, which is the basis of research based on natural science. Walls, Widmeyer and El Sawy (1992) and Markus et al. (2002) state that design is central to information system discipline. However, a prerequisite is that design should be based on science, such as theories, frameworks or models (Walls et al. 1992; Markus et al. 2002). In Paper 1, the CVF is the scientific principle used to design artifacts. Walls et al. (1992) use the term 'kernel theory' to denote scientific principles that govern design requirements implemented in artifacts.

Artifact evaluation research raises questions such as: How effective and efficient is an artifact? Paper 2, Paper 5 and Paper 6 belong to this category. In order to evaluate, it is necessary to assess the performance or consequences of the artifact, including context specific evaluation criteria of each type of artifact, i.e. construct, model, method, and implementation. Paper 2 presents an artifact evaluation of a COTS method and the chosen evaluation framework for this assessment is Iivari's (1991) paradigmatic framework for analyzing underlying assumptions in ISD approaches. Iivari's (1991) framework includes four dimensions: ontology, epistemology, research methodology, and research ethics. The justification for selecting the paradigmatic framework is mainly the possibility of comparing the result of analysis with previous paradigmatic analyses of ISD approaches. In the artifact evaluations presented in Paper 5 and Paper 6, the CVF is used as evaluation framework. Paper 5 presents a systematic analysis of R/3 and Paper 6 analyzes the portal solution, which is the web-based graphical user interface of

R/3 and labeled mySAP Workplace (Paper 6). The main argument for justifying the use of the CVF has been to match the analytical level to the level of organizational impact. Farbey, Land and Targett (1995) present an evaluation framework which addresses the link between expected benefits and types of information systems. Based on Farbey et al's (1995) classification schema and previous research on Enterprise Systems, which indicates that they are organizational systems (Davenport 1998; Boudreau and Robey 1999; McKeen, Smith and Parent 1999) and should thus be judged against such criteria. The CVF is further explained and discussed at the end of this chapter.

Information system artifacts can be studied and developed scientifically (March and Smith 1995). Moreover, natural and design science should not be viewed as contrasting research approaches, but as complementary approaches with many interaction points, at least for information systems research Mingers (1991). For instance, the development of Enterprise Systems is a design science task (Scheer 1992) that gives rise to new phenomena to investigate from a natural science perspective (e.g. Gable 1998; Joseph and Swanson 1998; Brown and Vessey 1999; Gupta 2000; Parr and Shanks 2000; Koch 2001; Scott and Wagner 2002). Another example is the result of the paradigmatic analysis in Paper 2, i.e. that COTS methods are information predetermined, could be studied based natural science framework and the proposed business model could be used as a kernel theory in the design of a business model evaluation tool. The last example illustrates how natural science provides knowledge which can be incorporated into the artifact while it is being designed, as suggested by Walls et al. (1992). According to March and Smith (1995) another interaction point between natural and design science is that design science can be used as a justification for natural science theories. For instance, the realization of Enterprise Systems confirms Blumenthal's (1969) hypothesis of a total-system, see section 4.2.

To summarize, the scientific study of information system in context belongs to natural science, whereas the scientific development of information systems belongs to design science (Simon 1996). The difference between natural science and design science is that the former is mainly concerned with explaining how and why things are, whereas the latter is concerned with how things ought to be (Simon 1996). Three artifacts, R/3, mySAP Workplace and ASAP, have been studied in the thesis and one artifact has been developed, i.e. the requirements framework. R/3 is principally presented in Chapter 4 and in Paper 4. The two other artifacts evaluated are presented in Papers 2 and 6. The developed artifact is presented in Papers 1. In addition, one model, i.e. the business model, has been proposed in Paper 3. The fourth paper presents

a framework for improving the use of Enterprise Systems. The use of narratives in information systems evaluation has been suggested in Paper 7.

What type of approach is this then? This is based on my interpretation of the artifacts (R/3, mySAP Workplace and ASAP). The interpretation of the artifacts is based on my own experience when attempting to use and maintain the system and trough artifact evaluations. The artifact evaluations were based on the CVF (Quinn and Rohrbaugh 1981; 1983) and the paradigmatic framework (Iivari 1991). The second part of the purpose aimed at developing and proposing artifact. This has involved the design of artifacts, i.e. the requirements specification framework (Paper 1). The applied research approach cannot be labeled as interpretative research, since the focus is on the artifact and not the context. Thus, I labeled the research approach as an artifact construction approach. The approach resembles the reflective system development approach (Checkland and Scholes 1990; Vidgen and Braa 1997; Mathiassen 1998) involving research goals (such as understand, support and improve) and research activities (such as interpretation, design, intervention) (Mathiassen 2002) with one large alteration. The artifact construction approach has not been used in action research, i.e. intervention and improvements of practice. Thus, the claims made in the thesis have not lead to any intervention or improvements of information system practice.

3.1.1 Relationships and Limitations

A question is how the papers relate to each other? March and Smith (1995) presents a two dimensional framework for research in information systems that specifically reconciles natural and design sciences activities as one dimension and design science research outputs as the other dimension, see Table 3.1. According to the authors this framework addresses four shortcomings in prior information systems research frameworks: 1) choosing important interaction points; 2) do not acknowledge the present design research; 3) do not recognize that information system is artificial; and 4) do not acknowledge the changing nature of the artificial and the changing context. Exceptions are for instance Orlikowski and Iacono (2001) and Robey and Boudreau (1999). March and Smith (1995) view information systems research as "the study of artifacts as they are adapted to their changing environments and to changes in their underlying components" and "an appropriate framework for IT research lies in the interaction of design and natural science" (p. 255).

The logic of Table 3.1, is that artifacts, i.e. constructs, models, methods, and instantiations, are created and become objects of study. The performance of artifacts has to be determined, i.e. evaluated. Then it is important to

investigate why and how the artifact worked or not within its context, i.e. to theorize and justify. The research outputs or artifacts forms the first dimension of the proposed framework, including constructs, models, methods, and instantiations. Constructs or concepts is the vocabulary of a domain and used to describe problems and specify solutions of the domain. For instance, Markus and Tanis (2000) provides four concepts of the Enterprise Systems life cycle including Chartering, Project, Shakedown, and Onward and upward. Models refer to a set of propositions expressing relationships among constructs or concepts; see for instance Figure 4.1. This type of model should not be compared with the interpretation of models in natural science where it is often interpreted as framework or theory, cf. ERPM framework (Paper 4). Method on the other hand is the procedures used to perform a task. For instance, ASAP prescribes the tasks to successfully implement R/3, according to SAP. The final research output is instantiations or implementations, which is the realization or use of an artifact in context. The use of artifacts demonstrates the feasibility and effectiveness of the methods, models, and concepts they contain.

The second dimension is related to the research activities of natural and design science and includes theorize, justify, build, and evaluate. Buildings refer to the construction or development of artifacts. Evaluation on the other hand is the development of criteria and assessing the artifacts performance against the criteria. The initial research activity in natural science are theorizing, i.e. the development of theory that addresses how and why artifacts work or do not work and the subsequent task is to justify or prove the theory, which involves data gathering that supports or rejects the theory.

In Table 3.1, which is based on March and Smiths two-dimensional framework are the appended papers depicted. Each paper is depicted to the quadrant they mainly belong to, even though they may belong to several. Paper 1 presents the construction and development of a requirements framework (i.e. a model). Paper 2 on the other hand presents an evaluation of a method. Paper 3 develops and conceptually illustrates a business model concept. Paper 4 also develops a framework, but it is also enhanced empirically, i.e. justify. Paper 5 and Paper 6 presents two evaluations of instantiations, i.e. R/3 and mySAP workplace. Paper 7 presents the development of Enterprise Systems evaluation approach, i.e. a method.

The limitations of the chosen approach are manifold: The first is the selection of the artifacts to be evaluated. The availability of R/3, mySAP Workplace and ASAP through the collaboration between LUSEM and SAP affected the

Table 3.1. Information systems research framework and appended papers (adapted from March and Smith 1995)

		Research activities			
		Design Science		Natural Science	
		Build	Evaluate	Theorize	Justify
Research outputs	Constructs				
	Model	Paper 1		Paper 3	Paper 4
	Method	Paper 7	Paper 2		
	Instantiation		Paper 5 and Paper 6		

choice and has limited the research. However, applying the same artifact evaluation on several Enterprise Systems would not have been feasible, due to the lack of available Enterprise Systems and LUSEM's capacity of managing Enterprise Systems. The benefit of focusing on one Enterprise System is that it provides a potential of studying more aspects of one instance of Enterprise Systems. Whereas the alternative to study several Enterprise Systems would have provided more observations of Enterprise Systems, such an approach would have limited the potential of in depth understanding of each artifact. My selection of theoretical lenses is another limitation, which affects the findings, but the four 'theoretical' fields have hopefully broadened my understanding of Enterprise Systems. The use of several theories from different paradigms may resolve the problem of that no theory can be general, accurate and simple at the same time (Weick 1985). The problem Weick (1985) attempts to address is that people (IS researchers, my postscript) only see what they expect to see and the problem is, they never learn what they have overlooked. Weick's (1985) and Mingers (2001) solution to this problem is to apply several theories and research approaches to see their subject more accurately (Weick 1985, p. 129). Paper 4 is an example of the potential of integrating two theoretical fields (ITRM framework and the CSF research) from opposing paradigms (idiographic versus nomothetic) one based on process theories and the other on variance models (Markus and Robey 1988).

Another limitation of the thesis and the papers is the assumption of the validity of the key characteristics. The credibility of the result is largely dependent on the acceptance of the key characteristics. The selection of characteristics is based on my understanding of Enterprise Systems and what other researchers have done. For instance, Klaus et al. (2000) and Davenport (1998) have identified Enterprise Systems characteristics. It is possible that

other people working with Enterprise Systems would identify competing and complementary or the same characteristics. The selection has been done carefully. It has been an incremental process as my understanding of Enterprise Systems has evolved. The key turning point was the process leading to solving the problem of "out of factory calendar", which involved identifying and solving (reconfiguration) a problem. The importance of master data and generic system became evident during this process. Furthermore, it is not possible to guarantee whether the identification is right or wrong. Thus, it is likely that there will be several interpretations of Enterprise System; which the four perspectives on Enterprise Systems presented at the end of Chapter 5 might illustrate.

The chosen research strategy, deliberate or not, has its advantages as well. The main one is the opportunity and possibility of applying research approaches from different research paradigms, since this will provide a richer understanding of the phenomena (Mingers 2001).

3.2 Competing Values Framework

The CVF (Quinn and Rohrbaugh, 1981; Rohrbaugh 1981) has been used in the development and evaluation of artifacts (Paper 1, 5 and 6). The role of the CVF is twofold. In Papers 1, the role of the CVF has been as the scientific principle guiding the design of artifacts, in Walls et al.'s (1992) terminology the kernel theory. In Papers 5 and 6, the CVF is used as a measurement for evaluating the artifacts. The main reasons for using the CVF are:

- It is a high-level comprehensive framework of organizational effectiveness, with a strong link between theory and empirical studies. The reason for choosing a high-level framework is justified through the need of fit between analytical framework (measurement criteria) and anticipated level of impact (Paper 5 and Paper 6), see also Farbey et al. (1995) for a discussion on the link between anticipated level of impact and evaluation criteria.
- CVF addresses the link between means and ends. The benefits of a means and ends framework is this case is that it provides a link between the selection of solution (means) to the problems intended to be solved (ends). The importance of relating problem and issues to the solution is stressed in Paper 1. Furthermore, a means and ends framework can provide support to look beyond the technology and focusing on organizational issues. Hirschheim and Smithson (1998) discusses problem in information systems evaluation when focusing on technical issues instead of organizational and social aspects of the problem domain.
- CVF acknowledges opposing and multiple criteria of effectiveness, which is crucial when considering the variety of impact related to Enterprise Systems, see for instance Paper 5.

- It can be used to understand how information systems can affect organizations and thus affect organizational effectiveness.

There are, of course, alternative frameworks and models that could be used instead of the CVF. In relation to the use of CVF I have made an extensive search for competing or complementary frameworks, but have not found any addressing organizational effectiveness. In the study, it could be argued that several, and even competing frameworks and models, applying different levels of analysis or theoretical assumptions, would have enhanced improved the understanding of the R/3 artifact. For instance, the business model (Paper 3), the balanced score card (Kaplan and Norton 1996) or the IT balanced score card (Graeser, Willcocks and Pisanias 1998) are examples of frameworks that could be used to enhance the artifact evaluations. In Paper 6 the CVF is complemented with key organizational parts, adapted from Mintzberg (1979). The side effect of only applying the CVF has to some degree been compensated in Paper 3 and 4, where competing theoretical lenses have been used. Paper 7 provides a different perspective and lens on evaluation than, for instance, in Paper 1, Paper 5 and Paper 6.

There are benefits of applying one valid framework, i.e. a framework that has been confirmed in previous research, including new research confirms the validity of the framework. This is a deductive verification of a theory and contributes to the validity of the CVF (Lee and Baskerville 2001). Paper 5 and Paper 6 contributes to the validity of CVF by applying it in new settings, i.e. on new types of information system. Review of information systems research and CVF can be found in section 3.2.5.

The remainder of this section includes a more comprehensive review of the CVF, which has not been possible in the publication channels used for the appended papers.

3.2.1 Development of the CVF

The CVF emerged as a response to the debate on organizational effectiveness (Quinn and Rohrbaugh 1983), which had been ongoing since early 1970 (see for instance Campbell 1977; Goodman and Pennings 1977). According to Scott (1992) became organizational effectiveness an important theoretical concept with the introduction of contingency theory (e.g. Woodward 1965; Lawrence and Lorsch 1967; Thompson 1967; Galbraith 1973; Lawler and Rhode 1976; Kotter 1978). Prior to contingency theory, organizational effectiveness was not perceived to be a theoretical issue in organizational theory, merely an applied area within organizational development and organizational design (Scott 1992). Following this, several attempts were made

in the 70s by researchers such as Richard W. Scott and Kim Cameron to integrate the effectiveness literature, but the conclusions showed both consensus and disagreement (Quinn and Rohrbaugh 1983).

Instead of focusing on the operational structure of organizations, Quinn and Rohrbaugh (1981) began to investigate the organizational theorist perception regarding the construct of organizational effectiveness. The overall question investigated was: "How do individual theorists and researchers actually think about the construct of effectiveness?" (Quinn and Rohrbaugh 1983). The procedure was a two-stage process. In the first stage, seven respondents evaluate the 30 organizational effectiveness criteria summarized by Campbell (1977). Seventeen organizational effectiveness criteria remained. During the second stage, the respondents evaluated the similarity between every possible pairing of the 17 organizational effectiveness criteria. The scale used varied from very dissimilar to very similar. The scores from the evaluation were then subjected to multidimensional scaling. A three-dimensional space emerged representing the researchers' perception of the organizational effectiveness construct. The first dimension was interpreted as reflecting the differing organizational focus (internal versus external). The second dimension was interpreted as reflecting the differing organizational preferences for organizational structure (stability and control versus change and flexibility). The third was interpreted as reflecting the differing organizational outcomes or means-ends (process/outcome), also referred to as depth (Quinn and Rohrbaugh 1981). Figure 3.1 depicts the three-dimensional space with the organizational effectiveness criteria. On the horizontal axis, the first dimension is related to organizational focus. The vertical axis depicts the second dimension, which was related to focus. In each of the four quadrants, the third dimension (means and end) is illustrated. In addition, each quadrant was labeled. The upper left quadrant, reflecting internal and flexibility, was labeled the human resource (HR) model. The upper right, focusing on external and flexibility, was labeled the open system (OS) model. The quadrant in the lower left corner was labeled the internal process (IP) model. The last quadrant was labeled the rational goal (RG) model.

To confirm their initial study (Quinn and Rohrbaugh 1981), Quinn and Rohrbaugh (1983) applied the same procedure, but using a different sample of respondents. In the second study, the respondent group was 45 researchers that had been published in Administrative Science Quarterly prior to the initial study.

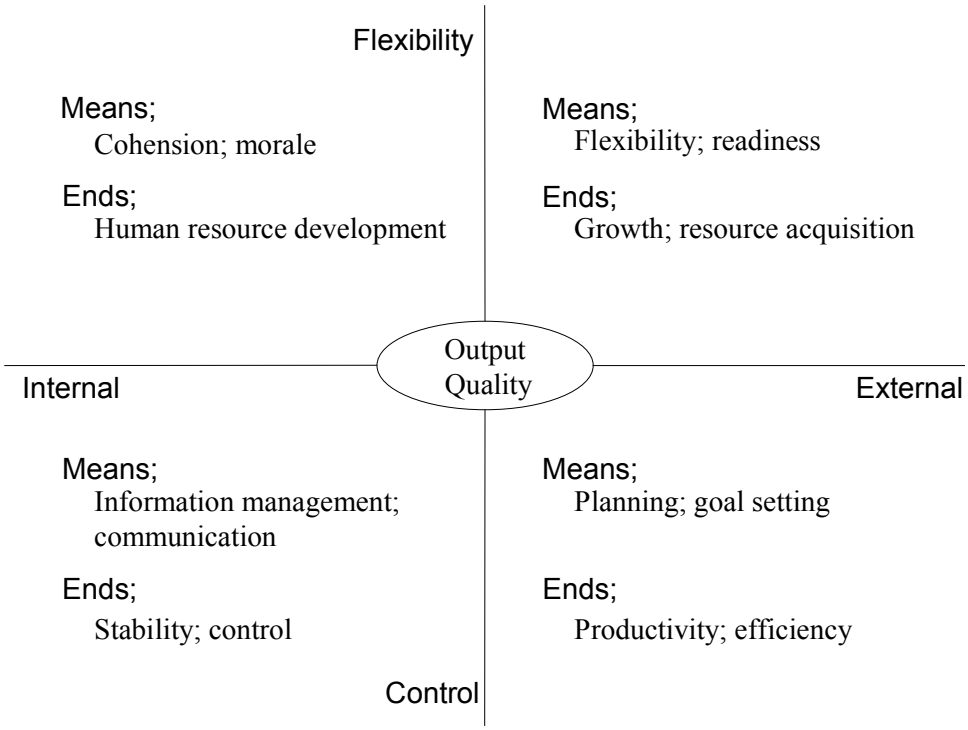

Figure 3.1. The Competing Values Framework (based on Quinn and Rohrbaugh 1981)

The conclusion drawn by Quinn and Rohrbaugh (1983) was that there is a shared implicit theoretical framework among researchers and the criteria of organizational effectiveness can be sorted along the three dimensions.

Over the years, there have been minor changes or adaptations of the framework or of the terminology used. The first is that the output quality has been eliminated from the framework or is not depicted any longer. This change probably stems from the difficulties experienced with the quality concept as such and the problem of having one effectiveness criteria that is not distinct in relation to the value dimensions. Another change is that, in the initial paper, Quinn and Rohrbaugh (1981) described the following value dimensions: structure, focus, and time. However, in the paper from 1983, they described the following three value dimensions: structure, focus, and means and ends. The time dimension has been replaced or relabeled as the means and end dimension. There is a difference, but where it comes from is uncertain. It might just be the case that the authors decided to change their terminology. However, Quinn and Rohrbaugh (1983) emphasize that time is an important, but neglected, aspect of organizational effectiveness.

Since Quinn and Rohrbaugh's initial studies, the use and development of CVF have evolved. The following sections address specific research streams that have applied the CVF as an analytical and conceptual tool.

3.2.2 Organizational

The initial research concerning the CVF aimed to clarify the organizational effectiveness construct (Quinn and Rohrbaugh 1981; Quinn and Rohrbaugh 1983). This section briefly describes the major contributions made.

The first operationalization and empirical validation of the CVF was by Rohrbaugh (1981). Rohrbaugh studied how effectively offices were performing. The case was a local Employment Service in the USA. A questionnaire containing 38 items pertaining to organizational effectiveness was used and a factor analysis revealed eight factors. By comparing offices, the analysis showed different perceptions of effectiveness. The conclusion offered was that the most effective offices had the most balanced perception of effectiveness.

Organizational research suggests that not all effectiveness constructs are equally important and critical at the same time (Goodman and Pennings 1977; Harris 1994). This hypothesis was tested by Quinn and Cameron (1983). The study showed changing criteria for measuring organizational effectiveness over organizational life cycles.

Building on this research, Zammuto and O'Conner (1992) associated certain perceptions of organizational effectiveness, i.e. the four quadrants of the CVF, with different production technologies. For instance, the internal and flexible quadrant involved craft technology, the external and flexible quadrant involved no routine technology, the internal and stable quadrant involved routine technology, and the external and stable quadrant involved engineering technology.

Later, Buenger et al. (1996) studied contextual (technological and environmental) and structural variables (vertical and horizontal coordination) across organizations, if these were associated with the different organizational models of the CVF. Based on a LISREL analysis, the result showed that the values of an organization (the four quadrants of the CVF) were partially predictable on the basis of on contextual variables. Furthermore, the values seemed to influence how the organization was structured.

The conclusion of this research is that an effective organization is one that can balance contradictory or complementary effectiveness criteria. The next

section addresses the people who are responsible for this, i.e. the management.

3.2.3 Managerial

The second area that the CVF was applied to was management and leadership studies. Quinn developed effectiveness criteria based on the CVF, except for output quality, into different managerial roles (Quinn 1989; Quinn, Faerman, Thompson and McGrath 1996). Eight different roles were defined which were related to the four organizational models. The HR model included facilitator and mentor roles. The OS model includes the innovator and broker roles. The roles of monitor and coordinator are related to the IP model. And the RG model involves the roles of director and producer. Paper 6 describes these roles.

Building on these roles, Denison et al. (1995) explored the paradoxes and competing values inherent in leadership behavior. Scales for eight leadership roles were developed, providing empirical data from 176 executives. The results showed that high-performing managers had a more complex, contradictory, and paradoxical behavior than low-performing ones. Quinn (1989) found support for the perception of differences in the importance of the effectiveness constructs in relation to hierarchical levels. Furthermore, Hart and Quinn (1993) developed a model of executive leadership consisting of four roles related to the CVF including: vision, setter, motivator, and analyzer and task manger. These roles are empirically tested and support the conclusions drawn by Denison et al. (1995).

Great effort has gone into operationalizing the CVF into both an organizational and a management instrument. For instance, checklists for assessing managers, management development and requirements programs have been developed (Quinn 1989; Sendelbach 1993) and enhanced (Quinn et al. 1996). The different perceptions of organizational effectiveness and management roles can be interpreted as reflections of different organizational cultures, which is the third area the CVF has been applied to.

3.2.4 Culture

Lately, organizational culture has been studied through the lens of the CVF (Chang and Wiebe 1996; Cameron and Quinn 1999; Goodman, Zammuto and Gifford 2001). Manley et al. (1998) studied why some organizations fail and some succeed in organizational change. They used four organizational culture models, Team, Open Systems, Hierarchy, and Production, corresponding to HR, OS, IP, and RG. They found that the Production

culture is the most influential driving force, emphasizing production and economic profit. The second most influential force is Open Systems and ideas of growth and flexibility. Goodman et al. (2001) studied organizational culture and work-related variables and Howard (1998) validated the CVF as a representation of organizational culture through a multidimensional scaling analysis.

Cameron and Quinn (1999) have operationalized the CVF into a diagnostic instrument for organizational culture consisting of six items including: dominant characteristics, organizational leadership, the management of employees, organizational glue (i.e. the things holding the organization together), and criteria for success. Each item is scored and a profile of an organizational culture emerges – as is. In addition, the same questionnaire can be repeated but with the change that each question should be answered from the point of view of what is preferred. The two results can then be analyzed and used for developing an organizational culture change program.

Organizational cultural as a promoting and inhibiting factor has been studied. Cooper (1994) studied the influence of culture on the implementation of information systems and linked different MIS applications to different organizational cultures.

3.2.5 Information Systems

Information systems research based on the CVF has involved both the individual perception (McCartt and Rohrbaugh 1989; McCartt and Rohrbaugh 1995; Sääksjarvi and Talvinen 1996) and artifact evaluation of different information systems (Carlsson and Widmeyer 1994; Carlsson and Leidner 2000).

Rohrbaugh (1989) proposed that the CVF could be used in information systems research and illustrated this with an artifact evaluation of different computer applications for each quadrant of the CVF. McCartt and Rohrbaugh (1995) made a retrospective analysis of the long-term impacts of Group Decision Support Systems (GDSSs). They studied the participants of 26 decision conferences using GDSSs. The result was that GDSSs changed people's behavior and provided support task and organizational activities related to the IP model and RG model of the CVF.

Sääksjärvi and Talvinen (1996) evaluated the effectiveness of marketing information systems. They used four levels of the organization, top, middle, marketing personnel and support personnel from both perceived and expected. The conclusion proposed suggests that the variance caused by

groups was more important than the variance in the dimensions of the CVF. Thus, researchers have to be careful when designing the empirical evaluation of information system, since the respondents who are participating explain much more of the variance in the object under investigation.

In addition, there have been a number of papers applying the CVF as a general set of references in the artifact evaluation of information systems, e.g. executive support systems (ESSs). Carlsson and Widmeyer (1994) and Carlsson and Leidner (2000) studied ESSs and provided conceptualizations of ESSs or theorizing of the artifact. The CESS Method of selecting ESSs is provided by Carlsson (2000) as an example of artifact building based on the CVF.

3.2.6 Concluding Words on CVF

The CVF of organizational effectiveness includes three theoretical underpinnings of organizations (Quinn and Rohrbaugh 1983). First, CVF views organizations as purposeful systems that exist to achieve certain goals or ends. Second, CVF incorporates the existence of simultaneously and conflicting goals, which an organization must manage in order to be effective and efficient. Third, CVF is based on the hypothesis that there is a tension between existing underlying value dimensions in organizations, including focus (internal versus external), structure (flexibility versus stability), and means versus ends. Based on the two first value dimensions, four organizational models emerge: human relations model (HR), open systems model (OS), internal process model (IP), and rational goal model (RG), each with unique settings of means and ends.

Three of the appended papers have applied the CVF in two different ways. Firstly, in Paper 1 CVF has been used to design artifacts (i.e. requirements specification) where the CVF has been used as a scientific principle included in the artifact, cf. Walls et al. (1992). The CVF is used to derive requirements based on organizational effectiveness criteria. This approach should be contrasted with the functional requirements supported by a traditional requirements specification. Secondly, the CVF has been used to evaluate artifacts. The CVF is used in Paper 5 to evaluate R/3 while in Paper 6 it is used to evaluate the mySAP Workplace. The role-based graphical user interface was found to support the external and flexible quadrant more adequately. However, both evaluations showed strong support for the IP and RG models, very little support for the OS model and in particular for the HR model. This result has scientific and practical relevance. Firstly, research claiming that Enterprise Systems have a positive impact on the OS and HR models should be questioned. Another claim that could be questioned is the

one made by Davenport (1998) who claimed that Enterprise Systems could provide the means for growth. In a sense the evaluations provides theorizing of the Enterprise Systems artifact. The approach to theorize the Enterprise Systems artifact is similar to Mathiassen and Sørensen (2002) approach in developing a task-based theory of information service. As regards practitioners, the result might make them question claims concerning Enterprise Systems. For instance, the role-based graphical user interface was introduced and sold as the solution to problems related to R/3 being too stable and rigid, which the analysis does not provide any support off.

Even though several papers have used the CVF as a foundation - it is not perfect. Causalities between quadrants and effectiveness measures are only addressed by statements such as "organizations with a balanced set of criteria are more effective than those with an unbalanced emphasis on various effectiveness criteria" (Rohrbaugh 1981). The lack of causality between the quadrants is a shortcoming in the CVF. However, increased integration between the different effectiveness constructs might not be possible, since these reflect opposing and, to some extent, contradictory values. For instance, an organization can be effective, but it does not have to be efficient or vice versa. Another shortcoming is the difficulty illustrating hierarchical and functional differences in the perception of the varying importance of organizational effectiveness construct.

The overall result of the two artifact evaluations based on CVF (Paper 5 and Paper 6) is that Enterprise Systems artifacts mainly support values related to IP model and RG model, since Enterprise Systems enforces standardization of information process, advanced control and planning models. This can be contrasted with claims that Enterprise Systems have strategic implications, which is related to the OS model. The contribution of applying CVF to the phenomena of Enterprise Systems is twofold. Firstly, it contributes to the understanding of the embedded nature of Enterprise Systems, which can be summarized as "ordnung must sein". Secondly, the black box of IT becomes lighter.

Chapter 4

Enterprise Systems - The Artifact

In the previous chapter, the research approach and the CVF were described. In this chapter, the Enterprise System artifact is presented. This involves a presentation of the characteristics of Enterprise Systems. Initially, however, there will be a clarification of terms, i.e. Enterprise Systems and Enterprise Resource Planning (ERP) systems. This is followed by a historical overview of Enterprise Systems and COTS systems. The next section presents the key characteristics of Enterprise Systems. The chapter is then concluded.

4.1 Enterprise Systems versus ERP Systems

All popular phenomena receive different names and terms for good reasons, so too with Enterprise Systems. The reasons might be contextual, scientific, personal, or there might be an actual need for several terms. Related to Enterprise System, which is the preferred term in Part one of the thesis, a number of other terms are, and have been, used (Klaus, Rosemann and Gable 2000). In Table 4.1 are some of the terms with references shown.

In the first part of the thesis, the term "Enterprise System" is used, but in the second part of the thesis, the terms "Enterprise System" and "Enterprise Resource Planning (ERP) system" are used interchangeably.

The term Enterprise System was coined by Thomas Davenport (1996; 1998; 2000b) who also introduced Enterprise Systems as a specific information system research object in 1996 (Davenport 1996). Davenport does not provide any justification for his choice of term – accept for stating that they are enterprise systems – but he does provide a descriptive definition:

> These commercial software packages promise the seamless integration of all the information flowing through a company – financial and accounting information, human resource information, supply chain information, customer information (Davenport 1998, p. 131).

Table 4.1. Terms used to denote Enterprise Systems

Terms	Authors
ERP system	Boudreau and Robey (1999), Loos (2000) and Holland and Light (2001)
Enterprise-Wide IS	Taylor (1998), Al-Mashari (2000) and Sumner (2000)
Enterprise System	Davenport (1998); Markus, Petrie and Axline (2000) and Cotteleer (2002)
Computer Integrated Manufacturing (CIM)	Scheer (1994)
SAP R/3	Bancroft, Seip and Sprengel (1998) and Keller and Teufel (1998)
Standard software	Robert (1997), Nilsson (2000) and Light, Holland and Wills (2001)
Application software package	Scherer (2000) and Swanson and Dans (2000)
COTS	Maiden and Ncube (1998)
Total system	Blumenthal (1969)
Super system	Dearden (1972)

The term ERP, on the other hand, can be traced to manufacturing terms and concepts, such as MRP (Material Requirements Planning), MRP II (Material Resource Planning) and CIM (cf. Scheer 1994; Toomey 1996). The term ERP system was, according to Klaus et al. (2000), probably first used in the journals Datamation and Industrial Engineering in 1992. Enterprise Systems differ from MRP, MRP II and CIM by including functionality such as financial planning, investment management, plant maintenance, and human resource management, and by providing support for businesses and industries that are not manufacturing-related (Klaus et al. 2000).

Consequently, I find the term Enterprise System more suitable since it is more generic and not limited to a certain industrial legacy, such as manufacturing, but grasps the entire spectrum of organizations and business that can be supported by Enterprise Systems.

4.2 From Information Systems to Enterprise Systems

The conceptual idea behind Enterprise Systems has to be credited to Sherman Blumenthal (1969). He based his work on Jay Forrester's idea that information systems are a network which integrates all parts of an organization. He presented a framework for planning and developing Management Information

Systems (MISs). Blumenthal (1969) described what Enterprise Systems would be in the following words:

> The devotees of the total-systems approach start with the premise that all things and processes within the firm, and between the firm and its environment, are interrelated, and that, therefore, the information networks can and should be similarly interrelated by conscious design, before implementation (Blumenthal 1969, p. 23).

The "total-system" idea was heavily criticized in 1972 by Dearden (1972), who stated that:

> The notion that a company can and ought to have an expert (or a group of experts) create for it a single, completely integrated supersystem—an "MIS"—to help it govern every aspect of its activity is absurd.

However, today the absurd idea of an integrated supersystem has been realized and implemented at most multinational firms (Markus and Tanis 2000).

Large corporations attempted to realize the idea of Enterprise Systems or total-systems through large in-house development projects. For instance, in Sweden during the sixties, two large projects were initiated in order to develop total-systems. SAAB began a requirements analysis in 1967 to develop TIPS (Totalt Informations- och Produktionsstyrningssystem – Global Information and Production Management System, my translation). TIPS was scheduled to take five years to develop and was aimed at changing the entire organization and its planning structure (Sundström 1969). Volvo Information System (VIS) was also initiated during the sixties. This project attempted to integrate all the sales and production units of the car division of Volvo. The goal was to make the firm more flexible *vis-à-vis* the market, to reduce capital costs and costs for administration and production, and to improve the information provided to management (Datateknik 1970). TIPS, as one integrated system, was never implemented due to being too complicated, lacking development tools, the time to complete the project, resource constraints, and difficulties proving the return on investment (Sundström 1972). TIPS and VIS were custom-made for their organizations by an internal software development department, which was also the norm for most early information systems.

Meanwhile, large organizations were developing custom-made information systems, software vendors and consulting firms had begun to develop generic information systems for all businesses, i.e. COTS systems. It started with the development of MRP systems and Accounting Information Systems (AISs) in

the 1950s (Nilsson 1991), and with the development of payroll systems in the 1960s (Haines and Petit 1997).

The first information system referred to as an Enterprise System by information systems researchers was R/3 (Real-time in data processing Version 3), which was introduced in 1992 by the German software vendor SAP AG. This was the first integrated Enterprise System based on client/server architecture and with a graphical user interface. The predecessor was R/2, which is a mainframe-based Enterprise System with a text-based interface (Keller and Teufel 1998). Today, several information system are labeled as Enterprise Systems, e.g. Oracle Application, PeopleSoft, Baan IV, JD Edwards, Movex, and IFS Application.

The evolution of Enterprise Systems has been an incremental and path-dependent process (Upton and McAfee 2000) from the first information system to what is today referred to as Enterprise Systems – not a strategic leap, which the previous paragraph might give the impression of. From the data processing perspective, there is no difference between Enterprise Systems and information systems – they are the same. They process (capture, transmit, store, and retrieve) data by means of rules and use input and output sources, cf. Langefors (1966), but an influential development leading to Enterprise Systems is the evolution of their antecedents, i.e. different types of COTS systems.

4.2.1 The Evolution of COTS Systems

Initially, COTS systems were designed for specific functions. For instance, SAP AG's first system was a financial accounting system. Later, functionality for controlling was added, and then manufacturing and so on (Keller and Teufel 1998). Baan system on the other hand was initially specialized for MRP. PeopleSoft started out as a human resource planning system. Oracle Application was developed on the technological infrastructure, i.e. the database technology, which is the base for Oracle (Rashid, Hossain and Patrick 2002). The various legacies, i.e. manufacturing, accounting, and human resource management, are used to structure the development of different types of COTS.

Manufacturing legacy

An MRP system is designed to efficiently calculate the need for material, e.g. raw material requirements. They are designed to support the creation and maintenance of the bill-of-material (BOM) and include algorithms for both

demand and consumption-based planning (Wight 1982; Toomey 1996; Scheer 1998).

MRP II is based on MRP, but it includes functionality for sales, capacity, and schedule planning to provide support to the entire control and production planning process (Klaus et al. 2000). MRP II includes the master production schedule (MPS), which is based on long-term sales forecasts. The MPS is the input to the MRP. This is then followed by capacity planning in order to plan the overall actual production need. The production schedule is then compared with the production resources available. Next, backward and forward scheduling takes place and the current production orders are then released for production. In the final step, detailed assignments are scheduled for each production order and machine done (Klaus et al. 2000; Scheer 1994; Toomey 1996).

The next development was in the 1980s with the advent of the CIM. The CIM is a conceptual idea for integrated and computer-supported manufacturing. In CIM, computer aided design (CAD), computer aided manufacturing (CAM), and computer support for administrative functions is included (Scheer 1994; Scheer 1998a). The main difference between CIM and MRP and MRPII is that CIM includes primary and secondary activities (Porter 1985), production and administrative units (cf. Rhenman 1970), or business-administrative and technical functions (Scheer, 1994). The CIM concept integrates operative and controlling activities into one system. Furthermore, the CIM concept was influenced by the development of data and process modeling frameworks (Klaus et al. 2000), e.g. IBM's Business Systems Planning (IBM 1981) and the Architecture of Integrated Information Systems (ARIS) (Scheer 1989; Scheer 1992).

It seems that the ARIS and CIM concepts, as developed by Scheer (1989; 1998a; b), have been influential in the development of R/3. For instance, Scheer (1998a) illustrates the ARIS concept with references to R/3 and Keller and Teufel's (1998) illustration of business process implementation of R/3 draws upon ARIS.

Accounting Legacy

Meanwhile, the development of support systems for manufacturing activities the development of AISs was also in progress. AISs include support for financial and controlling models. General ledger systems or financial accounting and management accounting information systems are perceived, in the Swedish tradition, to be one system that includes both financial and

Table 4.2. Accounting system approaches (based on Samuelson 1989, p. 75)

Time period	Approaches
1945-1965	Charts of accounts
1955-1965	Computerization of accounting systems
1970-1985	Package software
1980-	Methodological
1988	User-orientation

management accounting systems (Samuelson 1989). However, there is a debate as regards whether these two systems should be integrated or not. For instance, the German accounting tradition separates these systems, see Keller and Teufel (2000) and Scheer (1998a). The development of AISs is and has been closely related to the development of manual accounting systems in general, e.g. budgeting systems, cost controlling, and profit centers, or charts of accounts, and the development of methodological approaches, such as the RP model of accounting systems (Samuelson 1989). Table 4.2 shows the historical development of accounting systems in Sweden, which have been an incremental process, cf. Upton and McFee (2000) description of Enterprise Systems evolution.

Human Resource Management Legacy

The third major part of Enterprise Systems, besides manufacturing and accounting, is Human Resource Management (HRM) systems or Human Resource ISs. Development of these systems has been similar. They started out as transaction-based systems for payroll and management control systems for workers. Gradually, they have grown and today include any computer-based support of human resources (Haines and Petit 1997). For instance, PeopleSoft's HR-module includes the functionality to manage the career development, training, and selection of project members based on their competence (PeopleSoft 2002).

The development and integration of these three independent application areas has led to what is today labeled as Enterprise Systems.

4.3 Key Characteristics of Enterprise Systems

Enterprise Systems are among the most complex information systems ever designed, developed, and implemented by organizations (Joseph and Swanson 1998; O'Callaghan 1998). One way to illustrate this is to describe the key characteristics of Enterprise Systems. The main difference between Enterprise Systems and information systems is that they have been developed by a software vendor. Several other characteristics have been identified, making them worth studying and differentiating them from previous generations of information systems. As some characteristics, Davenport (1998) outlined commercial software packages, off-the-shelf solutions, integrated solutions, scope, configuration, generic systems and master data. In addition, Klaus et al. (2000) discuss real time data processing and process orientation as key characteristics. Integrated systems and process orientation are briefly discussed in this section whereas industry coverage, functionality and scope, generic, and master data are addressed in separate sub-sections.

The business consequences and implication of integrated system and process orientation lie in the use & operation of the system. In Paper 4 these two characteristics were perceived, by the expert consultants, as terms most managers know, but do not understand the implications of. The explanation provided was that most organizations still are functional structured.

The idea of integrated system in relation to R/3 can be inferred to the ARIS concept and CIM concept (Scheer 1989; 1992; 1998a; b). Integrated system incorporates the total system idea of Blumenthal (1968), i.e. "all things …. are interrelated". Lately, Markus (2000) has put integrated systems and business integration in a historical context. Her main arguments are thus: Businesses were unintegrated due to a decentralized organizational structure, but to meet changing customer preferences, such as 'available to promise' and 'global inventory visibility', firms have to integrate business processes and the tool is integrated information systems.

Business process orientation or reengineering attracted tremendous interest for the information systems discipline during the 1990's. R/3 incorporates process orientation in several ways, such process oriented implementation methodology (Paper 2) and the functionality embedded in the system is structured along business process, see section 4.3.3. The concept business orientation is strongly linked to R/3 and German business organization science. Keller and Teufel (1998) links business orientation to the German organizational theorists Nordsieck and Kosiol. The focus of Nordsieck's and Kosiol's was on the structuration of operational tasks.

4.3.1 Industry Coverage

Enterprise Systems are generic systems in the sense that most organizations can implement and use them. However, different businesses and industries, e.g. manufacturing, retail, and public service, do not have the same requirements for information processing and functional support. For instance, retail businesses and public service companies do not need computer-based support for their material requirements planning, and organizations in the pharmaceutical industry have to comply with requirements made by the FDA (Federal Drug Agency in the USA). In order to match different industry requirements most Enterprise Systems vendor has developed industry solutions, e.g. SAP, Oracle, PeopleSoft, Baan, JD Edwards and Intentia (Hossain et al. 2002). Each industry solution is adapted to the unique requirements of an industry. For instance, Aerospace and Defense include functionality for the maintenance, repair and servicing of aircraft; airline operations; and the functionality to allocate budgets to combat units. The healthcare industry requires special functionality to manage and coordinate patient care, to document clinical care, and for patient relationship management, external physicians, and donors. Furthermore, Enterprise Systems vendors provide solutions for small and midsized firms.

Table 4.3. Industry solutions developed by SAP (SAP 2003)

Industry solution	
Aerospace & Defense	Media
Automotive	Mill Products
Banking	Mining
Chemicals	Oil & Gas
Consumer Products	Pharmaceuticals
Engineering & Construction	Professional Services
Financial Service Provider	Public Sector
Healthcare	Retail
Higher Education & Research	Service Providers
High Tech	Telecommunications
Insurance	Utilities
Industrial Machinery & Components	

The development of industry solutions might be interpreted in several ways, e.g. decreasing the complexity of the system or as a reflection of the need for different marketing and sales strategies in different industries. For instance,

SAP has developed 23 industry solutions. Table 4.3 presents the 23 industry solution developed by SAP AG.

Independent of industry solutions, each Enterprise System includes generic functionality that is industry independent, e.g. accounting. The generic functionality will be described next.

4.3.2 Scope of Enterprise Systems

Another characteristic is the broad scope of functionality. The same functionality can be found in separate stand-alone information systems, e.g. MRP systems, accounting systems or human resource management systems, but not in one single information system. There are some differences between different Enterprise Systems, but most of them include the same scope and functionality (Hitt et al. 2002; Hossain et al. 2002; Klaus et al. 2000). The functionality described here comes from R/3 version 4.6b. SAP has structured is functionality into three application areas, accounting, logistics and production, and human resources with sub functionality.

Accounting process data and information which are related to financial accounting and management accounting. The financial accounting part is structured according to legal requirements, e.g. tax regulations. Management accounting, on the other hand, supports cost and benefits accounting. The data and information used in management accounting is mostly internally oriented and is used to allocate costs, profits and resources within the organization. A variety of dimensions can be used including: company, plant, cost center, division, sales department, sales group, and individuals.

Logistics and manufacturing, which stems from the manufacturing legacy, supports all processes and activities from the design of a product to the procurement of raw material, through the production and final delivery to the customer. Logistics plans, controls and coordinates logistical processes across department boundaries, based on the integration of existing data and functions. It covers several functional areas such as R&D, procurement, production, inventory, sales, marketing, shipment, and billing.

Human resources management includes two main areas. The first area is personnel planning and development, which supports the strategic use of personnel by providing organizations with the functionality to manage human resources systematically. Furthermore, functions such as organizational management, personnel development, workforce planning, training and recruitment are supported. The second area is personnel administration and payroll accounting, combining the administrative and operational tasks of

human resources management. This is supported by functionality such as time management, incentive wages, payroll accounting, and travel expenses.

In addition, there are functionality for such as plant maintenance and quality management, calendar, booking of conference rooms, ordering food, and self employee service (e.g. changing address and personal data).

4.3.3 Generic with a Touch

SAP claim that R/3 is a flexible system that may be configured to meet most business demands. Configuration refers to the adaptation of the system to requirements (also referred to as 'setting configuration parameters'). In cases when the system does not meet all the requirements, there are additional software programming workbenches to develop additional functionality.

There are three levels of configuration: generic, preconfigured, and installed (Klaus et al. 2000). The generic version is the scratch option with no preconfiguration. This is the software delivered by the vendor and can be used for any industry, being the initial product. In the preconfigured version, e.g. the industry solutions, the Enterprise System vendor has carried out some configurations, e.g. added or deleted functionality or processes. For instance, the retail version does not include the functionality for manufacturing, e.g. MRP or MPS. Besides the industry solution, there are also light versions adapted to small and medium-sized firms. The installed version is when the system is adapted to an organization. The interest of this study is mainly on the generic version, i.e. software artifact.

The generic and preconfigured version must be configured – adapted to specific organizational requirements. The adaptation of Enterprise Systems is referred to as configuration and the development of extra functionality is labeled customization.

Other information systems or software programs can also be configured. For instance, when you install an office package on a computer, you can select the language, font, and size, and customize the toolbar. It is not configuration as such that distinguish Enterprise Systems from information systems in general; it is the number of options. For instance, SAP R/3 includes 10,000 different parameters. The overall process of configuration and implementation is supported by implementation methodologies, such as ASAP (Paper 2). To deal with configuration, Enterprise System vendors and consulting firms have

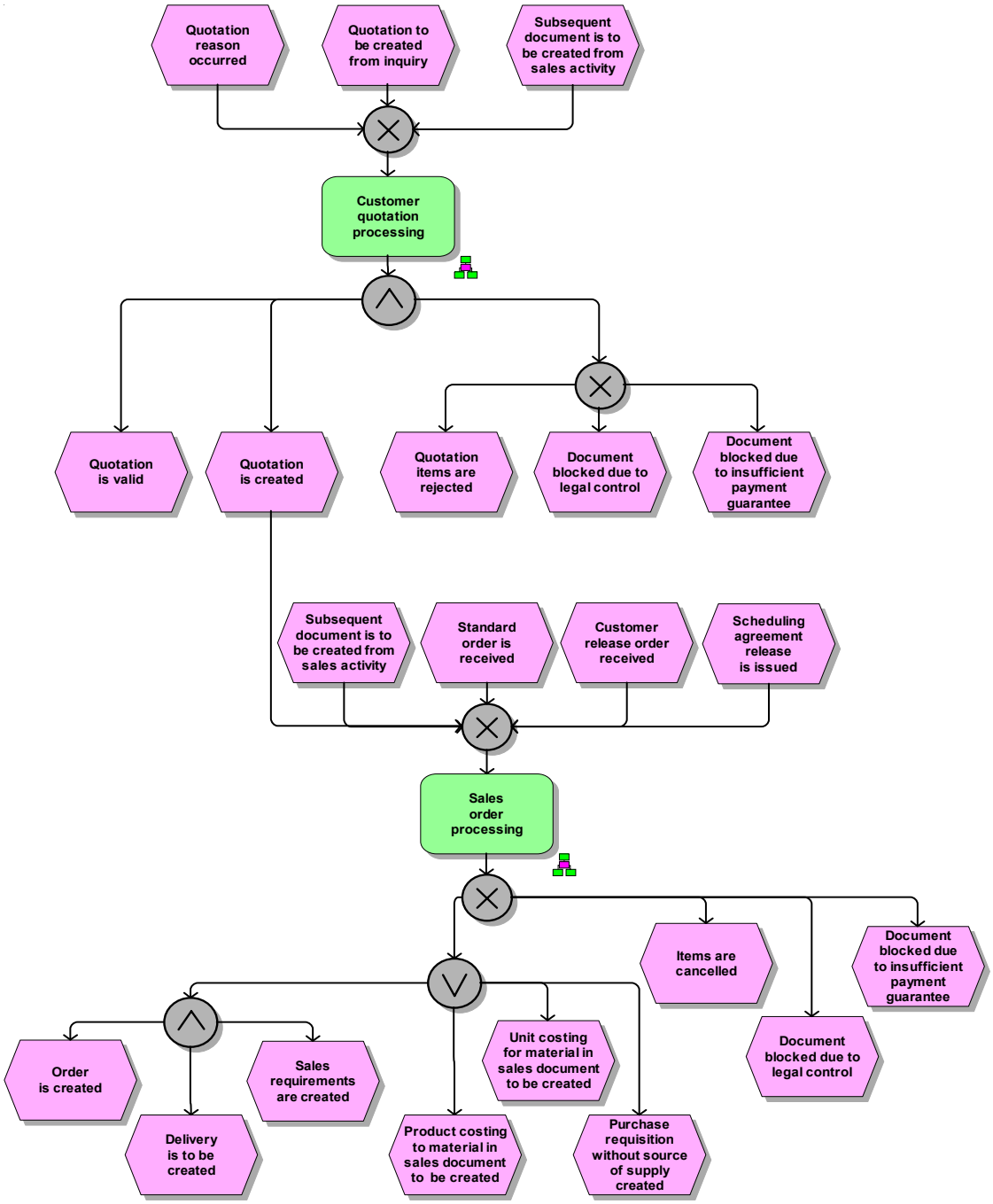

Figure 4.1. Standard sales order process (SAP R/3 reference model taken from ARIS Toolset version 6.2)

developed specific tools. The configuration of R/3 is supported by the implementation guide (IMG), which is used structure and documents the configuration. The implication of these methods is that they change parts of the traditional ISD process. In the ISD process, where information systems

are built from scratch, logical and conceptual design is central tasks. These tasks are replaced in COTS development with the continuous evaluation of reference models (Rosemann 2000).

But what is actually being configured? Underlying R/3, there is a reference model, organizational model, data model and data repository, which stipulates different ways of processing data, e.g. how to process an order. The reference model describes business processes and is structured in accordance to Porter's (1985) value chain. In R/3's reference model, there are over 1000 business process. For instance, there are 50 process models for processing an order, which each can be configured to meet specific information processing needs. Figure 4.1 shows an excerpt of processing a standard order. The standard order process involves several activities including billing, costing, shipping and warehouse management. Besides, the standard order process there are about 50 other processes for order processing, for instance rush order and third party order processing. Another process choice is make-to-stock versus make-to-order as the production model, each have fundamentally different data processing flows, depending on the underlying model. The different data processing needs have to be reflected by the system. Another example is charts of accounts, which are different in almost all countries, affecting which data is to be collected how it should be processed. The reference models include different levels of abstraction, e.g. organizational, data, control, and functional (Keller and Teufel 1998; Scheer 1998). The models focus on the description of the process execution and the data structure, but do not depict the configuration alternatives. They illustrate the complete functionality of the system from the point of view that the complete system is used. SAP's reference model, includes more than 4,000 entity types (Curran, Keller and Ladd 1998). The main area for reference models supports the configuration options, i.e. evaluations. The reference model depicts the central organizational units such as legal entity, purchasing organization, cost centre, plants, or distribution channel; see Table 4.4 for the organizational units of the SAP R/3 reference model. The rich potential of configuration-options is a distinguishing characteristic of Enterprise Systems, compared with traditional information systems (Klaus et al. 2000).

In R/3, there are two types of configuration options or parameters, global settings and system-specific settings. A global setting is independent of the system. These settings are a prerequisite for handling all business transactions, e.g. country, calendars, currency, and time zones etc. System settings are related to the following areas: organizational structure, accounting, controlling as well as financial, treasury, investment management, enterprise

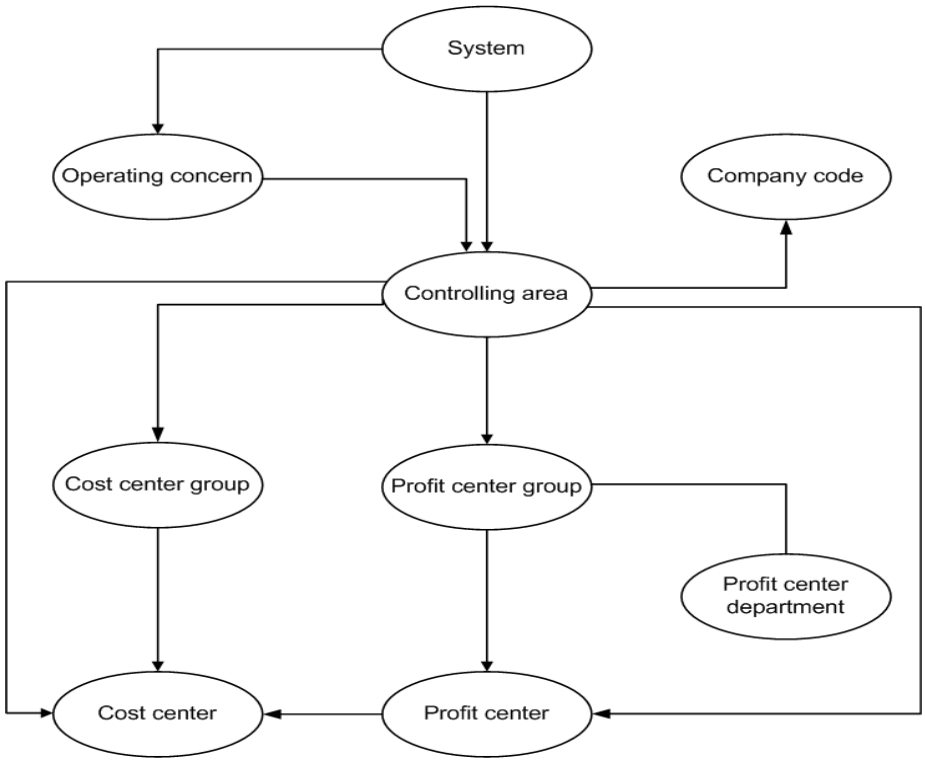

Figure 4.2. Excerpt of organizational model (based SAP R/3 reference model)

controlling, sales, distribution, materials management, quality management, plant maintenance, customer service, production, production planning, personnel management, and payroll to mention a few. All in all, there are over ten thousand configuration parameters in R/3 leading to an installed version.

The configuration possibilities are constrained by two main factors related to the artifact. The first is the R/3 reference model, which include the business processes supported. Any business process not included in the reference model thus can not be configured. Such situations can be resolved through customization of the system.

R/3's organizational model includes SAP's interpretation of how to organize business based on the requirements of the operational tasks of accounting, logistics and human resource management. The most central element in the organizational model is the 'company code', which is use to represents accounting units often legal units. The different elements of the organizational model, see Table 4.4 for organizational units in R/3 4.6b reference model, have relationships to each other, for instance 'company code' has a 1 to many

Table 4.4. Organizational units of the SAP R/3 reference model (SAP R/3 version 4.6b)

Area	Sub area	Organizational units
General		Enterprise, Work center, Physical R/3 System and Logical System
Accounting	Financial accounting	Company, Company code, Consolidation business area, Business area, Functional area, Consolidation group, Consolidation entity, Taxes on group sales or purchases, Credit control area, Dunning area, FM area and Funds center
	Controlling	Controlling area, Cost center group, Cost center, Operating concern, Profit center grouping and Profit Center
Logistics		Design office, Plant and Storage location (plant storage areas)
	Sales and distribution	Sales organization, Sales Area, Distribution channel, Division, Sales office, Sales group, Shipping point, Loading point and Transportation planning point
	Material management	Material valuation area, Purchasing organization, Purchasing area and Purchasing group
	Warehouse management	Warehouse complex, Warehouse, Storage bin and Storage area
	Plant maintenance	Maintenance planning plant, Maintenance plant, Maintenance planning group and Functional location
	Production planning and control	Work scheduler group, Capacity group, CAPP planner group, MRP group, Production scheduler group, Production responsibility group and Supply area
Human Resource Management		Personnel area, Personnel sub area, Employee group, Employee subgroup, Payroll accounting area, Organizational plan unit, Job (planned) and Job

relationship to ‘controlling area’. Consequently, a company code can include several ‘controlling areas, but a ‘controlling area can only belong to one ‘company code’. The relationships between elements of the organizational

model delimit the 'degree of freedom related to the organizational plan' (Keller and Teufel 1998, p. 194), i.e. firms have to organize their business in accordance to the organizational model. Figure 4.2 shows an excerpt of the organization model. Arrows with no end show 1 to 1 relationships an arrows with an end show 1 to many relationships. This excerpt illustrates organizational unites related to revenue and cost controlling.

The supported business process, the organizational model and other data elements, such as master data (see Table 4.5 for examples) are included in the data model. The relationships and definition of elements in the data model are stored in the data dictionary. Relationships and definitions are 'rules' for how to process data, including which data and the format of the data, e.g. text, number or picture.

When the system is installed the configuration options are difficult to changes, since the various parameters are interdependent based on the reference model, organizational model, and data model. For instance, the overall organizational structure, e.g. centralized versus decentralized, is theoretically possible to change, but practically the configuration leads to a cementation of the organizational structure. Hanseth and Braa (1998) discuss this type of issue by using terms such 'technology as traitor' and 'irreversible infrastructure'.

4.3.4 Master Data

Master data is the single most important aspect of Enterprise Systems and the potential of master data is tremendous in the long run. For instance, master data could be compared with the TCP/IP protocol, which has enabled the growth and development of the Internet. Another metaphor is the importance of the euro for Europe. The potential of master data is that it reduces the transaction costs for communicating data by reducing the cost of converting data to comparable sets of data. One could also compare it with a situation when all participants in a meeting speak the same language and the situation when people speak different languages and there is a need for interpreters, cf. the EU. The introduction of master data is a standardization of the data format used by organizations enabling the improved control and coordination of data, cf. Mintzberg (1979) and the role of standardization in the control and coordination of organizations.

In SAP R/3, there are three types of data: master, control and transaction. Master data contains data about objects that do not change frequently, e.g. vendors, customers, calendars, raw materials, users, and addresses. Control data is used to maintain the system and is not used in business transactions.

Table 4.5. Examples of Master Data related to the three main application areas

General	Accounting	Logistics	Human resources
	General ledger accounts Charts of accounts, country-specific and firm-specific.	Product master data (articles and services) Customer data Supplier data Production schedules	Employee data, addresses and competence

Transaction data, on the other hand, contains data about day-to-day business and is frequently used in business transactions, e.g. orders, requisitions, outgoing payments, incoming payments, balance sheets etc. Continuing with master data; there is master data for each of the three application areas, i.e. accounting, logistics, and human resources, and specific data for each of the industry solutions, see Table 4.5 for some examples of master data.

Furthermore, master data is independent of the business process and the user, several business processes and users can use the same data since it is relational. The independency comes from the fact that a data element is only stored in one place within the database. The benefit of this is that it ensures one "accurate" value for the business. Data is, as previously mentioned, relational, i.e. one data item is linked or related to another data, e.g. customer and order. The illustration is also an example of the relationship between master and transactional data. Another benefit is that data only has to be entered into the system once. This reduces the risk of data entry errors, which is common when an organization has to enter, for instance, one order into several different Information Systems.

A point to make regarding master data, which I perceive to be the single most important and valuable aspect of Enterprise Systems, is that it is not discussed in the information systems literature at all. Most of the information about master data stems from textbooks on Enterprise Systems (Curran et al. 1998; Keller and Teufel 1998; Scheer 1998).

4.3.5 Summary

Enterprise Systems provide a unique set of capabilities, i.e. key characteristics, such as industry coverage, functionality and scope, generic systems, and master data. Figure 4.3 summarizes the key characteristics. The italicized key

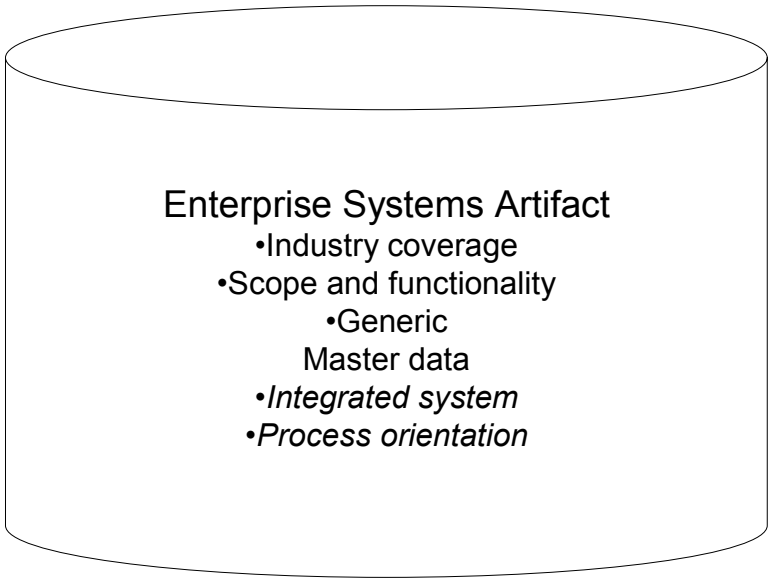

Figure 4.3. The key characteristics of Enterprise Systems

characteristics in Figure 4.3 were briefly described in the beginning of this section. The industry coverage of Enterprise Systems has no comparison with other information systems. The scope and functionality, e.g. human resource management, accounting, and logistics, provides almost complete coverage of all the organizational data information processing requirements. The generic solution embedded in the reference models, organizational model and data model enables configuration of the system to most business requirements. Master data provides the means for effective data processing by control of data formats. Altogether, they make Enterprise Systems unique in relation to previous generations of information systems.

4.4 Conclusion on the Enterprise Systems Artifact

This chapter has described the evolution and the key characteristics of Enterprise Systems. Besides the key characteristics there are some aspects related to the artifacts which I have been reflecting over and thus worth discussing.

The first is the strong link between the conceptual design of R/3 and ARIS (Scheer 1992; 1998). The conceptual design is what I perceive as the view of the world embedded in the system, i.e. the designer's or developer

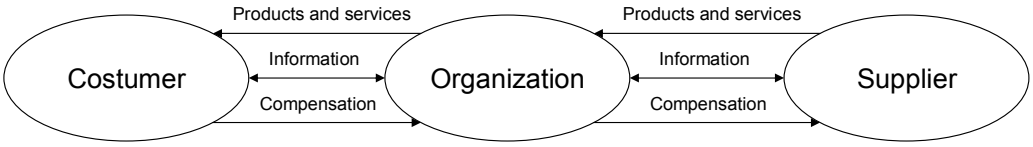

Figure 4.4. The world in the perspective of R/3 (adapted from Scheer 1992)

interpretation of the world. ARIS view or 'weltanschauung', to use Checkland's terminology, of organization is as an interdependent system consisting of the organization and its customers and suppliers, which is linked to each other through three flows, information, compensations, and products and services. Figure 4.4 shows what I believe is R/3 view of business and organizations. The Figure is based on Scheer (1992).

R/3 views the world as an interdependent system, which can be planed and controlled in advance and effectively supported through R/3. This implies that the organization is the information system or the information system is the organization and there is no other need for any other information system. In addition to this or prerequisite is that it is possible to enforce order, planning, control and structure by the implementation of R/3 - formalization on a CD. One can only speculate on explaining factors, but I think that the national and culture legacy of R/3 and ARIS are influential. My presumption about Germany and German culture might be best illustrated by the German sayings of 'ordnung must sein' and 'warum ist den banana krum'. The first saying postulates order, formalization, centralization and structure, whereas the second saying questions nature. In general this logic might be questioned, but order, formalization and planning does, however, fit information systems very well or at least the development of them. One part of the information systems discipline is about order and formalization, such as developing data models and programming. But there are aspects beyond formalization in the information systems discipline, which does not fit the German world order imposed through R/3, such human behavior governed by power and political ambitions (see Markus 1983).

Chapter 5

Enterprise System Life Cycle

The previous chapter presented the Enterprise Systems artifact. In this chapter the literature review is provided. The overall purpose of the review has three objectives. The first is to uncover areas where more research is needed. The second is to position the included papers in relation to existing literature and the third is to create a ground on which to build the conceptualization of Enterprise Systems.

The broad spectrum of research approaches, the theoretical framework and the levels of analysis make reviews challenging. Thus, the structure of the material is essential. The chosen structure of the chapter is as follows: Firstly, research related to the Enterprise System life cycle is presented. Then the selection, configuration, implementation, use and operations, and evaluation, respectively, of Enterprise Systems research are addressed. Finally, a summary and conclusion is provided. The review is not complete. Besides the publications that have been overlooked, a number of limitations have been made which include papers addressing curricula, the research direction, the future development of ERP systems, and technical issues. In addition, papers addressing CSF, such as Al-Mashari, Al-Mudimigh and Zairi (2003), Skok and Legge (2002), Umble, Haft, and Umble (2003) are presented in Paper 4.

5.1 Enterprise System Life Cycles

Life cycles describe the innovation, adaptation and diffusion of products (McGrath 1995), the creation of strategic resources (Kalling 1999), organizations (Quinn and Cameron 1983), information systems (Alter 1999) or Enterprise Systems (Markus and Tanis 2000). In the information systems literature, life cycles are often referred to as system development life cycles (SDLCs) and include the analysis, design, realization, implementation and evolution of information systems (Davis and Olson 1985; Alter 2001; Hoffer et al. 2002).

The waterfall and spiral models are common in information systems discipline (Andersen 1991). The waterfall model describes the development of

information systems as a sequential and stepwise process. It has been criticized for lacking phase validity, since real-life ISD often includes iterations between phases. The "lack" of relevance in the waterfall model led to the development of the spiral model (Boehm 1988). The spiral model is an evolutionary model. ISD, from this perspective, consists of several incremental releases, where the maturity of the systems grows. The spiral model includes six phases: communication, planning, risk assessment, engineering, construction and release, and evaluation (Hoffer et al. 2002). Both the waterfall and spiral models are widely accepted. The spiral model represents a more realistic view of how information systems are developed (George 2000). Another difference between the waterfall and spiral models is that the first has its background in information systems whereas the other is from software engineering discipline (Wohed 2000).

Alter (1999) presents a general information systems life cycle. This model includes four distinct phases, with the possibility of iterations. The phases are initiation, development, implementation, and operation and maintenance. The applicability and usefulness of this life cycle is discussed and illustrated in Alter (2001), including its explanatory power in relation to the waterfall model, the spiral model, Enterprise Systems implementations, and other change programs, e.g. BPR.

From Nilsson (1991), it is possible to deduce a COTS system life cycle. He describes three phases for COTS systems which include selection, adaptation and implementation. The use and operation phase is not included, since Nilsson's (1991) aim is to develop a method of acquiring COTS systems, i.e. the SIV method. Recently, Nilsson together with Brandt and Carlsson (Brandt et al. 1998) presented a complimentary method which included maintenance. However, use of the system is not explicitly addressed.

Research into Enterprise Systems has provided life cycles as well, see for instance Markus and Tanis (2000), Esteves and Pastor (2001), Somers and Nelson (2001) and Parr and Shanks (2000a; b). The "Enterprise Systems Experience Cycle" (Markus and Tanis 2000) is empirically verified in Markus et al. (2000) and used by Nah, Lau and Kuang (2001) to illustrate the shifting importance of Enterprise Systems CSFs. The "Enterprise Systems Experience Cycle" builds on Soh and Markus's (1995) framework of how information technology creates (or fails to create) business value. The Soh and Markus framework was modified in order to fit the context of Enterprise Systems. First, the outcome variable was changed from business value to Enterprise Systems success. Second, the framework included an initial phase when decisions are made as regards whether or not to acquire an Enterprise System,

i.e. the activities that lead to the selection of Enterprise Systems (Markus and Tanis 2000). The "Enterprise Systems Experience Cycle" includes the following phases:

- The Chartering phase comprises the activities leading to the selection and funding of an Enterprise System.
- The Project phase includes the activities intended to make the system operational, including configuration of the system.
- The Shakedown phase is when "normal operations" have been accomplished, i.e. the early stages of use.
- The Onward and Upward phase proceeds until the Enterprise System is replaced by an upgraded or different information system.

Esteves and Pastor (2001) present an Enterprise Systems life cycle to structure their bibliography. The life cycle includes six phases: adoption decision, acquisition, implementation, use and maintenance, evolution, and retirement phase. This life cycle is the only one to explicitly mention the termination or retirement of Enterprise Systems. Parr and Shanks' (2000a) life cycle, on the other hand, includes three phases: planning, project and enhancement. This life cycle is based on Enterprise Systems literature, including both professional books and material from academics. The project phase is divided into five sub phases: set-up, reengineering, design, configuration, and testing and installation. The project phase is the focus of their life cycle.

Kalling (1999), on the other hand, presents a framework that relates to the life cycle of strategic IT resources. The case studied was the in-house development of an integrated sales, manufacturing and logistics system. The framework includes two major phases: the resource phase and employment phase with five interrelated tasks, including identification, development, protection, internal distribution and usage.

5.1.1 Discussion

Life cycles attempt to describe and prescribe the evolution. In this case, the evolution concerns Enterprise Systems. A summary of the reviewed material, including the number of phases, labels, and strengths and weaknesses, is depicted in Table 5.1. The strengths and weaknesses are discussed in the following paragraphs.

Table 5.1. Life cycles in literature

Name	Phases	Labels	Strengths	Weaknesses
Waterfall model (Hoffer et al. 2002)	5	Planning Analysis Design Realization Maintenance	Simple	Unrealistic, scratch development
Spiral model (George 2000)	6	Customer communication Planning Risk assessment Engineering Construction Customer evaluation	True, relevant	Complex, engineering oriented, scratch development
Work system life cycle (Alter 1999; Alter 2001)	4	Initiation Development Implementation Operation and maintenance	General, theoretical ground, conceptually illustrated	Terminology of the first phase, selection not stressed
COTS system life cycle (Nilsson 1991; Brandt et al. 1998)	3	Selection Adaptation Implementation Maintenance	COTS system specific	Discard use
Enterprise Experience Life Cycle (Markus and Tanis 2000)	4	Chartering Project Shakedown Onward and upward	Enterprise Systems specific, operational focus, theoretical ground	Rationalistic assumptions about the world, neglecting selection of system and problem the solution is selected for
Enterprise Systems Life cycle (Esteves and Pastor 2001)	6	Adoption decision Acquisition Implementation Use and maintenance Evolution Retirement	Enterprise Systems specific	Unnecessary phases and the implementation phase is too broad, theoretical ground unknown
Process model (Parr and Shanks 2000)	3	Planning Project • Set-up • Reengineering • Design • Configuration • Testing and installation Enhancement	Linkage with CSF	Project phase includes too much
Resource development life cycle (Kalling 2000)	2 + 5	Resource • Identification • Development • Protection Employment • Internal distribution • Usage	Strong theoretical ground and empirically tested, use included	For in-house and scratch development

All life cycles that have been reviewed have their strengths and weaknesses, see Table 5.1. The waterfall and spiral models are commonly used in information systems literature and education. They apply to the process of developing information systems and software from scratch in accordance with user requirements. This is the strength of these two life cycles, but also their weakness, since they do not grasp the entire spectrum of tasks related to the development and implementation of Enterprise Systems. For instance, Enterprise System implementations are an organizational change project just as much as it is an information system project (Markus et al. 2000) and the system design reflects someone else's perception of information requirements (Paper 2). However, the waterfall and spiral models are likely to fit the development process taking place at the Enterprise System developer, cf. Figure 1.1 in Chapter 1. Kalling's resource development model may also be used to study the development process taking place at vendors. However, in that case it has to be developed to fit the case of developing offerings instead of internal resources. The strength of this model, according to Table 5.1, is the strong theoretical ground, cf. Paper 4 where Kallings's model is used to study factors affecting usage of Enterprise Systems.

Alter's life cycle, on the other hand, is generic and should thus fit the context of Enterprise Systems' adoption and adaptation. The strength of generic life cycles becomes their weakness. The characteristics of Enterprise Systems, which differentiate them from other information systems, are not emphasized. The COTS system life cycle emphasizes the selection and adaptation of the system. This is not stressed by the former life cycles, which is the COTS system life cycle's strength. However, this life cycle does not cover use. Markus and Tanis' (2000) life cycle is primarily focused on the later phases, i.e. use and operation, and thus foresees the initial selection of a system, which is stressed in the COTS system life cycle. Esteves and Pastor's life cycle is comprehensive in terms of phases, but differentiating decision and acquisition is an unnecessary step. Parr and Shanks (2000a) include only three phases, which makes their middle phase – project – very broad and includes five sub-phases. To summarize, there are strength and weaknesses of the reviewed life cycle, but none of them fits the thesis.

5.1.2 Proposed Enterprise Systems Life cycle

The shortcoming and strengths discussed in the previous section leads to a proposal of an Enterprise Systems life cycle. It is applicable to COTS systems in general, but Enterprise Systems in particular, and is focused on the process taking place at the user organization. The proposed life cycle is based on the understanding of the key characteristics of the Enterprise Systems artifact

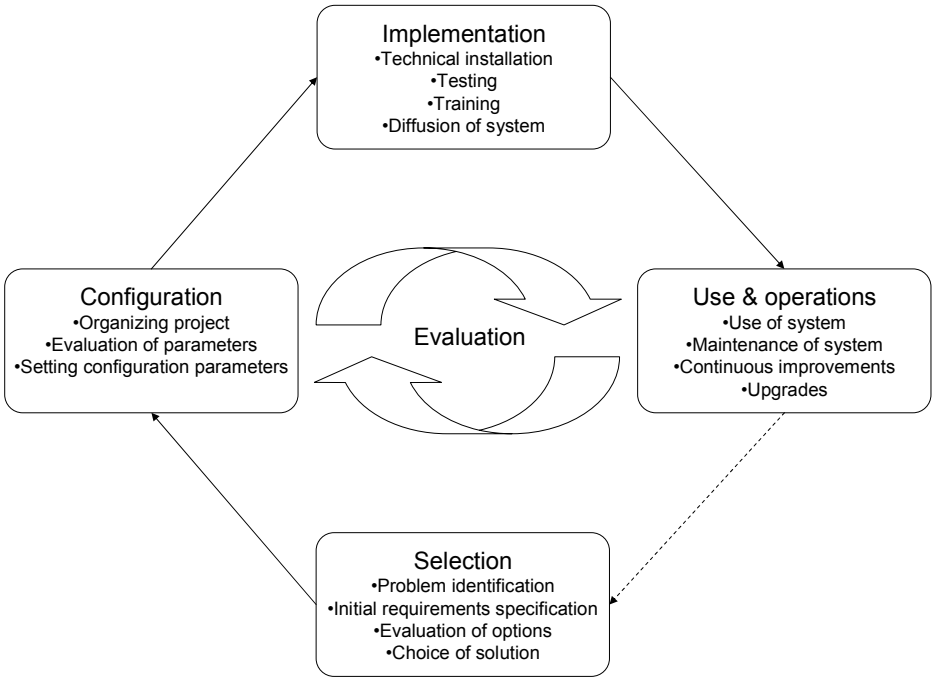

Figure 5.1. The proposed Enterprise Systems life cycle

Chapter 4) and on an integration of the reviewed life cycles in section 5.1. The life cycle resembles mostly Alter's (1999) and Markus and Tanis' (2000) life cycles with four distinct phases. However, instead of using Alter's (1999) term "Initiation", Markus and Tanis (2000) term "Chartering" or Kalling's term "Identification" for the first phase, the proposed life cycle uses the term 'Selection'. The choice of 'selection' stems from Nilsson (1991), but also stressed in Paper 1 and Paper 7. Selection is also stressed by Esteves and Pastor (2001) and inspired by Markus and Tanis' (2000) first phase, which comprises activities leading up to selection. The importance of selection in the acquisition of Enterprise is also stressed by Kirchmer (1998) and Rosemann (2001).

The second phase in the proposed life cycle is labeled 'Configuration'. This term reflects the actual tasks taking place during this phase and emphasizes the changes between scratch development and the configuration of COTS system. See for instance Paper 1, Nilsson (1991), and Rosemann (2001) for elaboration on the difference between scratch development and COTS systems. Markus and Tanis (2000) and Markus et al. (2000) emphasizes configuration as a central task, see also Parr and Shanks (2000). The protection phase of Kalling (1999) is not relevant to Enterprise Systems, since

Enterprise Systems are generic systems available on the market. Paper 4 discusses this issue as well.

The third phase applies Alter's terminology - implementation. The term implementation is also to be found in the waterfall model, the COTS system life cycle, and in Esteves and Pastor's work. This phase is concerned with the installation and diffusion of the system (cf. Kalling's (1999) term internal distribution).

The fourth and final phase is use & operation. This is a modification of Alter's terminology through emphasizing the use – not the administration – of the system. The use of Enterprise Systems is particularly stressed both by Markus and Tanis (2000) and Esteves and Pastor (2001), including two phases of use. Markus and Tanis label them as the Shakedown and Upward and Onward phases. Esteves and Pastor apply the terms use and maintenance and evolution. Thus, the proposed life cycle can be summarized:

Phase I. The Selection phase involves activities for determining the need for a system, assessing and evaluating different solutions, and the acquisition. The starting point is the identification of problems that may be solved by the implementation of a COTS system. Another task is the requirements specification, which is used to assess and evaluate different solution against each other. Acquisition involves the decision to select the product that best meets the requirements. Selection can be based on factors such as functionality, price, training and maintenance services.

Phase II. The Configuration phase involves every activity from acquisition to implementation. Funding the project, including financial and internal resources (time and people), and managing it are central to this task and are prerequisites for the project. The main tasks are configuration and customization of the system. This is usually done with the help of external consultants and internal super users.

Phase III. The Implementation phase involves the technical installation, testing, training of most end users, and the diffusion of the system into the organization. Implementation may involve several strategies, depending on the scope of the implementation and the organization. A consequence of this phase is either the introduction of information systems or a replacement of information systems.

Phase IV. The Use & Operation phase involves the use and administration of the system until it is terminated and replaced by another solution. This can include the implementation of additional functionalities including integration with other information systems, e.g. data warehouses, customer relationship management, supply-chain management, and electronic commerce.

In which respect and how does the proposed life cycle differ from and enhance the understanding of the Enterprise Systems life cycle? The main difference in comparison with other life cycles in Table 5.1 is related to the first two phases. The selection phase includes the identification of problems that ought to guide the selection of the system. The second phase applies a more specific terminology which is founded in the actual task done. The conceptual relevance of the life cycle is that it provides a means of understanding the adaptation and diffusion process of Enterprise Systems. It stresses the key activities of the process and provides a number of constructs that can be used in further research. The proposed life cycle depicted in Figure 5.1 also provides causal links between constructs. This figure is an elaboration on Figure 1.1 presented in Chapter 1. The main difference is the inclusion of a number of constructs related to each phase.

5.2 Selection

The selection of Enterprise Systems is the initial phase of acquiring them. This comprises problem identification, an initial survey of alternative options, assessing the options, and the actual selection of the system. The selection of Enterprise Systems has been, and can be, studied from a variety of disciplines and different theoretical lenses (Nilsson 1991) which include: decision-making and decision style Enterprise Systems selection (Shakir 2000), procurement (Robinson, Faris and Wind 1967), requirements engineering (Rolland and Prakash 2000), acquisition strategy (Iivari and Ervasti 1992; George 2000), option pricing (Taudes, Feurstein and Mild 2000) and information systems (Alter 1999).

A taxonomy is proposed by Parr and Shanks (2000a), including technical, operational and strategic selection criteria. In the literature, one can find a number of factors, for instance, technical factors such as how to replace old and outdated information systems (O'Callaghan 1998) and Y2K problems (Bernroider and Koch 2001; 2002). New and changing business demands require the integration of the disparate information systems (Markus 2000). Welti (1999) describes changes in the production model (make-to-order versus make-to-stoke) as a factor in the selection of Enterprise Systems. Organizational factors, such as the centralization of business functions or decentralizing decision-making are other factors that promote the choice of Enterprise Systems (Taylor 1998). The search for competitive advantage is another factor (Davenport 1998; Shang and Seddon 2000; Bernroider and Koch 2001). The creation of a common infrastructure is also suggested to be a factor (Hanseth and Braa 1999).

Bernroider and Koch (2001) present an empirical survey of selection criteria. They compared selection criteria between small and medium seized enterprises (SME) and large organizations (In the paper there is no supplied definition of SME or large organization). Initially, 29 selection criteria were identified using a Delphi approach and the importance of these criteria were studied in a survey of 138 Austrian organizations. Over 80% of the respondents were large organizations while only 22 were SMEs. The main result showed differences in the importance of the selection criteria between SMEs and large organizations. SMEs are mainly interested in the cost of implementing the system and the adaptability of the system. Large organizations, on the other hand, were more interested in the market position of the system vendor and how the system could support organizational flexibility. Everdingen, Hillegersberg and Waarts (2000) present a study of 2,401 midsize firms in ten European countries. The results of the study showed a fit between system and organization, flexibility of the system, cost, user friendliness, scalability and support as the most important selection criteria.

Swanson and Dans (2000) approached the selection of Enterprise Systems related to aging information systems which are expensive to maintain and which eventually have to be retired and replaced. They approached this problem by investigating what shapes managers' judgments about a system's remaining life-expectancy. Drawing data from 758 system replacements in 54 organizations, they studied system maintenance and prospective replacement. Support for an exploratory structural model was found in which the relationship between the maintenance effort and the remaining system life expectancy is supported. Another finding was that a system's size is directly and positively associated with its remaining life-expectancy. Joseph and Swanson (1998) studied convergence in replacement decisions at these 54 organizations. They found that information systems supporting core activities, e.g. production, sales, and procurement, were likely to be replaced by specific information systems (scratch-developed systems) than information systems supporting infrastructure activities, e.g. accounting. In addition, core activity systems had a shorter life span than infrastructure systems. However, a word of caution is in order regarding these results in that the empirical data was collected in 1995 and ISD at organizations has changed a lot since then. In these two papers, Enterprise Systems are not explicitly addressed, but mentioned as an option.

Another stream of research related to the selection of Enterprise Systems is selection methods. This is prescriptive research aiming to improve practice.

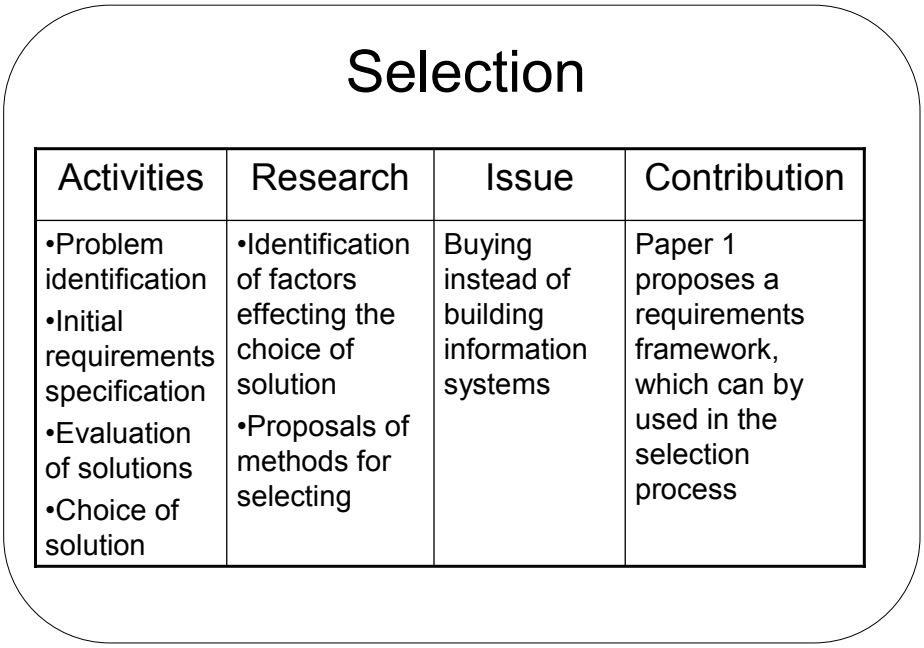

Figure 5.2. Summary of issues related to selection phase

For instance, SHERPA (Systematic Help for ERP Acquisitions) is used to collect user requirements (Illa, Franch and Pastor 2000). Komiya et al. (2000) present a method of selecting ERP systems based on business process reengineering (BPR). It is a synthesized product inspired by the ISD literature (Stefanou 2000). Maiden and Ncube (1998) present a procurement-oriented requirements engineering model for matching COTS functionality to user requirements. The SIV method is one of the more comprehensive methods for selecting COTS systems (Anveskog, Järperud, Lundeberg, Melin and Nilsson 1983; Anveskog, Nilsson and Nord 1984; Nilsson 1991; Nilsson 2000).

5.2.1 Discussion

Selection is the first phase of the proposed life cycle. In relation to selection, Paper 1, Paper 5 and Paper 6 address this. Paper 1 proposes a requirements specification framework to support the process of defining requirements based on what end an organization pursue. In Paper 5 and Paper 6 are to artifact evaluations presented, which can be used to selected solutions.

The activities, research and the included contribution are illustrated in Figure 5.2. Research related to selection can be divided in relation to the aims of this

research. This illustrates the distinction of scientific research, i.e. natural and design science, discussed in Chapter 3. The initial aim is to identify criteria affecting selection. The other topic addressed is aimed at developing methods of selecting Enterprise Systems. Even thought these two streams of research are very much related to each other, they do not build upon each other. It seems that these two research streams have emerged independently and are unaware of each other.

5.3 Configuration

Configuration involves the activities taking place from when the system is selected and acquired, leading up to the actual installation and diffusion of system (Pollock and Cornford 2001). The activities taken place in configuration can be compared to analysis, design and realization in traditional ISD. However, research related to the configuration of COTS systems and COTS methods is scarce. One exception is Ng, Ip and Lee (1998) proposal of a design and implementation methodology called the hierarchical design pyramid. Another is Rolland and Prakash (2000) who argue that ERP system configurations are difficult to align with business requirements because of the low level at which Enterprise Systems functionality is described. Organizations think in terms of goals and objectives instead of Enterprise System functionality. They propose a mapping technique to match organizational goals with Enterprise System goals. Enterprise System goals are tasks or functional descriptions formulated as performance abstractions. These descriptions can be used to match Enterprise System goals with organizational goals when selecting Enterprise System functionality. To select an Enterprise System, organizations have to describe all the desired functionality as Enterprise System goals. The proposed technique is inspired by scenario techniques from requirements engineering.

Rosemann (2001) discusses problems in requirements specifications in Enterprise Systems configuration. Configuration of the reference model is problematic, since the reference models do not present the options and consequences of configuration. The presented solution to this problem is an alternative modeling technique that complements the configuration technology in R/3. Scheer and Habermann (2000) illustrate the use of computer-based support tools when configuring Enterprise Systems. Another approach to requirements specifications is proposed in Paper 1, who argue that requirements specifications should be based on the ends an organization is seeking. Besson and Rowe (2001) studied configuration and implementation issues arising from designers' (consultants') inability to assess the impact on

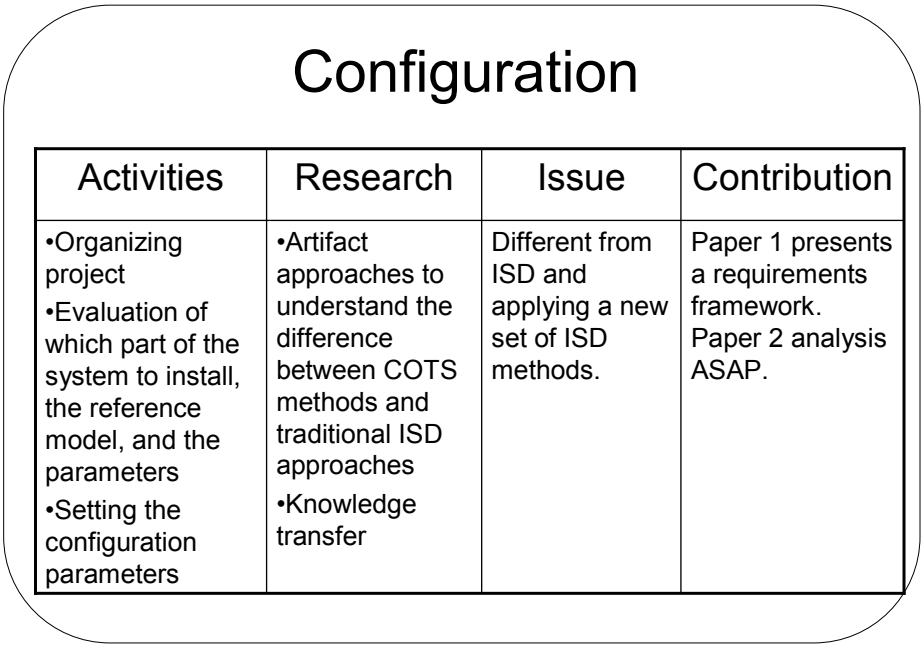

Figure 5.3. Summary of issues related to configuration of Enterprise Systems

work and processes made by Enterprise Systems. The role of user participation in configuration was investigated and found to be different than in traditional ISD (Kawalek and Wood-Harper 2002). Alvarez and Urla (2002) address issues related to requirements specifications by discussing the role of narratives in the requirements specifications of Enterprise Systems.

Lee and Lee (2000) view the configuration and implementation of Enterprise Systems as knowledge transfer or internalization, i.e. the implementation of knowledge embedded in the reference model. They stress the clashes between the embedded knowledge and the required knowledge. Esteves, Chan, Pastor and Rosemann (2003) apply a knowledge perspective to the configuration as well. However, in their paper, they study different knowledge requirements during the implementation. O'Leary (2002) proposes the use of knowledge management throughout the life cycle and has developed a prototype to support the selection and configuration.

Dolmetsch et al. (1998) present a case study of four Enterprise Systems implementations and their use of ASAP as an implementation method. They found that ASAP supports the implementation, but the methodology provides little support for change management. A paradigmatic analysis of ASAP is provided in Paper 2 and the conclusion provided is that the underlying

assumption of information requirements is totally different in Enterprise Systems implementation methods than in traditional ISD approaches. The view on information requirements is that the method knows what is best for the organization (Paper 2).

5.3.1 Discussion

Configuration is one of the fundamental tasks, but can be very difficult and can take years to complete at multinational firms. Mistakes during configuration might lead to the system not functioning or not supporting the business. Initial mistakes are difficult to change later, since they affect how data, as well as what data, is stored in the database. Rosemann (2001) and Paper 1 consider configuration to be an equivalent of design, analysis and realization in scratch development – a work task view. The implication of the new task is only, however, discussed on a conceptual level with little empirical support. The only conclusion that can be drawn is that configuration is different than tasks in traditional ISD, but it is uncertain what the implications are as regards this. Another view of configuration is the knowledge-transfer perspective, e.g. Lee and Lee (2000). These views imply a change in how ISD can be perceived. For instance, traditional ISD views the development process as a creative process, whereas the development process of Enterprise Systems, i.e. configuration, is about the exploitation of knowledge. Paper 2 provides support for the idea that configuration is different than traditional ISD. Paper 1 on the other hand claims that the methods used in the configuration changes the relationship between user and designer. The consequence is that user does not or cannot participate during the configuration due to time and resource constraints inherent in Enterprise Systems projects. In traditional ISD are user participation a CSF, but not found in relation to Enterprise Systems implementations. A summary of the issues related to configuration of Enterprise Systems are found in Figure 5.3.

5.4 Implementation

Research into implementation covers aspects such as taxonomies, failure and success factors, comparisons with other software implementation projects, and implementation strategies. For instance, Parr and Shanks (2000b) present three categories or types of implementation strategies. The comprehensive implementation strategy is the ambitious project typically involving global implementation, including most of the functionality. The vanilla approach comprises single site implementation with some modules that have relatively few users. The middle of the road strategy is some thing in between the two

other implementation strategies. In addition, each implementation category may vary with respect to the system, reengineering and technical scope, and modules implemented, such as financial and manufacturing. System scope refers to single versus multi site implementation and the degree of the system implemented – the whole package or parts thereof. The reengineering scope addresses whether or not the organization should be adapted to the system. The technical scope refers to modification of the system (Parr and Shanks 2000). The categories can be contrasted with phased and big bang implementations, which have been described previously, see for instance Eason (1988). The categories with their variations were developed into a taxonomy of implementation strategies, which was verified by means of 42 expert interviews. The conclusion drawn by the authors was that it is impossible to discuss a single Enterprise Systems implementation strategy. Each implementation is unique as regards some aspects.

Al-Mudimigh (2001) present an integrative implementation framework based on a literature survey. Rajagopal (2002) has developed an implementation model based on innovation and diffusion theory, which has been tested in several case studies. The "Enterprise Systems Experience Cycle" (Markus and Tanis 2000) was applied during a large study of Enterprise Systems implementation success (Markus et al. 2000a). This study included five in-depth case studies, interviews with 11 additional firms and 20 interviews with implementation consultants. The specific goal of this paper was to learn from Enterprise Systems adopters. The main conclusions were that all firms had experienced problems along the process of implementing and using Enterprise Systems. Another finding was that problems during the early phases often remained during later phases. Success during one phase could easily turn into failure during a later phase.

Different phases of the implementation require shifting managerial competencies and learning (Dong 2001; Kraemmergard and Rose 2002). Learning is of major concern during the implementation (Agarwal, Ratan and Ghosh 2000; Markus et al. 2000; Robey et al. 2002) and in particular in multi site implementations (Parr and Shanks 2000a). Initial failure was considered to be an important factor in explaining implementation success, due to the learning experiences gained (Markus et al. 2000a). Robey et al. (2002) report on a comparative case study of 13 organizations implementing Enterprise Systems. The focus of this study is on the dialectic learning process. Two types of learning processes, all organizations had to overcome. The first was associated with the configuration of the ERP package. The second was associated with the assimilation of new work processes. Two factors were found to have a positive affect on learning including 1) strong core teams and

carefully managed consulting relationships and 2) user training (Robey et al. 2002). Learning becomes more difficult with more complex implementation. Initial failure can explain why some firms succeed later on if they have the ability to learn from their failures. The firms which learn from their previous failures have a greater probability of succeeding than those which do not learn. The result is based on a study of two firms implementing R/3, where one failed while the other succeeded (Scott and Vessey 2000).

Corporate culture is another factor found to affect implementation (Krumbholz et al. 2000; Sarker and Lee 2002), as well as the political role of implementation (Koch 2001). Koch (2001) studied the political role of Enterprise Systems in organizational change. This study illustrates the deterministic power of such systems at 30 manufacturing firms, i.e. the implementation is used to make organizational changes. Two important actors besides the organization are the suppliers (vendors) and management consultants, who promote certain political programs, which may or may not be aligned with the organization.

Enterprise Systems may be viewed as an infrastructure (Hanseth and Braa 1999). This view provides complementary analyses of the implementation. The goal of standardization is inherent in being viewed as an infrastructure. In this case, this should be interpreted as technical standardization and not confused with other standardizations, e.g. organizational. The goal of an implementation is to deploy an infrastructure for the firm. However, in their case, this was not the situation. The universal benefit of standardization disappeared during implementation and, finally, the infrastructure was perceived as a traitor (Hanseth and Braa 1998).

The interrelationship between organization and management consultants, e.g. implementation partners, was studied by Adam and O'Doherty (2000). They found that the role of the implementation partners was not just technical. They also supported organizations in organizational and business change, and played a key political role. The importance of implementation partners has been stressed by Bhattacherjee (2000), Ross and Vitale (2000) and (Kumar 2002), and is considered to be a critical success factor (Holland and Light 1999; Nah et al. 2001; Somers and Nelson 2001). For instance, Bhattacherjee's (2000) case of Geneva's implementation of SAP R/3 illustrated the importance of the implementing partners, and in particular selecting the right partner. During the fist phase of Geneva's implementation, they used an R/3 consulting firm which had the proper technical expertise, but no knowledge of Geneva's business. Consequently, the first phase was delayed. During the second phase, they switched implementing partner to consulting firms with

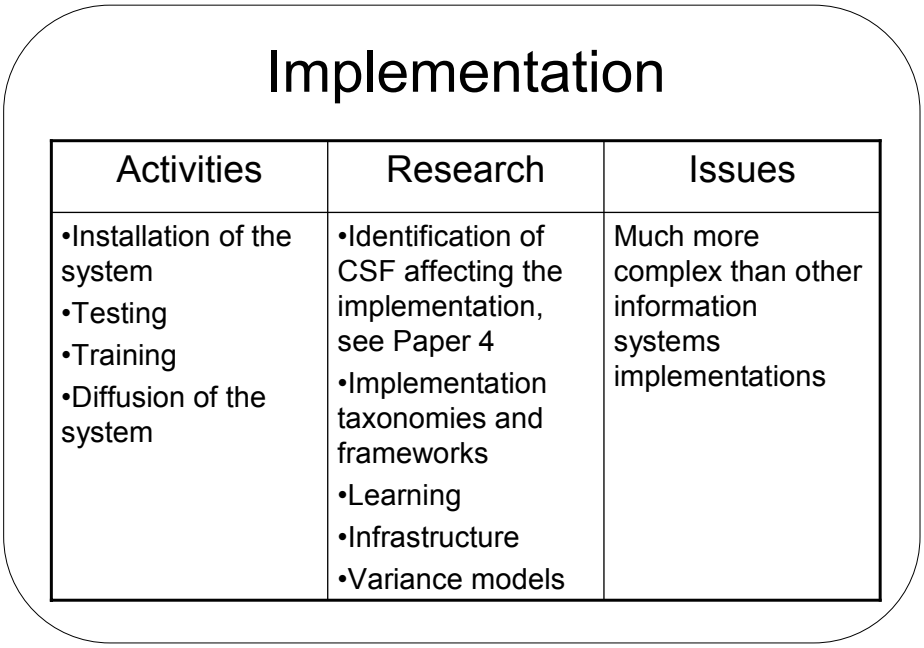

Figure 5.4. Summary of issues related to implementation phase

skills in Geneva's business. Another important actor or stakeholder, who is seldom addressed in Enterprise Systems research, is the end user. Taylor (1998) integrates BPR and R/3 implementation with a socio-technical system design approach and stresses the role of participative design and the end user.

5.4.1 Discussion

Implementation of Enterprise Systems is difficult and affected by corporate culture, the relationship between stakeholders, such as the organization, implementation partner, consultants, and the implementation strategy. The difference in scope of the implementation, due to organizational internal and contextual factors, makes it impossible to present the implementation as one implementation. As Parr and Shanks (2000b) propose, there is a need for implementation taxonomies. However, the taxonomy would have to include issues of importance to each implementation strategy, e.g. learning and knowledge. Several of the issues have been addressed via the review of CSFs. However, this section provides a broader and deeper understanding of the wide spectrum of problems firms might face when implementing Enterprise Systems. One such issue is that of implementation strategy (Parr and Shanks, 2000a), which puts the 28 CSFs presented in Paper 4 in another light. The vanilla implementation is likely to have less CSFs than a comprehensive one at

many sites. Another issue stressed in implementation research is learning, e.g. learning through failure, which also provides a new lens toward the CSFs. The learning issues are also stressed in the configuration section, but then as knowledge management. But as shown in the review of CSFs, and configuration and implementation literature, surprisingly little attention is given to the end users, regardless of their role or whether they are, or should be, participating. This can be interpreted in such a way that Enterprise Systems are so complex that end users cannot participate due to time constrains and a lack of system knowledge. However, such interpretation tends to forget that Enterprise Systems ought to support the business, and not the reverse. On the other hand, this supports Hirschheim and Smithson's (1988; 1998) conclusion that information systems are often viewed as technical systems and thus forget the organizational and personnel issues involved in implementing information systems.

Besides providing a broader and richer picture of CSFs, there is a theoretical difference between CSF research and implementation research. CSFs are based on causal or variance theories and models, whereas implementation research is based on process theories and models, e.g. Robey et al. (2002). The difference between process and variance theories is that in process theories or models, each event is necessary but not sufficient to cause outcome. In variance models, variance in the independent variable is necessary and sufficient to cause variance in the dependent variable (Markus and Robey 1988; Seddon 1997).

5.5 Use & Operation

Research into the use & operation of Enterprise Systems is concerned with the impact of systems on organization, i.e. organizational well-being, and is traditionally studied from a management perspective (Kwon and Stoneman 1995; Brynjolfsson and Hitt 1998). Information system impact can refer to different levels of measurements. Shang and Seddon's (2002) study of managers' perceptions of Enterprise Systems benefits reported five categories of benefits, including operational, managerial, strategic, organizational and IT infrastructural benefits, see Table 5.2. The study was based on vendors' reported success stories and interviews with 34 organizations. The interviews were used to verify vendor stories published on the Enterprise Systems vendor's homepages. Cronk and Fitzgerald (1999) proposed five levels of measurement including business, financial, organizational, strategic, and firm.

Hitt et al. (2002) studied the productivity impact in relation to investments in R/3. They analyzed every firm (in USA) publicly traded and purchased R/3 during the period 1986-1998. They found support for adopting firms showing increased financial performance and higher market value. They also found support for firms reporting performance dips during the initial year following the implementation.

Research related to strategic measurements are mostly based on Porter's (1980; 1985) work. For instance, the value chain analysis has been used in Enterprise Systems research (Al-Mashari and Zairi 2000). The relationship between the fit of Enterprise Systems and organizational strategy and integrating mechanisms affects the perceived value of the system (Somers and Nelson 2003). The external orientation has been criticized, providing an input to the Resource-Based view (RBV) (Barney 1986; Barney 1991), which has been used to study the impact of Enterprise Systems on competitive advantage in Pereira's (1999) analysis of how Enterprise Systems could lead to sustainable competitive advantages. Humans, i.e. users and consultants, were found to be an imperfectly mobile resource leading to potential competitive advantage. Another finding was that it is better to adapt the organization to the system than vice versa. Based on a review of strategy theory, Hedman and Kalling (2002b; 2003) propose a business model which is used to discuss Enterprise Systems impact and relationship to business.

Organizational impact has attracted interest, since Leavitt and Whisler's (1958) seminal article too late contribution (Robey and Boudreau 1999). Gattiker and Goodhue (2002) studied the degree of interdependency between sub-units as a factor explaining benefits associated with Enterprise Systems implementations. Support was found, in a survey of 124 firms, for the degree of interdependency being associated with a positive impact. In addition, they found that the time frame was an important factor explaining a positive impact. Another focused study of Enterprise Systems impact is the supplier characteristics' impact on Enterprise Systems (Mason 2002). The organizational impact of Enterprise Systems is stressed by Davenport (1998).

The deterministic nature of Enterprise Systems is also found in Hanseth et al's. (2001) study of Enterprise Systems as organizational tools for increased control. The contradictory role of the technology is explored by Sia, Tang, Soh and Boh (2002) who found support for both increased control and enhanced empowerment.

Table 5.2. Enterprise Systems benefits (based on Shang and Seddon 2002)

Operational	Managerial	Strategic	IT infrastructure	Organizational
Cost reduction	Better resource management	Support business growth	IT cost reduction	Changing work pattern
Cycle time reduction	Improved decision making and planning	Support business alliance	Increase in IT infrastructure capability	Facilitating business learning and broadening employee skills
Productivity improvement	Performance improvement in a variety of ways on all levels of the organizations	Building business innovation		Empowerment
Quality improvement		Building cost leadership		Building common visions
Customer service improvement		Generating product differentiation		Shifting work focus
		Enabling worldwide expansion		Increased employee morale and satisfaction:
		Enabling e-commerce		
		Generating or sustaining competitiveness		

Financial impact is concerned with the financial return on investments in information systems, based on a cost benefit analysis (CBA). This is also labeled under the term IT-investments. There are numerous methods for conducting CBAs, e.g. Total Cost of Ownership, Net Present Value, Total Cost of Opportunity, and Economic Value Added. The main idea is to calculate a positive margin between costs and benefits e.g. financial performance, sales growth, profitability reflected by ratios such as return on investment, return on sale, return on equity, and earnings per share are some of the measurements used (Remenyi, Money, Sherwood-Smith and Irani 2000). For instance, Poston and Grabski (2001) studied 54 firms that had completed their implementations prior to 1998. They expected to find support for improved performance through reductions in cost and enhanced decision-making. The results showed no significant improvements associated with residual income or ratio of selling during each of the three years following implementation. However, large performance improvements were found in relation to decreases in the cost of goods during the third year following implementation. In addition, there were significant reductions in the ratio

between employees and revenues for the three years following implementation. Problems determining the Enterprise Systems' contribution to financial performance have been studied by (Murphy and Simon 2002a; b). They suggest that the inclusion of intangible benefits, e.g. increased customer satisfaction, may provide a broader perspective.

Robinson and Wilson (2001) studied the impact of Enterprise Systems from a different economic perspective and applied requirements based on Marxist economics in order to analyze the impact of Enterprise Systems. They criticize economic analysis of Enterprise Systems 1) for only addressing why the adoption is necessary and 2) for applying microeconomic theory. Instead, they propose that economic analyses of Enterprise Systems should also include three Marxist concepts: labor theory, labor process, and the full circuit of capital. They apply their model and analyses to a consulting survey of Enterprise Systems benefits. They conclude that Marxist economic analysis provides a broader picture of the economic value of Enterprise Systems than the economic theories previously used in studies of Enterprise Systems. They conclude that Enterprise Systems "address fundamental issues in the processes of accumulation of capital" (Robinson and Wilson 2001, p. 31).

The last level concerns business and operational impact. For instance, Al-Mashari and Zairi (2000) report findings from a case study which failed to deliver the expected changes in a supply chain. Another case study of failed reengineering efforts is reported by (Martin and Cheung 2000). Rizzi and Roberto (1999) studied the impact of Enterprise Systems on the efficiency of a manual warehouse. The result presented is that those successful implementations require a balanced approach, whereby the implementation is followed by business and organizational change, cf. Davenport's (1998) suggestion for a holistic approach. However, the reengineering of business processes in relation to Enterprise Systems can be risky (Sumner 2000).

In addition, it is suggested that the impact of Enterprise Systems may vary over time. Ross and Vitale (2000) proposed three phases of use; stabilization, continuous improvement, transformation with a different level of positive impact. The first phase resulted in a productivity decrease due to the adaptation of a new technology. The initial productivity dip is also suggested by Markus and Tanis (2000). During the later phases, improvements were reported, which is consistent with Markus and Tanis (2000). Holland and Light (2001) propose a stage maturity model for Enterprise Systems use, which includes three stages. The first stage involves the implementation of the new system. The second phase concerns the initial use of the system. The last stage is concerned with the realization of the strategic visions of IT use. The

maturity level was determined by five theoretical maturity constructs, including the strategic use of IT, organizational sophistication, the penetration of the ERP system, vision, and drivers and lessons. The model was tested through 24 case studies.

5.5.1 Discussion

Enterprise Systems affect organizations in many ways and the impact is studied at different levels of analysis, including the firm, strategic, organizational, business, and financial levels. This stream of research is emphasized regarding the impact of the system. Less concern is shown about how the system is used in business, e.g. how it affects decision-making, communication, integration among departments, information processing etc. Use and operation research has mostly applied variance approaches, where investment in, or the use of, Enterprise Systems is the independent variable and the impact or perceived benefit is the dependent variable, e.g. Hitt et al. (2002). In summary, there is little critical reflection regarding how and why the system affects business and the people using it.

The longitudinal impact, i.e. the progression of use and impact over time, and increased benefit over time has been suggested, e.g. Holland and Light (2001). This research is based on process models, e.g. maturity of Enterprise Systems adoption. However, a shortcoming is that less focus is given to how increased progression is achieved. In Paper 7 narratives are suggested to disseminate good use of the system. However, the ideas proposed in this paper have not yet been tested. The Business model suggested in Paper 3 includes both the causal and process models. However, they do not state how progression might be achieved, except for stating that learning and knowledge sharing are factors that might affect the use and the impact in the long run. Holland and Light's (2001) maturity model indicates that benefits may improve over time. However, they do not provide any means of improving use and gaining more benefits.

Research related to Enterprise Systems use and operation have, in particular, provided one surprising result, namely the proof of productivity improvements related to investments in Enterprise Systems in comparison to the firms that did not invest in Enterprise Systems (Hitt et al. 2002). The paper contributes to the widely discussed productivity paradox (Brynjolfsson and Hitt 1996; Strassmann 1997; Brynjolfsson and Hitt 1998; Mahmood and Szewczak 1999; Barua and Mukhopadhyay 2000). Thus, one can claim that investments in Enterprise Systems might lead to sustainable competitive advantages and that all firms should invest in Enterprise Systems. But one thing that is impossible to validate through Hitt et al.'s study is how these

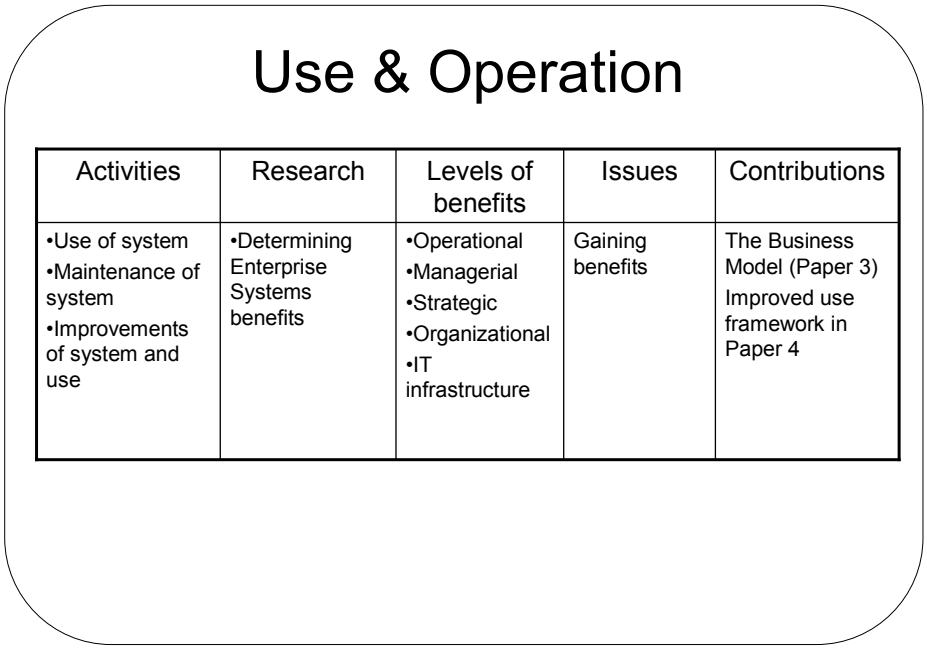

Figure 5.5. Summary of issues related to use & operations phase

firms would have managed without these investments, i.e. there is no control group. Another result of their study was the increased market value gained by the adopting firms in comparison to those which did not invest in Enterprise Systems. This factor might have been a strong promoter of investment in Enterprise Systems, especially for the firms with management incentive programs based on market value. The comments regarding Hitt et al's (2002) study are only speculative; the interesting thing is the result for the time period 1998 to 2002 with a slowdown in the economy and a falling stock market.

5.6 Evaluation

The importance of information systems evaluation has been stressed over the years (Carlson 1974; Björn-Andersen and Davis 1988; Willcocks 1994; Farbey, Land and Targett 1995; Garrity and Sanders 1998; Remenyi et al. 2000; Irani 2002). Information systems evaluation is the process of increasing the understanding, assessing, and measuring information systems against a set of criteria (Symons 1991). The overall context of information systems evaluation is described by Hirscheim and Smithson (1988; 1998) thus:

> Evaluation is endemic to human existence. Whether consciously or not, people evaluate the products and processes of their labor. Food, drink, appearance, social interaction etc., are constantly being evaluated by someone or something (cf. Legge, 1984, p.3). Evaluation is undertaken as a matter of course in the attempt to gauge how well something meets a particular expectation, objective or need (p. 17 and pp. 381-382).

The difference between research on use & operation and evaluation research is that the former is focused on the result, whereas the latter stresses the processes, i.e. how to evaluate information systems. The text in this section differs from the text in the previous section in this chapter regarding one aspect. The text is much more integrated with information system literature. The reason is that there are few contributions related to Enterprise Systems evaluation.

Evaluation and performance measurements have been proposed as CSFs for Enterprise Systems projects (e.g. Nah et al. 2001) and are also proposed in Paper 4. However, there is remarkably little research on Enterprise Systems evaluation. One exception is Stefanou's (2001) proposal of an *ex ante* evaluation framework based on a literature survey and interviews. The interviews are used to verify the framework. The purpose of evaluation in this framework is to assess costs, benefits, and risks along the life cycle. In addition, Stefanou (2001) discusses the difficulties of evaluating Enterprise Systems. Five aspects are described as factors affecting evaluation and making it more difficult. 1) The nature of Enterprise Systems being of a strategic as well as an operational character. 2) The number of stakeholders involved, e.g. users, consultants, and vendors. 3) The high degree of intangible benefits. 4) That implementation will also result in organizational change. 5) Benefits and costs span the life cycle. Another issues complicating information systems evaluation is stems from the nature of the information system itself, which make evaluations difficult (Mahmood and Szewczak 1999). Paper 5 and Paper 6 evaluates the impact of IT artifacts on organizational effectiveness based on the Competing Values Framework (CVF). Paper 7 prescribe, on the other hand, how evaluation may be carried out along the life cycle. They introduce narratives as a mean of sharing and disseminating best practice for Enterprise Systems use. In addition, they link measuring during evaluation to action, i.e. it should be possible to act or decide based on an evaluation. The intangible benefits are explored by Murphy and Simon (2002).

5.6.1 Enterprise Systems Evaluation Framework

The view taken on evaluation in the thesis is an organizational or business perspective of evaluation, cf. Paper 4 and Paper 5. In doing so, individual

aspirations are not considered, even though stakeholders, e.g. project managers and controllers, are important when organizations are evaluating information systems. The overall purpose of evaluation should, and has to, be improving the selection, configuration, implementation, and use & operations of Enterprise Systems (Paper 7). Remenyi and Sherwood-Smith (1999) and Bannister and Remenyi (2000) also state that the purpose of evaluation should be to improve either the information system in use or the ISD process. However, Kumar (1990) found that the purpose of evaluating information systems was, in many cases, to close the implementation project, with the emphasis on CBA, not on improving use. Kumar's conclusions are supported by recent research (Seddon et al. 2002), which studied evaluation practice in Europe and the USA and found that organizations do not rigorously evaluate their information systems investment.

By integrating the proposed life cycle (section 5.1) and ideas from the appended papers it is possible to enhance the proposed life cycle with evaluation purposes and evaluation procedures. Table 5.3 summarizes the view taken on Enterprise Systems evaluation. Each phase is discussed in the following paragraphs. The second row in Table 5.3 presents the phase of the Enterprise Systems Life Cycle. The next row describes the procedure, action or means of evaluation. The forth row stress the different purposes of each evaluation. The final row proposes different evaluation criteria.

During the selection phase, which is the initial phase, the focus of evaluation should be on selecting the most appropriate solution to the problems or opportunities identified. This does not have to include Enterprise Systems or information systems, but if it does, organizations should then try to select the "best" information system solution, which may or may not be an Enterprise System. Of critical importance during this phase is defining and gaining an understanding the problem or the problematic area. The problem can be related to various issues, e.g. technical, information system, business, organizational, and strategic. Knowing what domain your problems belong to is of crucial importance, since this affects the measurements that the solutions should be evaluated against.

The purpose of evaluation during the configuration phase has another focus. However, the overall criterion for these evaluations comes from the selection phase, so the problems that initiated the process are not forgotten. The objective of evaluation during this phase is to ensure a correct configuration of the system. In addition, evaluation should also take into account that the configuration is done in an efficient way (Paper 7). To do so, organizations have to rely on COTS methods, such as ASAP, that provides the means of

Table 5.3 The purpose of evaluation along the Enterprise Systems Life Cycle

	Enterprise Systems life cycle			
Phases	Selection	Configuration	Implementation	Use & operation
Procedures	Identifying problems and opportunities. Evaluating the impact of alternative solution, with and without Enterprise Systems.	Evaluation of reference model and the configuration parameters. Follow up costs and time budgets.	Narratives	Narratives
Purposes	To select the most appropriate system, based on the problems the solution is chosen for.	Ensure correct configuration in resource efficient manor.	Test the system (functional and technical). Control the diffusion and acceptance of the solution. Evaluate training programs regarding their fulfillment of spreading the future role of the system in the organization.	To improve the system and the use of the system.
Measurements	Based on the problems and opportunities and can be strategic, organizational, managerial, operational or technical	The overall measurements to control the projects should be the same used to select the system (These criteria should be used in the remainder of the life cycle, until there is a need for changing them). Time and budget. Business and user requirements.	Acceptance and understanding of the system	Related to those area of improvements sought.

accomplishing the configuration in an efficient way (Paper 1). However, the problem with COTS methods is that they tend to kill the initial ideas of implementing Enterprise Systems, due to the high degree of formalization

(Paper 4). Another problem with the COTS methods is that they tend to exclude end user, i.e. they lead to less end user participation during the configuration (Paper 1). Thus, it is important that evaluation during configuration phase ensure that the initial idea is not forgotten and that end users become involved. If evaluations are performed continuously during configuration and implementation phase the risk of the evaluation gap decreases. This occurs when the project initiators distance themselves from the project and loses sight of the business objectives of the project (Remenyi and Sherwood-Smith 1999). Often, evaluations are not performed during the configuration or and implementation of the system (Seddon, Graeser and Willcocks 2002). In cases, of so- called comprehensive implementations (Parr and Shanks 2000), evaluation has an additional purpose of conveying learning experiences between implementations (Robey et al. 2002).

The implementation phase has yet another focus, but the overall criterion for evaluation of various activities in this phase stem from the initial purpose of selecting the system. However, the initial criterion should not be viewed as a law; they should be changed, altered, or developed if there is need of such changes. The purpose of evaluation during implementation is to ensure that the system is diffused and spread throughout the organization and that users accept the solution. Acceptance of solution is crucial, but difficult since users have been not involved in the configuration. Thus, evaluations have a communicative purpose, i.e. to explain the role of the system in the organization and link the individual use to the organizational role of the system (Paper 7). An important part of evaluation during this phase is developing training programs, i.e. how can end user training and end user acceptance be improved?

The final evaluation phase is the use & operation phase and the only organizational goal of evaluation during this phase is improving use until the system is terminated (Paper 7). This mainly involves user satisfaction studies, with different focuses, for instance usability studies. One proposition made in the thesis is that narratives can be used as a tool for achieving this. Narratives should be contrasted with cost benefit analyses based on ROI, which is the common approach in post evaluation. Another suggestion made in the study is that evaluation should be made with an action perspective in mind, i.e. evaluation has to be followed by some action, which will, hopefully, lead to improved use and a positive impact on organizational effectiveness (Paper 7).

In what aspects does the idea presented in Table 5.7 improve our understanding of Enterprise Systems evaluation? The existing papers addressing evaluation of Enterprise Systems are either appraisal frameworks

(Stefanou, 2001) or research proposals (Ezingeard and Chandler-Wilde 1999; Ravarini, Tagliavini, Pigni and Sciuto 2000). The Enterprise Systems Life Cycles, e.g. Markus and Tanis (2000), are path-based models and surpasses a continuous evaluation along the life cycle. The large body on information systems evaluation (e.g. Hirschheim and Smithson 1988; Kumar 1990; Lubbe and Remenyi 1999; Bannister and Remenyi 2000; Serafeimidis and Smithson 2000; Irani 2002; Irani and Love 2002) do not perceive evaluation as an ongoing process with varying purposes of a system life cycle. Information systems evaluation is portrayed as an isolated task. A notable exception is Remenyi and Sherwood-Smith (1999). The consequence of not addressing ISD and evaluation in an integrated fashion is that the purpose of evaluation is forgotten, which can change along the life cycle.

The conclusion regarding evaluation is that it should be an ongoing integrated process, from selection to the system being terminated. Furthermore, the overall purpose of evaluation should be improving the organization.

5.7 Summary of the Literature Review

To summarize the literature survey, research into Enterprise Systems is fragmented. There are papers focusing on technical issues, organizational impacts, implementation issues, CSFs etc, based on different scientific methods and theoretical frameworks. A variety of research approaches have been applied which include explorative, descriptive, explanatory, conceptual and interpretative approaches.

The literature reviews fail to capture all aspects and dimensions of all articles, requiring some judgments to be made. It is clear that Enterprise Systems research has gained an increasing interest of the research community over the years, but there is still a need for more research. Altogether, 77 publications have been included in the review, most of them journal publications and some conference publications. Table 5.4 show the number of articles included in the review broken down by year. Research publications were booming in 2000 with several special issues, e.g. in the Journal of information Technology. The reason for including over 20 papers from 2000 is that these papers, or their content, are the initial frame of reference of Enterprise Systems research.

Table 5.5 summarizes the results of the literature review. Each paper is classified into four categories, including focus, methodology, research approach, and major issues addressed in each paper. Some of the articles fit more than one category, leading to a total that is higher than the number of

Table 5.4. Breakdown of reviewed literature

Year	1991	1996	1998	1999	2000	2001	20002	2003	Total
No. of articles	1	1	8	5	22	16	17	7	77

articles in the review. Details of the review for each paper can be found in Table 5.6. The further discussion is structured around these four categories.

Focus in Table 5.5 deals with whether the article stresses or emphasizes the artifact, context or literature. A large number (45%) of the articles focus on the context of Enterprise Systems and 40% on the literature. Context refers to the organizations and is often the norm in case studies. Case studies are also the major methodology applied in Enterprise Systems research, see Table 5.5. Robey et al.'s (2002) multi case study and Kalling (1999) are two examples of papers stressing the context. Literature refers to focus on the theoretical discussion of the individual study and is very common in many of the conceptual papers. This can involve both literature on Enterprise Systems and theoretical reviews. However, there are relatively few articles, only 16 %, that focus on the artifact. One exception is Geneva Pharmaceuticals implementation of R/3, where both the context and the artifact is well described (Bhattacherjee 2000). This paper also illustrates a paper having multiple focuses. The problem arising from poor descriptions of the artifact is that it is difficult to know what system, or part system, is being studied. Consequently, it is difficult to amass a body of knowledge and understanding of Enterprise Systems. The implication of lack of a body of knowledge is stressed by Orlikowski and Iacono (2001) in their review of 188 articles in Information Systems Research between 1990 and 1999 where they found no conceptualization of the IT artifact in 24.8% of the published articles.

Methodology selection shows great diversity, with a focus on case and multi case studies – 4 out of 10 articles. The choice of case methodology is understandable, since the area has not been completely defined yet and many issues have to be explored. Case studies are used in several ways, for explorative, descriptive and explanatory purposes. The single largest methodology category is unknown or not empirical comprising 34 % of the papers. This includes papers which have not described their research approach, e.g. Davenport (1998), and conceptual papers. Surveys are slowly increasing and mostly used in papers addressing use & operation of Enterprise Systems. Few of the articles state a priori hypotheses and test them empirically, one exception being Gattiker and Goodhue (2002) and another is

Table 5.5. Summary of Enterprise Systems literature

		No. of articles	Percentage
Focus	Artifact	13	16%
	Context	37	45%
	Literature	32	39%
Methodology	Single case	21	25%
	Multiple case	11	13%
	Survey	18	23%
	Interviews	7	8%
	Unknown not empirical	26	31%
Approach	Exploratory	4	5%
	Descriptive	14	17%
	Explanatory	19	23%
	Inductive/Qualitative theory building	17	21%
	Conceptual	19	23%
	Interpretative	8	10%
Major issue	ISD	6	6%
	Selection	16	15%
	Configuration	19	18%
	Implementation	33	31%
	Use and operation	27	26%
	Evaluation	4	4%

Hitt et al. (2002). Another observation is that few articles apply multiple methodologies.

There is also diversity in the research approaches. The most frequently applied approach is descriptive, followed by explanatory and inductive/qualitative theory building. There are relatively few exploratory papers even though this has traditionally been the strong side of information system research (March and Smith, 1995). There are some publications based on the interpretative approach. This category also includes papers based on critical approaches.

The major issue is related to implementations 33 % of the papers addressed this. Implementation issues were the issue in papers prior to 2001. Use & operation has been covered by 27 % of the papers. Papers related to use and operation have been the emerging theme of recent publications. There are very few papers addressing ISD or evaluation. For instance, only four papers address evaluation and Enterprise Systems. The category ISD refers to paper applying an SDLC perspective. The large number of articles addressing configuration can be explained by the ten papers addressing CSF which covers selection and configuration.

5.8 Conclusion of the Literature Review

To conclude, one of the overall observations made from the review concerns the different interpretations and perspectives that can be found in the literature. At least four such perspectives can be found. The first interpretation views Enterprise Systems as a way of developing information systems (cf. Nilsson 1991; Paper 1 and 2). This perspective has its roots in the question of whether an organization should "build or buy" its information system solutions (Joseph and Swanson 1998). Nilsson (1991) describes the option of buying an information system, such as an Enterprise System, as an alternative to developing information systems from scratch. A second perspective concerns a specific instance of information systems or software, cf. with AIS or payroll systems (cf. Brandt, Carlsson and Nilsson 1998; Gattiker and Goodhue 2002; Paper 5 and Paper 6). In this view, information systems are classified into categories, e.g. functional, hierarchical or industrial. The contribution made by this approach is that, as research accumulates, the knowledge of a type of information system grows with time. The third interpretation views Enterprise Systems as a means of controlling and managing organizations and businesses (cf. Davenport 2000) and has its roots in business disciplines. The focus of this perspective is on how Enterprise Systems can be used in organizations to improve them. In addition, obstacles to effective utilization which are of critical concern in understanding the implications of Enterprise Systems better (cf. Robey et al. 2002; Paper 3, Paper 4 and Paper 7). A fourth perspective is infrastructure, i.e. Enterprise Systems are viewed as an infrastructure of data and information processing upon which an organization can build on (cf. Hanseth and Braa 1999). This perspective is also closely related to the issue of standardization and the impact of standardization on society and organization. Each perspective emphasizes different issues. For instance, the first interpretation focuses on methods of selecting, developing, implementing, and using Enterprise Systems, whereas the second interpretation studies critical success factors regarding the effective implementation and use of Enterprise Systems. The third interpretation focuses on the impact and effect of Enterprise Systems on organizations and on the consequences that one resource entails for other resources and the processes in which Enterprise Systems are used. The fourth perspective focuses on the role of infrastructure as an irreversible base.

Table 5.6. Classification of Enterprise Systems literature

	Artifact, Context or Literature			Methodology					Approach						Major Issue					
Author	Artifact	Context	Literature	Single Case	Multiple Case	Survey	Interview	Unknown or Not Empirical	Exploratory	Descriptive	Explanatory	Inductive/Qualitative theory building	Conceptual (non-empirical)	Interpretative	ISD and SDLC	Selection	Configuration	Implementation	Use and operation	Evaluation
Adam and O'Doherty (2000)		X					X				X							X	X	
Akkermans (2002)		X		X							X							X		
Al-Mashari and Zairi(2000)	X			X						X									X	
Al-Mashari et al. (2003)			X					X					X			X	X	X		
Al-Mudimigh (2001)			X					X					X					X		
Alvarez and Urla (2002)			X			X								X			X			
Bernroider and Koch (2001)		X				X				X						X				
Besson and Rowe (2001)		X		X								X					X	X		
Bhattacherjee (2000)	X	X		X						X							X	X		
Borell and Hedman (2000)			X					X					X				X			
Davenport (1996)			X				X		X									X		
Davenport (1998)	X							X		X								X		
Dolmetsch et al. (1998)		X			X					X								X		
Dong (2001)			X					X					X					X		
Esteves and Pastor (2001)			X					X					X		X					
Esteves et al. (2003)	X							X					X				X			
Everdingen et al. (2000)			X			X	X			X						X				
Francalanci (2001)		X				X						X							X	
Gattiker and Goodhue (2002)		X				X						X							X	
Hanseth and Braa (1998)		X		X							X			X				X		
Hanseth and Braa (1999)		X		X							X			X					X	
Hanseth et al. (2001)		X		X							X								X	
Hedman and Borell (2002)	X							X					X							X
Hedman and Borell (2003)			X					X		X				X						X
Hedman and Kalling (2002)			X					X					X						X	
Hedman and Kalling (2003)		X		X							X								X	
Hedman (Paper 2)	X							X						X			x			

Table 5.6. Classification of Enterprise Systems literature (contd.)

	Artifact, Context or Literature			Methodology					Approach						Major Issue					
Author	Artifact	Context	Literature	Single Case	Multiple Case	Survey	Interview	Unknown or Not Empirical	Exploratory	Descriptive	Explanatory	Inductive/Qualitative theory building	Conceptual (non-empirical)	Interpretative	ISD and SDLC	Selection	Configuration	Implementation	Use and operation	Evaluation
Hitt et al. (2002)		X				X						X							X	
Holland and Light (2001)		X			X							X						X	X	
Holland *et al.* (1999)		X			X							X						X		
Hong and Kim (2002)			X			X					X							X		
Illa et al. (2000)			X					X					X			X				
Joseph and Swanson (1998)			X			X					X					X				
Kalling (1998)		X		X							X				X					
Kawalek and Wood-Harper (2002)		X		X								X					X			
Koch (2001)	X			X	X							X						X		
Komiya et al. (2000)			X					X					X			X				
Kraemmergard and Rose (2002)		X		X							X					X	X	X		
Krumbholz et al. (2000)		X			X							X							X	
Larsen and Myers (1998)		X		X							X								X	
Lee and Lee (2000)		X		X							X						X	X		
Markus (2000)			X					X					X						X	
Markus and Tanis (2000)	X							X					X		X	X	X	X	X	
Markus *et al.* (2000)		X			X						X						X	X	X	
Martin and Cheung (2000)		X		X							X								X	
Mason (2002)		X	X			X						X								X
Murphy and Simon (2002)		X	X	X							X								X	
Nah et al. (2001)			X					X				X			X	X	X	X	X	
NG et al. (1998)			X					X					X				X			
Nilsson (1991)			X		X		X			X				X	X					
O'Leary (2002)			X					X		X						X	X			
Parr and Shanks (2000)			X			X						X							X	
Parr et al. (1999)			X				X			X								X		
Pereira (1999)			X					X					X						X	

Table 5.6. Classification of Enterprise Systems literature (contd.)

	Artifact, Context or Literature			Methodology					Approach						Major Issue					
Author	Artifact	Context	Literature	Single Case	Multiple Case	Survey	Interview	Unknown or Not Empirical	Exploratory	Descriptive	Explanatory	Inductive/Qualitative theory building	Conceptual (non-empirical)	Interpretative	ISD and SDLC	Selection	Configuration	Implementation	Use and operation	Evaluation
Pollock (2001)		X		X					X									X		
Poston and Grabski (2001)		X				X						X							X	
Rajagopal (2002)		X				X	X					X						X		
Rizzi and Roberto (1999)		X		X						X									X	
Robey et al. (2002)		X			X						X							X		
Robinson and Wilson (2001)	X		X					X					X						X	
Rolland and Prakash (2000)			X					X					X			X				
Rosemann (2001)	X							X						X			X			
Ross and Vitale (2000)		X				X			X									X	X	
Sarker and Lee (2002)		X		X								X						X		
Scheer and Habermann (2000)	X							X		X							X			
Scott and Vessey (2000)		X			X								X					X		
Shang and Seddon (2002)			X			X	X					X							X	
Skok and Legge (2002)		X			X									X			X	X		
Somers and Nelson (2001)			X			X			X						X	X	X	X	X	
Somers and Nelson (2003)			X			X					X								X	
Stefanou (2000)			X					X					X			X				
Stefanou (2001)			X			X		X				X								X
Sumner (2000)		X			X					X								X		
Swanson and Dans (2000)			X			X					X					X				
Taylor (1998)		X		X							X							X		
Umble et al. (2003)	X	X		X						X						X	X	X		
Upton and McAfee (2000)	X							X					X					X		
Total	13	37	32	21	11	18	7	26	4	14	19	17	19	8	6	16	19	33	27	4

Chapter 6

Conclusions

In Chapter 1, the background and the area of inquiry were introduced and the purpose outlined. Papers in Part two were introduced in Chapter 2. Chapter 3 described the research approach. After this, the Enterprise Systems artifact was presented, followed by a literature review in Chapter 5. In this chapter a synthesis of the whole exercise is presented. This is done by presenting an integrated framework. The framework's validity is discussed in terms of explanatory power and relevance. The chapter is then concluded and some ideas for the future research are presented.

6.1 Integrated framework

An assumption made prior to commencing the study was that Enterprise Systems entail some uniqueness in comparison to other information systems, which were worth exploring. My initial assumption has not changed. Enterprise Systems entail characteristics worth exploiting in the future, such as organizations pre-understanding of integrated systems and process orientation and assessment of reference models. Empirical support for the idea that Enterprise Systems are unique was provided in the survey of Enterprise Systems experts (Paper 4), but as I interpret them they perceived that some organizations do not treat and manage Enterprise Systems differently than other information systems. Thus, there are several interpretations of Enterprise Systems and this research has presented my interpretation.

This section presents an integrated framework as a final synthesize of the research. The broad scope of the research has been justified through the difficulties of stating a clear focus in a topic area, such as Enterprise Systems. The framework is based on the preceding chapters and the papers of Part two. It includes a conceptualization of the Enterprise Systems artifact, the life cycle of Enterprise Systems, consequences of COTS methods and the evolving purpose of information systems evaluation. The framework is centered upon the artifacts and is based on my interpretation and understanding of

Enterprise Systems. The framework is shown in Figure 6.1 and the components of the framework are explained and discussed in the remainder of this section.

Prior to discussing the framework, the contributions of the study are summarized, focusing on the key characteristics and the interrelationship to the proposed framework. This is followed by a discussion of COTS methods and their consequences on configuration and implementation. The last aspect discussed is the relationship between evolving purposes of evaluation and the framework. The integration of the framework is discussed along the way. The contribution and validity of the framework is discussed in section 6.1.1.

The objectives of the study has been "*to improve our understanding of Enterprise Systems artifacts and the key characteristics leading to changes in ISD and the increased importance of evaluation and to develop methods and evaluation approaches for Enterprise Systems*". The message and central idea that I have been communicating is that Enterprise Systems include characteristics which affects the ISD process leading to a need of supplementary methods and tools. In the process of reaching the objectives a number of outputs or individual contributions have been presented:

- The conceptualization of Enterprise System's key characteristics, including industry coverage, scope and functionality, generic, COTS system, and master data. The interrelated characteristics constitute Enterprise Systems as a unique type of information systems providing input to changes in ISD and information systems evaluation (section 4.3).
- In paper 1 changes in requirements specification of ISD is ISD addressed. The proposed requirements specification framework takes attempts to bridge the gap between selection and configuration, by providing a link between means (Enterprise Systems) and ends (organizational goals).
- Besides affecting requirements specification Enterprise Systems entail their own configuration and implementation methods (Paper 1; Paper 2). This type of ISD method is designed for the configuration and implementation of Enterprise Systems and is labeled as COTS method. The implication of COTS methods for ISD is that they entail a deterministic view of information requirements (Paper 2), which is a major change in comparison to 'traditional' ISD methods.
- Paper 5 and 6 contributes with two artifact evaluations of an Enterprise System and a portal solution. These two papers applies the CVF in an ex ante evaluations of the two artifacts. The result presented in Paper 4 is a series of hypotheses related to the impact of Enterprise Systems on organizational effectiveness. Paper 5 on the other hand speculates on the impact on managerial process as defined in CVF.
- The characteristics of Enterprise Systems (section 4.3), changes in ISD (Paper 1 and 2) and the increased importance of evaluation (Paper 7) leads to the proposed Enterprise Systems life cycle (section 5.1). The proposed life cycle complements existing and competing life cycles, by applying a terminology related to the tasks

performed. The life cycle includes four phases or interrelated tasks, including selection, configuration, implementation and use & operation.

- The phases of Enterprise Systems life cycle is complemented with related and shifting purposes of evaluation, leading to an Enterprise Systems evaluation framework (section 5.6). In this framework shifting purposes of evaluation related to the different phases of the life cycle are discussed.
- Paper 3 proposes and conceptually illustrates the business model concept, which can be used to understand the relationship between resources, such as Enterprise Systems, and business.
- Paper 4 proposes an Enterprise Systems resource management framework. The view on Enterprise Systems in Paper 4 as well as in Paper 3 views Enterprise Systems as a resource. The presented framework in this paper enhances the management process of the business model. Thus, providing a link between the resource and its characteristics and specific resource management issues.
- Paper 7 addresses explicitly information systems evaluation as well and proposes the use of narratives in Enterprise Systems evaluation. The justification for narratives is their potential of grasping the complexity and the role of Enterprise Systems in business. Another contribution in this paper is that evaluation should lead to action.

Figure 6.1 summarizes the key ideas of the thesis. The logic of the framework is as follows. The artifact, with its key characteristics, is evaluated in the process of selecting an information system solution. This assumes that information systems are a solution to the problems intended to be solved. There are cases when Enterprise Systems are selected based on other logics than rationality. For instance institutional behavior, such as isomorphism can explain the selection of Enterprise Systems and in particular the large market share of R/3. The selection process, when it is at least based on bounded rationality (Simon 1976) can be supported by methods of selecting Enterprise Systems. The characteristics that make Enterprise Systems complex solutions create the need for product-specific configuration and implementation methods – COTS methods, which in turn changes the ISD process, since COTS methods include paradigmatically different assumptions regarding ISD. The configuration and implementation, and use and operation of the artifact affect the Enterprise System artifact. Thus, the artifact *per se* evolves during its life cycle. The configuration has to be completed prior to implementation. Consequently, the framework is based on an underlying process model with a causal relationship between the phases of the framework. The role of process models and theories is summarized by Kaplan (1991 p. 593):

> valuable aids in understanding issues pertaining to designing and implementing information systems, assessing their impacts, and anticipating and managing the process of change associated with them Kaplan (1991 p. 593).

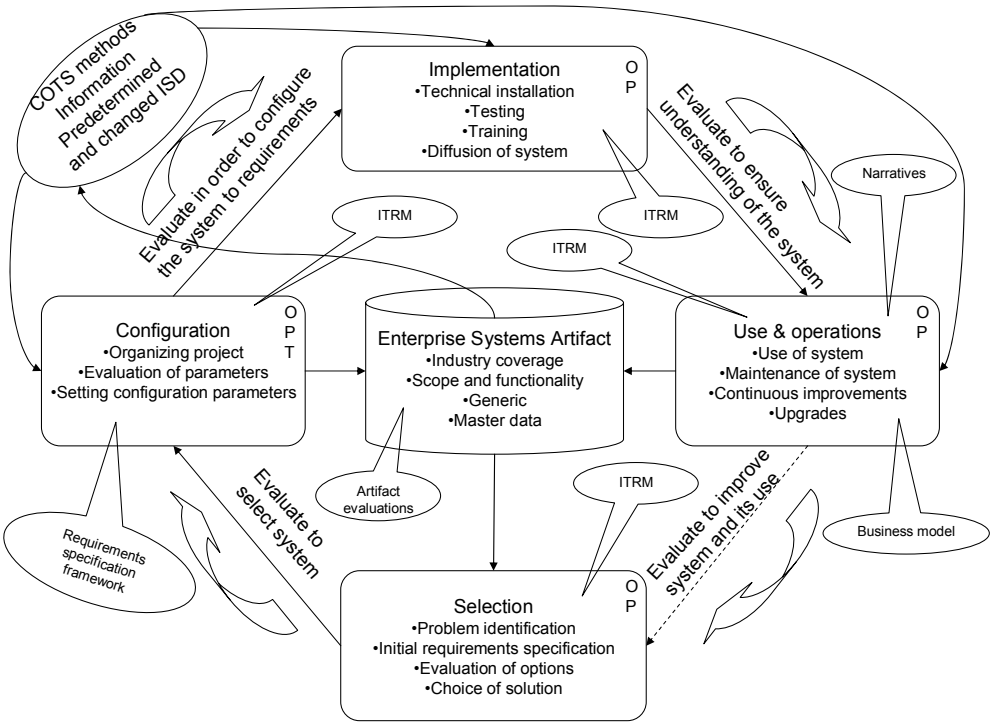

Figure 6.1. Integrated framework (O = Organizational, P = Project, T = Technical)

The purposes of evaluation during the life cycle are changing along the life cycle. Narratives are particularly related to improve use, during the final phase. The life cycle ends with a possible termination of the system, which may or may or not lead to a new life cycle.

The framework consist of the following components, the key characteristics, Enterprise Systems life cycle, and changes in ISD instigated by the COTS methods, evolving purpose of information systems evaluation, and the relationship between the frameworks components. The key characteristics are presented in Chapter 4 and the overall life cycle is initially proposed in section 5.1 and enhanced with the findings presented in Paper 4. Each phase of the life cycle (i.e. selection, development, implementation, and use & operation) is complemented with interdependent organizational and project factors and the development phase is also complemented with technical factors. These factors provide a depth into the framework. The organizational, project and technical factors are illustrated with O, P and T respectively in Figure 6.1. The importance of organizational, project and technical factors varies along the life cycle. For instance organizational factors are more important during implementation than during configuration. The shifting importance might be a future area of investigation and in particular in relation to implementation

success versus use & operation success. The COTS methods are specifically addressed in Paper 2. Paper 1 and Paper 4 also address issues related to the COTS methods. The changing role of evaluation is discussed in section 5.6 and in Paper 7.

In Chapter 4, the following key characteristics were identified as essential features; industry coverage, scope and functionality, generic, and master data, and together constituting the uniqueness of Enterprise Systems. In addition integration and process orientation were briefly addressed. These features are parts of the nature of R/3. Combined and independently each of the characteristics entails consequences for ISD (see for instance section 5.1 and Paper 1 and Paper 2) and evaluation (section 5.6 and Paper 7).

The impact of the identified key characteristics (section 4.3) is related to the Enterprise System life cycle (section 5.1.2). First, the existence of Enterprise Systems artifact provides an alternative option to developing information systems from scratch, which concerns the issue of building versus buying. This is what I see as a departure from the traditional information systems discipline, including programming and system development courses, which I was taught in. Whether this evolution is good or bad can be discussed. Nevertheless, the option of Enterprise Systems involves issues that previously were none-issues. For instance, there are several Enterprise Systems to choice among from different providers (such as SAP AG, Oracle, PeopleSoft, JD Edwards, and Intentia etc) with their own legacy (manufacturing, accounting, human resource management), which should be evaluated during the selection of solution. This requires that organizations behave at least in accordance to bounded rationality. Besides, selecting among competing Enterprise Systems providers, the vendors offers several systems, for instance industry specific solutions and upgrades of their system. This is related to the key characteristic of industry coverage in Figure 6.1.

The next characteristic, i.e. the broad scope and functionality, complicates the matter. For instance should a firm select the entire package or part of it? One of the observations related to current use in Paper 4 address this issue – the degree of diffusion varies among organization. The explanation provided were different organizations choose to use different parts of the system, an unwillingness to use more of the systems due to initial drawbacks, and lack of understanding and knowing of the artifact. The business model (Paper 3) can be used a tool to discuss the interdependency between business and information technology.

The generic characteristic highlights the option of buying versus building – exploiting versus exploring knowledge. Other issues emerge from the

characteristic generic. The first is unique versus commodity resources. Unique resources can be a competitive advantage leading to a need for protection of the resources. Enterprise Systems are commodities that can be purchased on the market with no specific needs for protection (Paper 4). The question that emerges is what happens to IT as a competitive source? Paper 4 and 7 argues that organizations should put more effort into improving use of Enterprise Systems, arguing the competitiveness in relation to IT stems from the use of resources and not the resource itself. The second issue relates to the need for adopting the organization to the systems logic, embedded in the reference model, or adapting the system to the organizational requirements. The common wisdom described in the CSF literature suggests - adopt the organization to the system, see Table 3 in Paper 4. However, one of the conclusions presented in Paper 4 was that actions ensuring adoption of the organization, such as vanilla strategy, vendor tools, rapid implementation etc, can inhibit the long term success of using Enterprise Systems. Whereas the alternative strategy of changing the system to organizational requirements is a sign of an organizational culture that foster change and continuous improvements.

Configuration and implementation are two interrelated, but distinguishable, tasks, which are aimed at developing and introducing Enterprise Systems. In Paper 4, the terms development and internal distribution are used instead. The development includes what the information systems discipline traditionally refers to as analysis, design and realization. Paper 1 claims that configuration is fundamentally different than traditional ISD, referring to analysis, design and realization. For instance, the analysis is replaced by an evaluation of the reference model, master data, and configuration parameters. Design, on the other hand, leads to changes of the reference model and realization, i.e. programming, is setting configuration parameters. Setting configuration parameters leads to changes of the artifact, i.e. it is adopted to the future way of doing business. This can be in line with requirements, but it can also lead to changes in the business and organization. Consequently, leading to an in part unique resource adapted to an organization, but also, according to Hanseth and Braa (1998), to an actor with irreversible nature (cf. section 4.3.5). The changes in ISD in relation to configuration profoundly affect the relationship between designer and user – as it is prescribed in the Scandinavian school of ISD. The implementation is not directly affected by the characteristics, except for being more complex due to the interrelated characteristics.

Use & operation is directly affected by scope and functionality, generic and master data. Master data constitutes what data that can be put into the system. Functionality is what the system can do and what people interact with, for

instance receiving inputs, such as orders, confirmations, and offers etc, and spreading outputs, such as reports, income statements, procurement orders. How the input is processed and presented as outputs is decided by the reference model. Lack of or poor functionality or processing capacity, leads to improvement and/or upgrade. The alternatives to improvements and/or upgrades are either to make no changes of the artifact or commence the process of terminating the artifact. Paper 4 contributes to the use & operation of Enterprise Systems by providing causalities between this stage and the pervious.

The complexity, i.e. the interrelated characteristics, of Enterprise Systems leads to the use of COTS methods during configuration and implementation. The consequences of COTS methods are changes in the relationship between designer and users (Paper 1), the replacement of requirements specification with an evaluation of the reference models and configuration parameters (Paper 5) and the oblivion of the initial idea of selecting the system (Paper 4). Paper 2 offers a possible explanation for this, namely the deterministic view of information requirements as applied in the analyzed COTS method - ASAP. The COTS methods affect configuration, implementation, and use & operation in different ways. The procedures of the tasks performed during configuration are prescribed by the COTS methods. The process of implementing Enterprise Systems is controlled by the method. Ultimately, affecting use & operation. It seems that the success of the implementation project (involving the configuration and implementation), measured in terms of meeting budgets and time schedules can be related to COTS method. However, the unreflective use of COTS methods might lead to less success during use & operation.

Returning to information systems evaluation, the view taken is that there appears to be little use or value of specific tools or techniques, based on accounting, for assessing Enterprise Systems impact on organizational effectiveness (Paper 7). This is based on the idea that the impact of Enterprise Systems is a combination of organizational changes, new business processes and information systems that appears over time and depends on the usage within not just a part of an organization, but the organization as a whole (Paper 3). Thus, suggesting that the evaluation of Enterprise Systems is highly contextual and thus measurement of impact on organization is interchangeable with measurements of general improvements. This leads to the suggestion that the purpose of the evaluation is to understand how Enterprise Systems might affect organizational and improve the long term use. The evaluation can be used as a tool for supporting implementation by enhancing or enabling a better communication between designers and users.

This is achieved by using the evaluation for discussing organizational requirements of Enterprise Systems and related improvements.

6.1.1 Contribution and Validity

The contribution and validity of the framework is related to the overall purpose of the thesis, which is to improve our understanding of Enterprise System artifacts and the consequences for ISD and information systems evaluation. This is summarized in the integrated framework in section 6.1 and illustrated in Figure 6.1. This section will focus upon the contribution and the validity of the framework. In Paper 3, the validity of the business model concept discussed in terms of explanatory power and relevance. A third aspect of validity is integration, which in this case would refer to the extent of interrelationship between the components of the proposed framework, which has been discussed in the previous section.

Explanatory power can be determined in relation to competing frameworks or theories. The proposed framework is based on an integration of information systems frameworks and models, for instance are life cycle and information system evaluation frameworks integrated. The framework addresses the relationship between the components of the framework (the Enterprise Systems artifact, COTS methods, the life cycle, and information systems evaluation). There are competing frameworks and models addressing the life cycle, such as Markus and Tanis (2000), and *ex ante* evaluation frameworks (such as Stefanou (2001). In section 5.1 a competing life cycle was proposed focusing on the interrelationship between changes in ISD instigated by the characteristics of Enterprise Systems and the COTS methods. The proposed life cycle is a part of the concluding framework of this section. There are frameworks addressing some of evaluations issues (*ex ante* evaluation (Stefanou 2001) and Borell and Hedman's (2001) proposals of interpretative evaluation methods) discussed in section 5.6. In relation to information systems evaluation I would stress the link between measurements and purpose of evaluation, i.e. the link between means and ends. This has not been explicitly addressed previously, neither in information systems research or Enterprise Systems research. The role of and the consequences of COTS methods have not been found in any competing frameworks. Another contribution by the proposed framework is the integration of the conceptualization of the artifact, which is commonly treated as a black box in Enterprise Systems research. Paper 3 proposes an alternative perspective on Enterprise Systems, by integrating several theoretical perspectives. The main difference between the business model and the concluding framework is the view on Enterprise Systems. The business model view, Enterprise Systems as

a resource whereas the view taken here is as an artifact. Consequently, the business model applies and economic perspective on Enterprise Systems whereas the view here is an information systems development perspective. Paper 4 proposes yet an alternative and complementary perspective. The ERPM framework includes a life cycle perspective as proposed here, but the ERPM framework focuses on the interrelationship between tasks, phases and CSFs - not the artifact as such.

The relevance of the proposed model, i.e. what can the framework explain, can be illustrated through reviewing the process of introducing Enterprise Systems at LUSEM. The selection of Enterprise system back in 1998 was based on a rational decision. There were requirements on the LUSEM, but in particular on the department of Informatics to increase our collaboration with business and extending our network activities. Besides, SAP, there were two alternatives Intentia and IFS. Intentia's Enterprise System Movex was at that time based on IBM's AS 400 platform, which we had no competence of running. IFS Application on the other hand was based on Windows and Oracle database, which we had some experience of. The other large providers of Enterprise Systems (Oracle, JD Edwards and Peoplesoft) did not have any business of substance in Sweden at that time. Baan were in severe financial problems. The Swedish provider did not make any money and did not have any formalized networks with universities. SAP on the other hand was making money and had a formalized university collaboration program in Europe and USA. The choice was simple, we choose the market leading firm, which were and still is making money and have an extended network with universities around the world. The initial failure of using the Enterprise System, prior changing to R/3 version 4.0b, was related to the lack of the incomplete artifact and an improper technological platform for our purpose – UNIX. Thus technical factors have a role, cf. the Figure 6.1, but should not be a major issue as we experienced. The first implementation did not involve any requirements specification from our side or any attempts from the installation consultant to understand our need. For the second implementation, we formalized our demands together with SAP leading to a successful implementation, i.e. the system worked properly. However, the problems we later got confronted with were related to the characteristics of the artifact. We did not understand the complexity and the interrelationship of the artifact leading to in part failure in use & operation. Failure in this case mainly refers to diffusion terms, i.e. very few people have used the system. The role of evaluation was clear in the initial selection. In later phases evaluations did not take place. The use of R/3 can today day be characterized as none use.

The proposed ERPM framework in Paper 4 explains our problems and issues better way, including lack of competence, the role of management involvement, cognitive limitations. Based on our experience the main learning lesson related to the ERPM framework is the role of top management. Initially we had support and commitment, during the configuration phase there was no particular need for top management involvement. However, implementation and use & operation we still had support of the top management, but the lack of top management involvement was the main factor leading to failure. Top management involvement in LUSEM's case could have been expressed as use of R/3 in the courses the top management was responsible for.

6.2 Concluding Words

In the thesis I have argued for the importance of understanding the artifact, i.e. the need of conceptualizations or theorizing of the artifact. In the process of gaining an increased understanding of the artifact two pertinent issues to the information systems discipline became of interest, namely changes in the ISD and an increased importance of information systems evaluation. The changes in ISD reinforced through the COTS methods used to configure and implement the system. Instead of a requirements specification the COTS methods knows what information requirements organizations have – i.e. they are information predetermined. The role of information systems evaluation also becomes altered, with different purposes along the life cycle. Initially, the evaluations support the selection of solution. During the configuration and implementation evaluations have two main purposes, i.e. to control the project and to communicate the vision of the system. In the use & operation phase, evaluation has the purpose of improving use of the system. In addition, the overall view of evaluations is that it should lead to actions.

The investigation has been very broad at least and several areas have been explored. In a sense in the thesis I have been developing an area of research, which in the future can be explored in depth. Three such research areas are proposed in the reminder of this section.

The first area is related to ISD. This is what I perceive as the core of the information systems discipline. The main message provided in the thesis in relation to ISD is that COTS methods involve a reversed logic of the ISD process, which is instigated by the embedded logic of information predetermination, leading to two distinct future research areas. The first is related to the analysis and design phase of the Enterprise Systems vendors' life

cycle (see Figure 1.1.). The principal question this research would be focusing on how does requirements specification function in the development of Enterprise Systems? What are the stakeholders and the role of different stakeholders? Who decides on future developments – the vendors or customer? The research questions could of course be applicable to any COTS system. Four possible stakeholders can be identified; developers, consultancies (i.e. the implementation partners, such as Accenture), user groups (such as Americas SAP User Group and SAP Svenska Användargrupp) and user organizations (probably key account customers). The interaction patterns between these stakeholders are of interest in understanding the development process of Enterprise Systems. This research area can be explored further, for instance, managing competing and conflicting requirements of key user organizations.

A second aspect of ISD research, which I find interesting, is related to the logic of information predetermination. I can intuitively understand the logic from the developers' perspective – *we know what the system can do, thus let us suggest which data and how this data should be processed.* However, this logic is in contrast to much of the intellectual thinking of the information systems discipline, for instance the socio-technical school, the Scandinavian tradition, and the trade union approach. The research question I would like to stress is how can the information systems discipline contribute and advance the existing COTS methods? Is it possible to develop COTS methods that incorporated, for instance, soft systems thinking?

The second main area is related to evaluation. The conclusion of Paper 7 stated that information systems evaluation should form the basis for action, i.e. do not measure if you cannot act on the measurement. Cameron and Whetten (1983) stressed the importance of posing critical question when assessing any form of effectiveness. This is closely related to the varying purpose of evaluation (Paper 7 and section 5.6). The research question could be formulated as: What is the purpose of evaluation of information systems? Another aspect of evaluation research I find interesting builds on the ideas of using narratives in information system evaluation. This could be explored along the following research question: How can narratives improve use and utilization of information systems?

The final area is related to the artifact. Enterprise Systems are likely to be the main corporate information system solution for the foreseeable future and research will be asked for. The area of research I would like to propose is related to the key characteristics of Enterprise Systems. The problem specifically is the pre-understanding of Enterprise Systems, from an

organizational perspective. The area of interest is related to one of the issues of Paper 4, namely the lack of understanding the organizational consequences of information system such as Enterprise Systems. This problem is not new. For instance, Walton (1989) concluded that:

> Information technology is revolutionizing how businesses operate. Indeed, advanced IT is becoming the single most powerful force shaping the structure and functioning of work organizations. But as managers across the country can verify, the revolution has not been without casualties: systems don't run the way they're supposed to.... What accounts for this situation...is management's failure to fully appreciate the interdependence of technology and organization (Walton, 1989).

Walton (1989) stressed the need of understanding the interdependency between IT and organization. The research addressing this issue can be formulated as: What are mangers preunderstanding of the organizational consequences of integrated and business process orientation imposed through the introduction of Enterprise Systems?

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Part Two

Appended papers

Paper I. Borell, A. & Hedman, J. (2000) CVA Based Framework for ERP Requirements Specification. Paper presented at the 23rd Information Systems Research seminar in Scandinavia, University of Trollhättan, Uddevalla.

Paper II. Hedman, J. (2003) Understanding COTS System Implementation Approaches and Methodologies: The Case of ASAP.

Paper III. Hedman, J. & Kalling, T. (2002) The Business Model: A Means to Comprehend the Management and Business Context of Information and Communication Technology. Paper presented at the tenth European Conference on Information Systems, Gdansk, Polen.

Paper IV. Hedman, J. (2003) Enterprise Resource Planning Systems: Critical Factors in Theory and Practice.

Paper V. Hedman, J. & Borell, A. (2002) The Impact of Enterprise Resource Planning Systems on Organizational Effectiveness: An Artifact Evaluation. In L. Hossain & J. D. Patrick & M. A. Rashid (Eds.), Enterprise Resource Planning: Global Opportunities & Challenges, Hersey, PA: Idea Group Publishing, pp. 78-96.

Paper VI. Carlsson, S. A. & Hedman, J. (2001) An Assessment of a Role-Based Information Portal. Paper presented at the Eight European Conference on Information Technology Evaluation, Oriel College Oxford, United Kingdom.

Paper VII. Hedman, J. & Borell, A. (to be published in 2004) Narratives in ERP Systems Evaluation. Journal of Enterprise Information Management (former Logistics Information Management). Vol 17, No. 3.

Paper I

CVA Based Framework for ERP Requirements Specification

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CVA Based Framework for ERP Requirements Specification

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Abstract

Enterprise Resource Planning (ERP) systems have an organizational impact and lead to organizational change. The goal with these changes is to increase organizational effectiveness. However, implementations have in some cases been associated with general information system problems. One such problematic area is requirements specification. This paper presents a competing values based framework for supporting requirements specification by enhancing communication between designers and users. With the framework it is possible to position ERP capabilities for different organizational processes. These are based on four different generic ERP subtypes, which are founded in human relations, open systems, internal process and rational goal organizational models and their competing value dimensions: structure, focus, and ends versus means.

Keywords: Competing values approach, ERP, requirements specification, effectiveness

1. Introduction

Enterprise Resource Planning (ERP) systems are important topics within Information systems and have been established as a generic label for application software packages or standard software, that are intended to support organizational processes. ERP systems do this by integrating information flows through a company (such as customer information, financial and accounting information, human resources information, and supply chain information) (Davenport, 1998) based on a "best business practice" reference model (Keller and Teufel, 1998; Kumar and Hillegersberg, 2000).

Despite the widespread adoption of ERP by business organizations (Joseph and Swanson, 1998), there is little academic research on ERP completed to this date (Shanks, 2000). However, there are numerous articles in business magazines, professional business books, and research publications from private research institutes.

The picture given is that there have been both successes as well as problems related to ERP and the implementation has impact on organizational culture, processes, strategies, and structures (Davenport, 1998).Thus, this article builds on the conclusion that most information systems knowledge is applicable to ERP. An important as well as problematic area in information systems development is requirements specification (Jackson, 1995; McGraw and Harbison, 1997), which is illustrated with the following quote:

"We have a tendency to focus on the solution, in large part because it is easier to notice a pattern in the systems that we build than it is to see the pattern in the problems we are solving that lead to the patterns in our solutions to them." (Ralph Johnson in Jackson, 1995 p. 2)

A solution to this is to develop methods that are based on management, organizational, and information systems models and theories (Carlsson, 2000) as well as reference models (Scheer and Haberman, 2000). This may support the implementation by enhancing communication between designers and users. The topic of this paper is a framework for ERP requirements specification.

This paper is organized in the following way. The next section describes benefits with ERP and associated organizational impact. The third section discusses approaches for implementing ERP in organizations. Section four follows with a presentation of competing values approach (CVA) and how CVA will form the basis for a requirements specification framework. The fifth section presents the framework and how it can be used, and the final section presents some conclusions and recommendations for further research.

2. ERP Benefits and Organizational Consequences

The attraction in ERP lies in that organizations have understood the value of integrating business processes (such as accounting, finance, and procurement) as well as integrating administration with operational processes (such as inventory management) (Taylor, 1999). Benefits from ERP include business process improvement, integration among business units, real-time access of data and information (Davenport, 1998), standardization of company processes, increased flexibility, increased productivity, increased customer satisfaction, optimization of supply chain, reduction of rework, business growth, improvement of order-to-cash time, competitive positioning ability, implementation of shared services, improved time to market cycles, and improved product quality (Cooke and Peterson, 1998). At the same time several ERP failures have been noticed, with devastating consequences for organizations (Davenport, 2000).

However, to achieve benefits from an ERP implementation it requires organizational changes (Van Der Zee and De Jong, 1999), which are prompted by business process reengineering (Bancroft et al., 1998), organizational transition to ERP, retraining of whole departments, job redefinition, procedures discarded or rebuilt from scratch (Deutsch, 1998), and transformation of core processes (Caldwell and Stein, 1998). ERP are often thereby assumed to be a deterministic technology, since organizations have to align their business process to the embedded business processes representing best practice, which are assumed to generate organizational change (Glass, 1998). However, this transformational power has been questioned (Boudreau and Robey, 1999).

These alleged organizational changes are similar to those that have captured information systems and management researchers interest, since Leavitt and Whisler's article (1958) "Management in the 1980", where every new technology or generations of technology have been accompanied with claims that organizations will be fundamentally altered (Robey and Boudreau, 1999). Early speculations predicted that organizations would use information technology to reduce middle management and centralize decision power (Leavitt and Whisler, 1958). This vision shifted in the 1980s towards a focus on autonomous knowledge workers and empowered workers (Dawson and McLoughlin, 1986) and during the latest decade there have been predictions of virtual organizations (Benjamin and Wigand, 1995).

In the following section ERP implementation will be discussed in order to give a background for the use of the proposed CVA based requirements specification framework.

3. ERP Implementation Approaches

A problem encountered in ERP implementation is that many individual users in organizations cannot participate in the requirements specification, due to time constraints (Nandhakumar and Jones, 1997) and due to the fact that ERP affects so many organizational members. This illustrates a change in the classical issue of the relationship between designers (designers refers to internal or external consultants) and users (refer to the user organization), where the general information systems literature recommends that users should be participate in the implementation process, e.g. project initiation, analysis, design, installation, and maintenance.

Of the over 1000 brand named information system methods and methodologies (Jayaratna, 1994) there are very few for application software packages (Davis, 1988; Nilsson, 1991). However, ERP vendors and ERP consulting firms support the implementation by providing designers and users with implementation methods, such as *Accelerated*SAP[1] (ASAP) by SAP AG and Method R/3 by Andersen Consulting.

ASAP is used as an example of implementation methods for standard software (Krichmer, 1998). ASAP incorporates knowledge and consulting practice from many implementation projects and in part from information systems literature (Buck-Emden, 2000). It is a computer-based project management and implementation method that comprises five phases: "Project Preparations", where project mission and scope are defined. "Business Blueprint" includes a complete and comprehensive analysis of requirements and business processes. "Realization", where the system is configured and tested. "Final preparation" includes transfer of data from the old systems and end user training. The "Go Live and Support" phase is when the actual installations take place (SAP, 1998). Each of the phases include a large number of tools and utilities to simplify the implementation, such as Concept Check Tool for handling data volume conflicts and Implementation Guide for supporting the configuration of the system (Buck-Emden, 2000).

The focus or goal of the method is on cost, time, and return on investment (Miller, 1998). This has to some extent been confirmed in a case study of four ASAP guided implementations, where change management and end user training were two areas found not to be sufficiently covered (Dolmetch et al., 1998). ASAP basically follows the stages in Systems Development Life Cycle (SDLC) (Hoffer et al., 1999), with the exception that ASAP phase

[1] *Accelerated*SAP is a trademark of SAP AG.

"Business Blueprint" comprises both SDLC requirements analysis as well as system specification and design, but in reverse order.

As stated previously, there are some differences between implementing a standard software and traditional software development. One of these differences appears to be the number of people using the system, another the fact that the systems are not "built to order" but rather bought "as is", with different levels of adaptability. Thus, the purpose of several steps in traditional software development changes, or even become redundant. So, it no longer appears meaningful to speak about user participation in the design process in a traditional fashion, because there is no design process as such. Instead there is evaluation of the reference model and the functionality imbedded in the ERP system considered, followed by a selection process. For each ERP system (or part of a ERP system[2]) considered, there are three basic options: accept, accept with changes, or reject - all with different organizational consequences. The accept option will lead to that organizations would align their business processes to the embedded ones. The "accept with changes" option may lead both to changes in the organization and the system. The last option will lead to a new evaluation process. These options should be considered compared to a requirements specification, which in turn has to reflect this. These differences are illustrated in table 1.

"Table 1: Differences in implementation. Users traditionally influence designers and thereby the system, implementation of standard software means pre-designed systems are installed in organizations."

Traditional	ERP
User	Designer
Designer	System
System	Organization

Thus ASAP can be described as technically oriented and the goal is to install the system in a user organization. ASAP may in some cases be useful, but it has some limitations. Since the method focuses to a too large degree on installing the system it is therefore not complete in generating suggestions for use of information technology for supporting organizations. This paper builds on the idea that the focus should be on organizations and their business and an ERP implementation method should address how organizational processes be supported, i.e. an effectiveness approach. The framework builds on the competing values approach (CVA), which will be presented in next section.

4. The Competing Values Approach

Organizational effectiveness[3] can be traced to early economic, accounting, as well as general management theories and is an important issue in Information Systems research (see for instance Checkland and Howell, 1999). Traditionally it has been defined as meeting or the surpassing of

[2] ERP systems are often constructed (or, at least perceived) as modular systems (Kumar and Hillegersberg, 2000)

[3] Effectiveness is used as an umbrella term for related concepts, such as efficiency and efficacy etc.

organizational goals (Bedeian, 1987). This goal approach towards organizational effectiveness is and has, despite criticism, been the dominating approach for studying organizational effectiveness (Hall, 1980). Criticisms have included organizations having multiple goals (Cameron, 1981), unambiguous criteria for measuring effectiveness (Meyer, 1985), and that organizations are rethinking their performance measures (Eccles, 1991). Thus, it is still difficult and potentially controversial to measure organizational effectiveness (Cameron and Whetten, 1983), which can be illustrated by a list of 30 different criteria for organizational effectiveness, ranging from productivity and profits to growth (Cambell, 1977). With regard to this CVA is especially notable, since it combines diverse indicators of performance and has developed to an accepted methodology for assessing overall organizational effectiveness.

CVA is based on the finding that most measures of effectiveness reflect one of four organizational models: human relations model (HR), open systems model (OS), internal process model (IP), and rational goal model (RG) (Rohrbaugh, 1981; Quinn and Rohrbaugh, 1983). The four models provide competing views on the meaning of organizational effectiveness. Human relations model is characterized by a focus on internal flexibility to develop employee cohesion and morale and stresses human resource development, participation, and empowerment. Open systems model is characterized by a focus on external flexibility and relies on readiness and flexibility to gain growth, resource acquisition, and external support. Internal process model is characterized by a focus on internal stability and uses information management, information processing, and communication to develop stability and control. Rational goal model is characterized by a focus on external control and relies on planning and goal setting to gain productivity. CVA also incorporates three fundamentally paradoxes found in the litterateur; flexibility and spontaneity vs. stability and predictability (related to organizational structure); internal vs. external (related to organizational focus); and means vs. ends. These paradoxes reflect underling competing value dimensions (Buenger et al., 1996; Quinn and Rohrbaugh, 1983; Quinn, 1988). Based on the four organizational models (HR, OS, IP, and RG) and competing values dimensions two organizational processes are defined for each model, see figure 1.

- For HR they are facilitating and mentoring. Facilitating includes teambuilding, building trust and moral in the organization, and conflict management. Mentoring includes engagement in the development of personal by listening and being supportive, communication internally, developing individual plans, giving feedback to individuals and groups, and developing management skills.

- For OS they are innovation and brokerageing. Innovation includes interaction with the external environment, identification of major trends, business intelligence, developing mental models, and facilitates changes, and R & D. Brokerageing includes communication with the environment, identification of problems, influencing the environment, maintaining external legitimacy through a network of external contacts, profitability analysis, and acquisition of valuable resources.

- For IP they are auditing and coordination. Auditing includes collection of data, mainly internal and quantitative information used to check organizational performance, enhance the understanding of activities, and ensure that standards, goals, and rules are meet. Coordination includes maintaining organizational structure and workflow of the

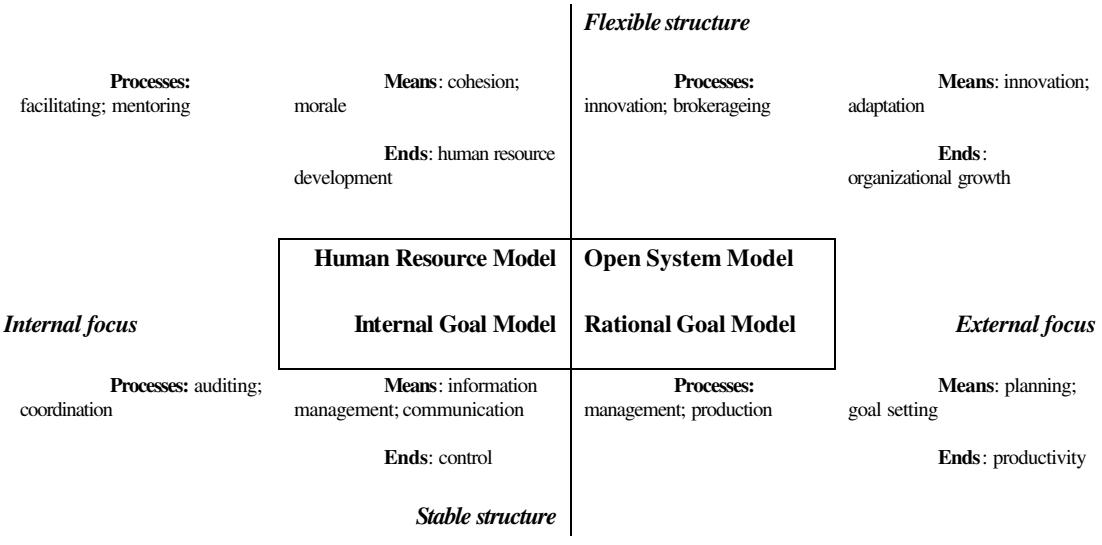
organization, coordinating activities, as well as collecting and distributing information.

- For RG they are management and production. Management includes clarification of expectations, goals and purposes through planning and goal setting, defining problems, generating and evaluating alternatives, generating rules and polices, evaluation of performance, and decision support. Production includes quality control, motivation of organizational members to enhance productivity, sales support, efficient production, and profit maximization.

A critical point to note is that while certain pairs of effectiveness criteria reflect competing organizational values, they are not dichotomies. To be effective may require that organizations are both flexible and stable as well as having an internal and external focus at the same time (Quinn and Cameron, 1988).

A point that should be made regarding CVA is that at least two important factors for studying organizational effectiveness are not taken into account, namely time frame (Quinn and Rohrbaugh, 1983) and level of analysis (Quinn, 1988). Time frame refers to the fact that criteria for measuring organizational effectiveness may vary on whether a relatively shorter or longer time frame is adopted and that organizational are in different stages in their life cycle, and that criteria various in different life cycle. Level of analysis refers to micro and macro levels will to a large extent affect the relative organizational effectiveness criteria, e.g. individuals, group or entire organizations.

"Figure 1: A summary of the competing values approach and organizational process,. Source: based on Quinn and Rohrbaugh (1981; 1983)"



Based on the CVA framework four generic ERP subtypes were defined; each reflecting different capabilities of software packages linked to different organizational models and their competing values. The four generic ERP subtypes are:

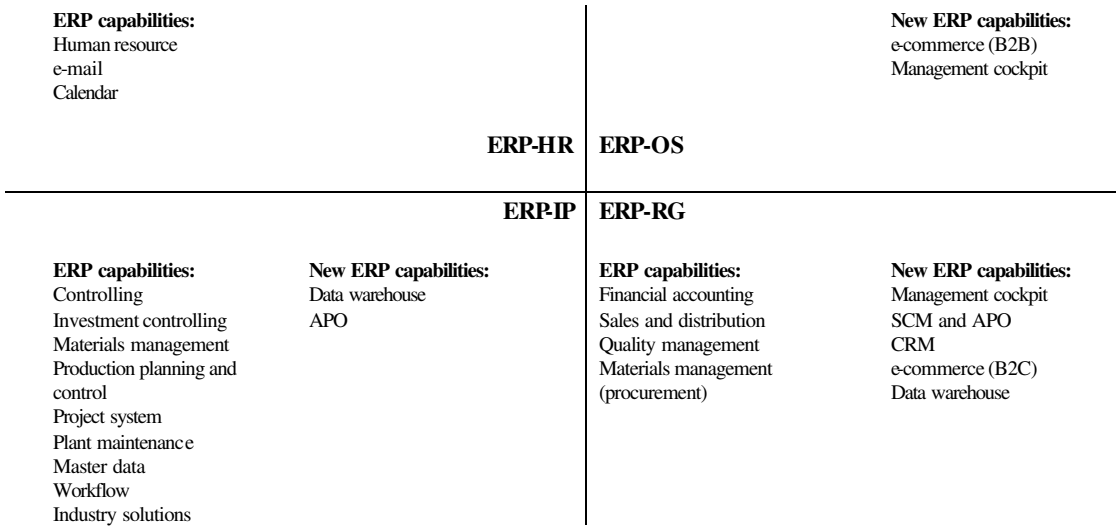
- ERP-HR is the first subtype and helps an organization in the development of the human capital. ERP-HR capabilities and features of importance are e-mail, voice mail, and videoconferencing. These technologies may be used to overcome distance and time. ERP human resource modules do support individual planning, training, and career planning and ERP do include both e-mail and calendar functionality.

- ERP-OS is the second subtype and has an external focus and an emphasis on structural flexibility. This supports an organization in identifying problems and possibilities by supporting environmental scanning, issue tracking, and issue probing. Environmental scanning may be quantitatively or qualitatively oriented and may include industry and economic trends, legislative issues, competitor activities, new product and process development, and patents. ERP usually do not support ERP-OS in a sufficient way. This tends to be ERP weakest spot, they are too structured and have too much of an internal focus. However some new ERP capabilities support the ERP-OS, such as e-commerce (B2B) and management cockpits.

- ERP-IP is the third subtype and has an internal and control emphasis. It supports the internal process model and the associated organizational activities, functions, processes, and tasks. From an organizational performance perspective the objectives is to provide user-friendly support for auditing and control. ERP is replacing traditional legacy systems, such as accounting systems and production systems. ERP capabilities for supporting ERP-IP include: controlling, investment controlling, material management (stock inventory), plant maintenance, production planning and control, project system, workflow, master data (refers to the work of creating master data records for e.g. customer, vendor, and material etc), and industry solutions (refers to predefined business processes benchmarked for a specific industry, such as banking, public sector, oil and gas). Newer ERP capabilities are Data warehouse and Advanced Planning Optimizer).

- ERP-RG is the last subtype and has an external and control emphasis. This should support organizations in handling semi-structured problems, sales as well as procurement and logistics. Capabilities and features found in traditional Decision Support Systems, such as goal setting, forecasting, simulations, and sensitivity analyses, are available in some ERP, but in a rudimentary way. Other ERP capabilities include: financial accounting, sales and distribution, quality management, materials management (procurement). Newer capabilities include: CRM (customer relationship management), SCM (supply chain management), e-commerce solutions (B2C), and management cockpit.

"Figure 2: A summary of the framework generic ERP subtypes and ERP capabilities."



4.1 Real case use

In a real case implementation an assessment of the current situation and description of future state would involve formal and non-formal methods and techniques by using different instruments (see for example Camron and Quinn, 1998). With instruments it is possible to assess if organizations perceives their processes as the effective or not as well as if the processes are important or not for the organization. The framework would here be complemented with, for example the "competing values organizational effectiveness instrument" (Quinn, 1988) - this instrument measures perceptions of organizational performance. Other formal and "non-formal" methods and techniques may also be used in order to understand the current situation (Watson et al., 1997). The results should also be presented to the organization, in order to enhance communication with designers and users in the organization, as recommendation concerning how the organizations should align their ERP system to important processes and how to change competing values as well as defining how the ERP system should support different processes in the future.

If there is a good fit between the current situation and the desired situation this means that there is no need for a new ERP. The result can still be used for discussing the design of an existing ERP, but the primary purpose of the ERP would be to improve the effectiveness - the ERP will primarily reinforce and improve the current state. If there however is a misfit between the current situation and the desired situation or there is a misfit between current support and desired support, then there is an opportunity to implement an ERP. In this case the ERP will be used as a means (tool) for focusing organizational attention and learning as well as a means for organizational change.

5. Conclusions and Further Research

The framework is presented as a tool for supporting requirements specification in ERP implementation and builds on the competing values approach. The purpose of the framework is to support the implementation by enhancing or enabling a better communication between designers and users. This is achieved by using the framework for discussing organizational impact, from an effectiveness perspective, caused by organizational change or alignment to the system. The focus is on supporting organizational needs, motivated by organizational effectiveness. The framework has thereby positioned itself against the technical orientation in standard software implementation methods, such as ASAP. The framework has been developed using management, organizational, and information systems models and theories as well as reference models, but it has not yet been used in a real case.

During the actual design of the framework one ERP example have been used, as a test bed. The usefulness of an example is the availability of descriptions of how ERP may support different organizational processes, i.e. reference model and the system functionality. A notion should be made here regarding the example: How a business should be organized and what use information technology has for that firm is based on how that vendor perceives this.

The proposed model has several characteristics making it useful. It is related to a critical construct: organizational effectiveness. The model stresses support of organizational processes and not just as an information system that supports organizations by integrating all information flows. It has a paradox and complexity perspective, which has been pointed out as necessary in information systems research and practice (Robey and Boudreau, 1999). The overall contingency approach makes it possible to evaluate an ERP in context. Hence, the model stresses that not all ERP are equally effective in a specific context.

Other remarks are that research has suggested that there are changes in the criteria of effectiveness in an organizations life cycle (Quinn and Rohrbaugh, 1983) and changes can be found with regard to different organizational levels (Quinn, 1988). Implications of these findings are that the importance and criticality of effectiveness criteria and organizational processes will vary over time as well as between organizational levels. This knowledge can (and should) be used in the implementation of an ERP. We believe that using CVA enhance the ability to see both patterns in the organization and in the solutions selected, thereby avoiding some (but not all) of the problems related to information system implementation.

Research in the future will include empirical studies needed to validate the usefulness of the framework. Future research will also include the development of tools taking the requirements specification and specify ERP characteristics and capabilities. Future research might lead to a development of the framework to an overall method for ERP appraisal, implementation, and evaluation.

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Understanding COTS System Implementation Approaches and Methodologies: The Case of ASAP

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ABSTRACT

The paper offers a paradigmatic analysis of the COTS system implementation method. The case analyzed is AcceleratedSAP™ (ASAP), which has been developed to support the implementation of the market-leading Enterprise Resource Planning system - R/3. The analysis is based on Iivari's (1991) paradigmatic framework for analysing the underlying assumptions of ISD approaches. The paper stresses the inherent view of information requirements and the results of the analysis show similarities between contemporary ISD approaches, such as the infological approach, information modelling and the socio-technical approach, with regard to its view on ontology, epistemology, research methodology and ethics. The main difference between ASAP and ISD approaches is the inherent view of information requirements, which can be summarised as information predetermined.

Introduction

The number of information systems development approaches (ISDAs) and methodologies (ISDMs) is increasing. According to Jayaratna (1994), there are more than 1,000 ISDMs, and Avison and Fitzgerald (1995) describe the situation as a "*methodology jungle*". This paper addresses a type of ISDA which supports the development and implementation of COTS systems (Commercially off the Shelf) in user organisations. The term COTS approach denotes this type of ISDA. Instances of COTS approaches, i.e. specific COTS methods, thus labels as COTS methodologies or methods. COTS methods are, in most cases, developed by practitioners, such as software providers or consulting firms, with the specific goal of implementing an information system (IS) (Maiden and Ncube 1998). There are COTS methods developed by researchers, for instance the SIV method (Standardsystem I Verksamheter – COTS in Business, trans.) (Anveskog, Järperud, Lundeberg, Melin and Nilsson 1983; Anveskog, Nilsson and Nord 1984; Nilsson 1991).

IS researchers have been criticized for not paying enough attention to the artifacts (Orlikowski and Iacono 2001) and not critically reflecting and challenging the approaches used in the development of IS (Iivari and Hirschheim 1996). Critically reflecting and challenging ISDA/M can lead to better understanding of the underlying assumptions embedded in ISDA/M which affect the ISD process and the IS (Iivari, Hirschheim and Klein 1998). The assumptions affect the choices with regard to the analysis, design and implementation alternatives and, in the long run, the organization (Iivari and Hirschheim 1996; Iivari et al. 1998). It is of critical importance to understand the underlying assumption in ISDA for research, education and practice (Iivari 1991).

The interest in COTS systems and COTS approaches and methods originates from the large-scale adoption of Enterprise Resource Planning (ERP) systems (Davenport 2000; Hitt, Wu and Zhou 2002; Kumar 2002; Robey, Ross and Boudreau 2002), even though COTS methods existed prior to ERP systems. ERP systems are, in most cases, COTS systems and are offered by ERP system vendors, such as SAP, Oracle, JD Edwards or PeopleSoft, who also provide implementation methods (Markus and Tanis 2000), such as ASAP from SAP, Implex from Intentia and JD Edwards One/Methodology from JD Edwards (Rashid, Hossain and Patrick 2002). These methods are used to adapt and implement the system in the acquiring organization (Markus and Tanis 2000). The adaptation of ERP systems is commonly referred to as configuration and can be compared to analysis, design and realization in traditional ISD; but the process is different to the development of IS from scratch (Borell and Hedman 2000; Rosemann 2001). However, little research has been carried out on COTS systems or COTS approaches. Even calls for such research have been made for over a decade (Davis 1988). This paper attempts to contribute to the understanding of ISD by analyzing the underlying assumptions of one COTS method. The analysis is based on Iivari's (1991) analytical framework and includes epistemology, ontology, methodology, and ethics of ISDA and later contributions, such as Iivari et al. (1998). The justification of applying Iivari's (1991) framework is that it builds on a research tradition focusing on improving the understanding of ISD and it enables comparison to previous research on "*contemporary*" (Iivari 1991) approaches and "*contrasting*" (Iivari et al. 1998) approaches.

The plan of the paper is as follows. The following section provides a background to and a review of research on the evaluation of ISDA leading up to the applied analytical framework. In section three, the research approach is presented followed by a description of ASAP. The fifth section presents the results of the analysis, which are followed by a discussion and limitations. The final section summarizes the results and provides suggestions for further research into COTS methods.

Background and literature review

The history of ISD reaches back about 60 years. Initially, there was no support for formal methods, but gradually practitioners began to develop and utilize methods. The purpose of ISDM is to improve the process of developing and implementing ISs and in due course increase the quality of the IS (Jayaratna 1994). The development of ISDMs is an incremental process. For instance, Information Engineering (IE) followed database technology while Object Oriented programming was followed by Object Oriented development methods (Wohed 2000). The diversity and innovation of ISs leads to an increased number of ISD methods and the continuous development of existing ones. For instance, Vigden (2002) enhanced Multiview for Internet-based ISs and the development of COTS systems has led to COTS approaches and methodologies (Nilsson 1991). Researchers' assumptions about the role of ISs in organizations have led to proposals for ISDAs (Iivari and Hirschheim 1996). For instance, ISDA such as the trade unionist approach initially and the infological approach are based on researcher's different assumptions (Iivari and Hirschheim 1996).

COTS methods remain unexplored in ISD research; see for instance (Iivari 1991; Iivari and Hirschheim 1996; Iivari et al. 1998; Iivari, Hirschheim and Klein 2001), where they have not been reviewed, even though they are commonly used in practice (George 2000). However, the issues of building or buying have been discussed. The term COTS is used mainly by British researchers (see for instance Maiden and Ncube 1998). In North America, the terms application package or software package are more commonly used (George 2000). In Sweden and Germany is the term 'standardsystem' used to denote COTS systems, e.g. Nilsson (1991), and Kirchmer (1998).

The analysis and validation of ISDM is limited (Nilsson 1991), but interest has increased (Nielsen 1990; Iivari 1991; Iivari et al. 2001). One of the first contributions was Taggert and Tharp (1977), according to Nielsen (1990). This was followed by, among other things, three conferences about Cooperative Review of Information Systems Design Methodologies in 1982, 1983 and 1986. The result of these conferences is a framework for comparing ISD methods (Olle 1991). Others have investigated the assumptions and purposes inherent in ISDA/M, which is the focus of this paper. For instance, Wood-Harper and Fitzgerald (1982), Nielsen (1990), Iivari (1991), Jayaratna (1994), Avison and Fitzgerald (1995), Iivari and Hirschheim (1996), Iivari et al. (1998) and Iivari et al. (2001) have all contributed to the understanding of ISDA/M. Table 1 presents some contributors and the analyzed ISDA/M. Several of the terms used in Table 1 resemble each other. The authors have used different terms to denote the approaches. For instance, SASS (Structured Analysis and Specification) in Jayaratna (1994) is labeled as the Structured Systems Analysis

Table 1 ISDA/Ms in the reviewed material.

Wood-Harper and Fitzgerald (1982)	Iivari (1991)	Jayaratna (1994)	Iivari et al. (1996)	Iivari et al. (1998)
General System Theory approach	Software engineering	SASS	Information Modeling	Interactionist approach
Participative approach	Database management	ETHICS	Decision Support System	Speech act approach
Human Activity Systems approach	Management information systems	SSM	Socio-technical approach	SSM approach
Traditional approach	Decision support systems		Infological approach	Trade unionist approach
Data Analysis approach	Implementation research		Interactionist approach	Professional work practice approach
Structured Systems Analysis approach	Socio-technical approach		Speech Act-based approach	
	Infological approach		Soft Systems Methodology	
			Trade Unionist approach	

approach in Wood-Harper and Fitzgerald (1982). ETHICS in Jayaratna (1994) is described as the Human Activity Systems approach in Wood-Harper and Fitzgerald (1982) and socio-technical in Iivari (1991) and Iivari et al. (1996).

Wood-Harper and Fitzgerald (1982) have developed a classification schema for ISDAs. They used 1) the underlying paradigm (specific way of thinking about problems which are acknowledged as the foundation for further practice (science/system)), 2) the conceptual model (refers to a subjective representation of reality which is implied in each methodology), and 3) objectives (analysis/problem solving) in their classification of ISDAs. The conclusion of Wood-Harper and Fitzgerald was that ISDAs are best understood in terms of their paradigm, conceptual model and objectives. This framework was later developed by Avision and Fitzgerald (1995) to comprise seven elements including: 1) philosophy (paradigm, objectives, domain, target), 2) model, 3) techniques, 4) scope, 5) outputs, 6) practice (background, user base, participants), and 7) products.

Jayaratna (1994) presents an approach to analyze and evaluate ISD. This approach is based on Soft System Methodology (SSM) and is labeled NIMSAD framework (Normative Information Model-based Systems Analysis and Design).

This framework is quite different from the previous one, since it is based on Soft System Methodology or the Human Activity Systems approach (Checkland and associates). This framework takes an ontological and epistemological standpoint, which the other ISD evaluation frameworks do not. In that sense, this framework is not value-free. The framework is general and can be used to understand any ISD method (Jayaratna, 1994). Three ISDM are analyzed, including SASS, ETHICS and SSM. The NIMSAD framework showed differences between the analyzed methods. For instance, the three methods address the design of the solution, but none of them provide any steps or procedures for implementing the solution. SSM emphasises the problem formulation, which the others do not address. The focus of the methods is also very different. SASS is task-driven and focuses on data related to task activities. ETHICS, on the other hand, is process-driven and focuses on involving people. SSM focuses on ill-structured problems and is thereby classified as issue-driven.

Iivari (1991) presents a paradigmatic analysis of seven contemporary ISD approaches or schools of thought, including software engineering, database management, management information systems, decision support systems, implementation research socio-technical and infological approaches. The paradigmatic analytical framework is based on the distinction between ontology, epistemology, methodology, and the ethics of research. The framework is summarized in Table 2. The ontological dimension consists of five levels; according to the view of 1) data/information, 2) data/information systems, 3) human beings, 4) technology, and 5) organization and society. Epistemology relates to knowledge and how this can be obtained. This dimension is based on Burrell and Morgan's (1979) distinction between positivism and anti-positivism, i.e. the nature of scientific knowledge. Methodology addresses the preferred research method of improving the ISDA. Three categories are used to distinguish between research approaches, including idiographic research methods (e.g. case studies and action research), nomothetic research methods (e.g. formal-mathematical analysis, experiments, field studies and surveys) and constructive research approaches (conceptual development and technical development). The two first research approaches (i.e. idiographic and nomothetic) are based on Burell and Morgan's (1979) illustration of two extremes in research. Constructive research methods on the other hand take into account the fact that IS science is also an applied science. In a later paper, Iivari et al. (1998) derive the constructive research approaches to Simon's work on the "*Science of the Artificial*" (Simon 1996). Ethics of research distinguishes between the role of IS research (means-end oriented, interpretative, and critical as potential roles) and its value (organization/management, end user, and others). The study showed great similarities between the seven approaches. The ontological dimension showed the greatest diversity. The seven contemporary ISD schools viewed IS mainly as a technical system. Data and information is descriptive facts. Viewing

Table 2 Summary of the paradigmatic framework, based on Iivari (1991).

Dimensions	Ontology	Epistemology	Methodology	Ethics role of IS research and values	
Level 1	The view of data and information	Positivism	Constructive research methods Conceptual and technical development	Means and end oriented	Organization/ Management
Level 2	The view of data and information system	Antipositivism	Nomothetic research methods Formal-mathematical analysis Experiments Field studies and surveys	Interpretative	End user
Level 3	The view of human beings		Idiographic Case studies Action research	Critical	Other
Level 4	The view of technology				
Level 5	The view of organization and society				

organizations in a structuralistic way and applying a positivistic epistemology. Using nomothetic and constructive research methodology to improve the approach and embracing a means and end oriented research ethics emphasizing organizational and management values.

Iivari and Hirschheim (1996) builds upon Iivari (1991) and studied two underlying ontological assumptions in eight ISDAs: information modeling, the decision support system, the socio-technical approach, the infological approach, the interactionist approach, the speech act-based approach, soft systems methodology, the and trade unionist approach. In comparison to Iivari (1991), Iivari and Hirscgheim (1996) focus only on one dimension of the paradigmatic framework. The first four approaches represent an old and established tradition while the four latter ones represent new ISDAs. The first assumption addressed is the perceived role of ISs in organization, i.e. the relationship and function of an IS within its context. The organizational role of the IS was further divided into three dimensions: technical (T), socio-technical (ST) and social (S). The technical view regards the IS as a technical artifact with well-defined input and output interfaces. The social view, on the other hand, primarily sees the IS as an organizational and social system, i.e. an integrated part of the whole. The socio-technical perspective regards an IS as an interdependent subsystem. The other assumption addressed what constitutes information requirements. The

Table 3 Orientation of ISDAs, based on Iivari and Hirschheim's (1996) tables four and five.

Methods	Organizational role			Information requirements		
	T	S-T	So	O	Su	I
Information Modeling	***		*	***	**	*
Decision Support System	***		*	**	***	
Socio-technical approach		***		***	*	
Infological approach	**	**	**	***	*	
Interactionist approach			***			
Speech Act-based approach			***	**		***
Soft Systems Methodology	**		**	**		**
Trade Unionist approach	***		*	**	*	**

T=Technical, S-T=Socio-technical, So=Social, O=Objectivism, Su=Subjective, I=Intersubjective
Note:*** Strong orientation, * Weak orientation

information requirements category contained objectivism (O), subjective (S), and intersubjective (I). Objectivism refers to the impersonal features, e.g. task position and organizational role. The subjective view, on the other hand, sees information requirements as personally based on the user's characteristics. The intersubjective view applies an emergent perspective of information requirements. In their analysis of the eight approaches, they used material from textbooks based on Kuhn's idea that books are important manifestations of existing paradigms. A summary of their findings is shown in Table 3. The first two traditions, i.e. information modeling and the decision support system, apply a mechanistic view of technology. The social-technical school views the IS as a social-technical system, whereas the infological approaches apply a combination of the three. The so-called new approaches emphasize the social nature of ISs. The view of information requirements did not provide the same variety of views. One of their conclusions was that new ISDAs have different sets of assumptions than the old ISDAs.

A fourth analysis of ISDAs is Iivari's et al. (1998) paradigmatic analyses of five contrasting ISDAs. These include the interactionist approach, the speech act approach, the soft system methodology approach, the trade unionist approach, and the professional work practice approach. The selection of these five approaches was justified by the fact that they assumably reflect different paradigmatic assumptions than the contemporary approaches analysed by Iivari (1991). Support for this hypothesis was also provided by the analysis. Iivari et al. (1998) based their analysis on Iivari's (1991) paradigmatic framework. The result of their analysis is presented in Table 4 and shows clearer differences than the contemporary ISDAs analysed by Iivari (1991). Lately, Iivari et al (2001) presented a four-tiered dynamic framework for classifying ISDA/M. These four levels are paradigm, approaches, methods, and techniques.

Table 4 Summary of the analysis presented by Iivari et al. (1998) and Iivari (1991).

	ISD approaches					
	Interactionist approach	Speech act based approach	Soft System Methodology	Trade unionist methodology	Professional work practice	Contemporary approaches (Iivari 1991)
Ontology	Social	Socio-technical	Socio-technical	Technical	Social technical	Technical view wherein data and information are descriptive facts
Epistemology	Positivist	Antipositivism	Dualistic	Positivist	Mostly antipositivism	Positivism
Research methodology	Idiographic, case studies	Nomothetic	Conceptual development and action research	Conceptual development, case studies and action research	Conceptual development and case and action	Nomothetic and constructive
Ethics	Interpretive	Means-end	Means-end and interpretive	Critical	Means-end	Means-end

There are differences between the ISDAs analyzed with regard to their ontological, epistemological, preferred research approaches and ethics preferences. Nevertheless, there is one common factor in the above-mentioned methods and approaches; they are all designed for scratch development - in-house or by an external party. The methods and approaches assume that ISs are

developed from scratch. The interactionist approach is excluded, since it has not yet been operationalised into methods for ISD (Iivari et al. 1998). The recent development and increased importance of COTS systems and the subsequent COTS approaches and methods have not yet been analyzed.

Research Method

Iivari and Hirscheim (1996) and Iivari et al. (1998) state that the best unit of analysis for ISD is the ISDA and not the ISDM, since the approach level conveys the essential characteristics or features of its instances. This makes it possible to analyze ISD independently if they are operationalised as methods or not.

COTS approach is not yet defined, thus we had to select a COTS method as an example or illustration of COTS approaches. The selection of a COTS method presented several difficulties. Firstly, most COTS methods are the proprietary products of vendor firms, e.g. SAP AG, Bann, Oracle and Accenture. Consequently, it is difficult to get hold of information about these methods.

Secondly, the research-based COTS methods are poorly documented e.g. PORE (Procurement Oriented Requirements Engineering) (Maiden and Ncube 1998). One exception is the SIV method. However, to our knowledge, this method is only applied in a Swedish context, which limits its practical relevance. In addition, the SIV method is mainly an acquisition framework and does not support configuration, which is a central task in COTS system implementation (Hedman and Borell 2000). Moreover, the SIV method builds on the infological approach (Langefors 1966) and its instance – ISAC (Lundeberg, Goldkuhl and Nilsson 1979; Lundeberg, Goldkuhl and Nilsson 1979). Another example of COTS method is the BIS (Business process oriented Implementation of Standard software) procedure model (Kirchmer 1998). BIS is the implementation method used by IDS Scheer – a German consulting firm, best known for its process modeling tool ARIS Toolset. This method integrates the conceptual thinking of Architecture of Integrated information System (ARIS) (Scheer 1998) and views the implementation of COTS systems as the introduction of a "*standard reference model*". Besides Krichmer (1998), other publications related to BIS are in German and, unfortunately, we have a language barrier here.

Iivari and Hirschheim (1996) justified their choice of ISDA based on the institutionalization of the ISDA in the scientific community. The degree of was based on the first three of Kuhn's (1970) criteria of institutionalization assessment: the existence of scientific journals, scientific conferences, textbooks, professional associations, informational and formal communication networks, and citations. The SIV method does meet one of the criteria, namely textbooks (Anveskog et al. 1983; Anveskog et al. 1984; Nilsson 1991; Nilsson 2000). One of the few vendor-developed COTS methods addressed by the research community is ASAP (Dolmetsch, Huber and Fleisch 1998; Borell and Hedman 2000; Rosemann 2001; Esteves, Chan, Pastor and Rosemann 2003) and is widely described in textbooks (Bancroft, Seip and Sprengel 1998; Hiquet and Kelly 1998; Miller 1998; Hernandez, Bueno, Servera and Elechiguerra 1999; Jacobs and Whybark 2000). In addition, there are professional associations promoting ASAP and there are newsgroups representing informal networks. ASAP is one of the few COTS methods which meet several of Kuhn's institutional assessment criteria.

The applied research method is literature and method analyses with the goal of uncovering the underlying assumptions in ASAP. In order to be able to compare the result of the analysis with previous work, we have chosen to apply the same methodological approach as Iivari (1991) and Iivari et al. (1998). The chosen research approach include three presumptions: 1) the COTS method is viewed as an artifact; 2) the artifact in forms of books and the actual methodology reflect the underlying assumptions that guided the design of the method; 3) by performing careful text analysis it is possible to infer those assumptions (Iivari et

al. 1998). To complement their approach, we have placed more emphasis on the ontological dimension and in particular the view on information requirements. This is based on Iivari and Hirschheim (1996). Following Iivari and associates, we have chosen textbooks (such as Hernandez et al. 1999; Hiquet and Kelly 1998; Jacobs and Whybark 2000; Keller and Teufel 1998) and the actual methodology (SAP 1998; SAP 1999). SAP (1998) is the official training material to become a certified ASAP consultant and SAP (1999) is the method packaged on a CD. The two sources, one a vendor product and professional textbooks are not the best choice from an analytical perspective. The point that Iivari and Hirchheim (1996) stressed was that the old established educational textbooks include "*theory in use*", due to the continuous development of educational material. However, in our case, the material only represents an "espoused theory", since it is not likely that the text books reflect actually use. The terms "*theory in use*" and "*espoused theory*" stem from Argyris and Schon (1974). Besides this limitation to our choice, there are arguments in favor of the selected method. First of all, it is well established on the market as regards implementing a market leading COTS system. Secondly, it is used in education via the university alliance program between SAP and about 400 universities around the world. Thus, the method has both practical and educational relevance.

The Case: AcceleratedSAP

In this section, we will be providing a review of ASAP, including a brief historical overview and a description of its phases. In addition, current research on ASAP is briefly reviewed.

The ASAP implementation methodology was introduced in 1996 with the specific goal of reducing the time to implement R/3 (Miller 1998). The previous, and to some extent competing implementation method Procedure Model, was introduced in 1995 and included four phases (organizational and conceptual design, detailed design and system setup, preparations for going live, and productive operations) with three levels of detail (project phases, work packages, and project activities). Hernandez et al. (1999) present the main differences between the two implementation methods. These are depicted in Table 5. The main difference between the two methods is that the Procedure model has a stronger focus on reengineering, whereas ASAP is more focused on short implementation projects. This is expressed as "*the absence of Business Process Reengineering*" (Hiquet and Kelly 1998, p. 18). The procedure model more resembles traditional ISD than ASAP. For instance, the focus on reengineering and the adaptation of the system to firms' requirements illustrate this. ASAP was initially developed by SAP AG's American subsidiary and is based on best practice by a number of implementation projects in the USA (Hernandez et al. 1999). There had been many customer complaints regarding the long

Table 5 Characteristics of the Procedure Model and ASAP, based on (Hernandez et al. 1999).

Name	Procedure Model	ASAP
Characteristics	Developed in Germany by the parent firm	Developed by the American subsidiary
	Integrated with R/3	Independent software tool
	High level of description	More detailed activities and tasks
	Four phases	Five phases
	Includes project management	External project management via MS Project and Excel
	Support online and via hypertext	Support via documents, templates, tools, presentations, models and databases
	R/3 Reference Model	R/3 Business Engineer, which includes R/3 reference model
	Implementation support	Lifecycle support
	Extensive reengineering	Limited reengineering
	Long implementation time	Short implementation time

implementations. Dolmetch et al. (1998) studied the implications of ASAP in four implementation projects. They concluded that the strength of the method lies in forcing companies to focus on essentials, on keeping implementation projects on time and within budget, on control of the projects organization, and on managing documentation. Two key areas were found to be insufficiently supported, including end user training and change management. Esteves et al. (2003) discusses required knowledge types along ASAP and Rosemann (2001) highlights problems when configuring R/3.

The ASAP method is packaged as an independent software application with connections to the IMG in R/3. IMG stands for Implementation Guide, which is used to configure the system. The ASAP software comprises four components the ASAP Implementation Assistant, the SAP R/3 Concept Check Tool, the Question and Answer (Q&A) database, and the ASAP Administration Tool. The administration tool is used to create and manage the projects and the users of ASAP. The concept tool is used to test and verify the system and the implementation project. The Q&A database is used to organize and document requirements. The implementation assistant structures and organizes the project, by stipulating what tasks are to be performed and when, as well as by whom.

The methodology consists of five phases presented as a roadmap. The roadmap only contains one road, making navigation much easier, but there are checkpoints:

Phase I. Project Preparations provide assistance in the initial planning and preparations for an R/3 project. This involves defining the project, specifying the scope, deciding on an implementation strategy, specifying the project schedule and sequence of implementation, establishing the project organization and steering committees, and assigning resources.

Phase II. The Business Blueprint is the requirements specification phase during which detailed documentation is gathered in from workshops. The Q&A database supports the creation of the Business Blueprint, documenting the business requirements and identifying the scope of the project. The Business Blueprint covers, for instance, business strategy, organizational structure, general settings, master data, and the documentation of business processes. The goal is to create a common understanding of how to run the business with R/3.

Phase III. Realization involves configuration of the system using guidelines decided in the Business Blueprint. Testing the system is important during this phase. Configuration is done in a two-step procedure. Initially, baseline configuration is done, which involves general configuration options, e.g. global settings such as currencies master data, the most important processes and the organizational structure. Final configuration involves configuring other processes, printing options, and background processing.

Phase IV. Final preparation mainly includes testing the system and end-user training on it. Loose ends from previous phases are also dealt with during this phase. The future system administration is set up and stress tests are performed.

Phase V. The Go Live and Support phase is when the actual installation takes place and the system comes into use. Initially, support for the users is essential since most problems are likely to arise at the beginning. The long-term goal is to optimize the system.

Each of the phases includes a large number of tools and utilities for simplifying work. The hierarchy of the methodology is that each phase includes a group of work packages, which are divided into activities consisting of groups of tasks that have to be completed. In some cases, the activities are structured into six hierarchical levels. Most of the activities are supported via Word, Excel, and MS project documents and files. For instance, there are documents for convening a start-up meeting including whom to invite and to organize a kick off meeting.

Result of the analysis

The assumptions of embedded into ASAP, related to its ontological, epistemological, research methodology, ethics, and view of information requirements, are presented and discussed in the following paragraphs.

In relation to the ontological position ASAP's view of data and information as descriptive facts. This is expressed in the method as references to the R/3 reference model. The reference model includes the conceptual design of R/3 (including process models, organizational models and data models) and

descriptions of data objects with their attributes and relationships. This is a reflection of a descriptive view of data and information, since the method takes for granted, and even presumes, what data and information are. It is a similar view to most of the contemporary ISDAs analyzed by Iivari (1991), see Table 4 last column. Information modeling approach as described in Iivari and Hirschheim (1996) show the strongest resemblance to ASAP in relation the view of data and information. A possible explanation for this is the strong link between R/3 and ARIS (Scheer 1998). The view on information requirements are further explored at end of this section.

The view of IS (technical versus organizational/social system), does ASAP not explicitly define. Implicitly, ASAP assumes the existence of one and only one IS, namely R/3 – thus there is no need for any other IS. This conclusion is based on a reversed logic, since there are no references to other ISs there is no need for other IS. The view of IS a technical view with organization implications. The implication of this is that the methods assumes that the organization is adapted to the system and the role of the ASAP is to support the organizational adaptation. ASAP express this as "*moving from an existing system and way of doing business to using R/3 to run the entire, or a part of, the business.*" The role and importance of ASAP is implicitly questioned by (Hernandez et al. 1999). They state that "*most of the methodologies … are good … most important to the project success is that the project manager and consultants working in a methodological framework are experienced and capable*". ASAP, on the other hand, defines how to succeed with R/3 implementations thus: 1) full commitment by the entire organization, 2) clearly defined and consistent project scope, 3) no customization of the system, 4) follow all SAP guidelines regarding implementation. Support, for ASAP's interpretation of success, can be found in research on ERP systems critical success factors (e.g. Somers and Nelson 2001; Parr, Shanks and Darke 1999). Hernandez et al. (1999) stress the skills the cognitive capacity of individuals is more important than the method. This might be an example of 'theory in use', when compared to ASAP's 'espoused theory'. The skills and cognitive capacity of individuals have Robey et al. (2002) and Kalling (2003) stressed as critical issues in overcoming problems related to the implementation of ERP systems. This view of ISs resembles mostly the management information systems view in Iivari (1991) and the information modeling and trade unionist approach in Iivari and Hirschheim (1996).

The view of the human being is deterministic, where humans have to adapt to the system. This can also be expressed as a Theory X view of the human being which assumes that most people have an in inherent dislike for work and therefore have to be controlled and directed in order to accomplish organizational goals. People are controlled by the 'order' enforced by R/3, which defines individual work tasks. The roles of humans are to perform tasks and roles and only those that the system cannot do. This is based on an instrumental

view of humans and organizations similar to information modeling. This might very well explain end users reluctance to use R/3 stressed by (Kennerley and Neely 2001) by creating an antipathy to the system (Aladwani 2001).

ASAP applies a general view of technology that is deterministic with casual effects, i.e. success will follow the use of ASAP, cf. the contemporary ISDAs. Technological choices are stressed during all phases of ASAP and the Concept check tool is mainly a technical test. The choice that organizations might have concerns using the system at all, and what parts or modules to use.

The organizational view inherent in ASAP is structuralistic, whereby the system is a reflection of the organization or more precisely the system is the organization. The organizational view is that the organization is subordinate to the system which also defines the organizational surroundings. Society is competitors, customers and suppliers, which the system knows how to manage.

The ontological stand point of ASAP show very strong resemblance to the contemporary approaches identified and studied by Iivari (1991) and can be summarized as data and information are descriptive facts, ISs are R/3, human beings have to be controlled, technology is deterministic, and a structuralistic view of organizations and society. This is a common view in IS research and the cause of many problems (Hirschheim and Smithson 1998). The technical interpretation of Enterprise Systems leads to the installation of a new technical system for data processing (Borell and Hedman 2001) and the institutionalization of Enterprise Systems as technical systems (Hanseth and Braa 1998).

The epistemological assumptions, which is deals with the nature of knowledge, include two opposite poles, i.e. positivism versus antipositivism, of ASAP are clearly positivistic. This is expressed in the method as "*it systematically guides you through the tasks involved in getting R/3 up and running in your business*" (Jacobs and Whybark 2000, p. 39). This can interpret as ASAP is the knowledge to implement R/3 and there is not need for complementary knowledge residing in human beings. ASAP include laws and procedures, which constitute the bases of a positivistic ISDA. The same view is inherent into all of the contemporary ISDAs (Iivari 1991).

The development of the method was initially conceptually based on surveys regarding implementation consultants and customer complaints. Further development has involved several research methodologies including surveys, case studies and action-based research. The research strategies for improving ASAP have included both nomothetic and idiographic research methods even though the methodology initially is based on a constructive research approach (March and Smith 1995). The same type of evolutionary are found in both contemporary approaches (Iivari 1991) and contrasting approaches (Iivari and Hirschheim 1996). The evolution of ISD is as stated by Wohed (2000) as an

evolutionary and path dependent process. Thus, it is likely that ASAP will continue to evolve and it is possible that future text books will include 'theory in use' and to only 'espoused theory'.

The ethics of ASAP, referring to the role of IS science and the value of IS research, indicate a clear means-end orientation, i.e. the role of IS research is to provide knowledge to improve the method. This openness up for interpretative and critical research on ASAP, which can be used to understand the human and organizational implications of the method. The value of research has a strong organizational/management orientation and thus neglecting end users and other aspects.

Moving towards the most distinguishing characteristic of ASAP compared to other ISDA/Ms. The difference between the ISDAs (e.g. the infological approach, the structured approach or the SSM approach) and the ASAP approach is that the latter support the implementation of COTS systems whereas the former are initially designed for the start from scratch development of ISs. This issue are often labeled as the built versus buy and is most evident in the information requirements analysis, based on Iivari et al. (1996). The view of information requirements, i.e. what constitutes or determines the information requirements, might be the most distinguishing aspect of ASAP in comparison with other kinds of ISDA/M, since there is no such need – the system provides the best solution to any firm's requirements. The view is clearly objective and emphasizes the organizational and task position of information requirements. However, there is one major difference between ISDAs in general and ASAP. In the traditional view of information requirements, e.g. in the contemporary ISDAs analyzed by Iivari (1991), it is the organizational role or task that determines the user's information requirements. In ASAP, on the other hand, this is presented in a similar way but in the reverse order. ASAP informs the user of the information options he or she has, so instead of user requirements, there is a system specification of information. This view of information requirements can be labeled as '**information predetermined**'. This is a composition of 'information' requirements and technology 'determinism'.

To summarize, ASAP is a technically-oriented ISD method with the specific goal of installing R/3 in organizations. The success of implementing R/3 depends on ASAP. It applies an instrumental view of humans and organizations. The guiding principle is to install the best technical solution, which will solve all data and information issues, both now and in the future. The overall view is that an effective and efficient organization is controlled and run by R/3, where all information requirements are pre-decided. This is in particular shown in the view of information requirements underlying ASAP – i.e. information determinism. This might be a fourth perspective on information requirements compared to objective, subjective and intersubjective (Iivari and Hirschheim 1996). ASAP's

view is similar to the objective view except for knowing what information requirements organizations have.

To what ISDA does ASAP belong to? Iivari et al. (2001) classified eleven ISDAs, both contemporary ISDAs (Iivari, 1991) and contrasting ISDAs (Iivari et al. 1998). Thus, providing a number of cases to compare ASAP's ontological, epistemological, research methodology and ethical assumption to. ASAP bear a strong resemblance to the contemporary approaches analyzed by Iivari (1991). This is not a major upset. Of the contrasting ISDAs analyzed by Iivari et al (1998), ASAP is closest to the trade unionist approach. Potentially this could be explained by the German heritage of both ASAP and the trade unionist approach. The trade unionist approach was initially inspired by Marx and ASAP is used to install another German system. As I see is R/3 is a modern version of Weber's theory of bureaucracy, He wrote:

> The decisive reason for the advance of bureaucratic organisation has always been its purely technical superiority over any former organisation. The fully developed bureaucratic mechanism compares with other organisations exactly as does the machine with non-mechanical modes of production (Weber, 1946).

Nevertheless, ASAP cannot be classified to any of the previously paradigmatically analyzed ISDAs, due to the underlying assumption of information predetermination. Thus, the proposal of the paper is that there is a category of ISDAs, which include information predetermination. This is contrasting to the contemporary ISDMs (Iivari 1991) and the contrasting ISDAs (Iivari et al. 1998). However, the proposal of a new and competing ISDA is problematic.

Like other studies on ISDA/M, our analysis is limited by the chosen research approach and analytical framework. The first issue worth discussing is whether or not our choice represents an ISDA/M at all? It is possible to interpret ASAP as a business and organizational change method thus it should be evaluated as such and not as ISD, cf. Alter's (2001) discussion of ISDM and organizational change programs. Based on Davis and Olson's (1985) definition of ISD as the analysis, design, realization, implementation, and evolution of information systems (p. 611), it is possible to conclude that ASAP is an ISDM which is labeled as COTS method, which belongs to the category of COTS approaches. The second issue that has to be raised concerns the generalization of the claim made. The conclusion builds on a generalization from one instance, i.e. an ISDM, to a population of ISDMs, i.e. ISDA. ASAP is used as a case, example or instance of an ISDA. This can be compared to ISAC (Lundeberg et al. 1979; Lundeberg et al. 1979) as an instance of the infological approach (Langefors 1966). Thus, the result should not and cannot be generalized to all instances

belonging to this ISDA. The research provided constructs that can be used in further investigation of COTS approaches – information predetermination.

Conclusions and Limitations

This paper contributes to the discussion on philosophical and conceptual assumptions underlying ISDA/Ms. The analysis of ASAP is based on Iivari's (1991) analytical framework of investigating underlying paradigmatic assumptions in ISD. The paper proposes a category of ISDA labeled as COTS approaches. The main distinguishing features of COTS approaches are the support the ISD of IS bought of the shelf and that they include an information predetermined view. In a sense COTS approaches supports the introduction of an external parties' 'world order' onto an organization. In this particular case, it is R/3.

Further research should involve other COTS methods than ASAP, e.g. the SIV method, the BIS procedural model, and ISDMs for COTS systems, such as CRM systems and SCM systems, as well as other ERP systems. This is justified by a need to build knowledge concerning COTS approaches in general, cf. Dolmetsch et al. (1998). An interesting question is how ASAP, i.e. theory in use, is used in practice. Are the underlying assumptions of the method also evident in practice or do consultants' assumptions takes the upper hand? In addition can IS research and the knowledge of, for instance, from contrasting ISDA's be incorporated into COTS approaches? The paper addressed the implementation methods of COTS systems. This process should not be confused with the development process taking place at the vendor of the COTS systems. However, the processes of developing COTS systems have not been addressed by the research community. This would involve a number of interesting research questions, e.g. how are generic systems developed (what methods are used?)? and whose requirements are being realized?

Limitations

An important limitation of this work is the fact that only one COTS method is analyzed. Thus, methods of other ERP vendors and other COTS systems are missed. This limits the possibilities of interpreting and discussing the results. Another limitation of the study is that the analysis was based on material published on the method and not how it is used in practice. The approach of using texts on ISDMs as empirical data have been used previously (Iivari and Hirschheim 1996; Iivari et al. 1998). The limitation of this is that the texts mostly include espoused theory and not theory in use. However, the approach is motivated by the possibility of comparing this analysis with previous analysis of ISDAs.

Another limitation is the choice of ASAP, which is an ERP system implementation method, can be questioned. The implementation of an ERP system might be so unique and require unique ISDA/M, leading to a category of ISD labeled ERP approaches consisting of instances such as ASAP. However, at this stage, it would be too early to propose ERP approaches as a specific category of ISDA. Thus, we have chosen to label it COTS approaches. The limitation of COTS is that it only stresses one feature, namely commercially off the shelf. Other aspects important to ERP systems, such as integration and process orientation, are not addressed.

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Understanding COTS System Implementation Approaches and Methodologies: The Case of ASAP

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ABSTRACT

The paper offers a paradigmatic analysis of the COTS system implementation method. The case analyzed is AcceleratedSAP™ (ASAP), which has been developed to support the implementation of the market-leading Enterprise Resource Planning system - R/3. The analysis is based on Iivari's (1991) paradigmatic framework for analysing the underlying assumptions of ISD approaches. The paper stresses the inherent view of information requirements and the results of the analysis show similarities between contemporary ISD approaches, such as the infological approach, information modelling and the socio-technical approach, with regard to its view on ontology, epistemology, research methodology and ethics. The main difference between ASAP and ISD approaches is the inherent view of information requirements, which can be summarised as information predetermined.

Introduction

The number of information systems development approaches (ISDAs) and methodologies (ISDMs) is increasing. According to Jayaratna (1994), there are more than 1,000 ISDMs, and Avison and Fitzgerald (1995) describe the situation as a "*methodology jungle*". This paper addresses a type of ISDA which supports the development and implementation of COTS systems (Commercially off the Shelf) in user organisations. The term COTS approach denotes this type of ISDA. Instances of COTS approaches, i.e. specific COTS methods, thus labels as COTS methodologies or methods. COTS methods are, in most cases, developed by practitioners, such as software providers or consulting firms, with the specific goal of implementing an information system (IS) (Maiden and Ncube 1998). There are COTS methods developed by researchers, for instance the SIV method (Standardsystem I Verksamheter – COTS in Business, trans.) (Anveskog, Järperud, Lundeberg, Melin and Nilsson 1983; Anveskog, Nilsson and Nord 1984; Nilsson 1991).

IS researchers have been criticized for not paying enough attention to the artifacts (Orlikowski and Iacono 2001) and not critically reflecting and challenging the approaches used in the development of IS (Iivari and Hirschheim 1996). Critically reflecting and challenging ISDA/M can lead to better understanding of the underlying assumptions embedded in ISDA/M which affect the ISD process and the IS (Iivari, Hirschheim and Klein 1998). The assumptions affect the choices with regard to the analysis, design and implementation alternatives and, in the long run, the organization (Iivari and Hirschheim 1996; Iivari et al. 1998). It is of critical importance to understand the underlying assumption in ISDA for research, education and practice (Iivari 1991).

The interest in COTS systems and COTS approaches and methods originates from the large-scale adoption of Enterprise Resource Planning (ERP) systems (Davenport 2000; Hitt, Wu and Zhou 2002; Kumar 2002; Robey, Ross and Boudreau 2002), even though COTS methods existed prior to ERP systems. ERP systems are, in most cases, COTS systems and are offered by ERP system vendors, such as SAP, Oracle, JD Edwards or PeopleSoft, who also provide implementation methods (Markus and Tanis 2000), such as ASAP from SAP, Implex from Intentia and JD Edwards One/Methodology from JD Edwards (Rashid, Hossain and Patrick 2002). These methods are used to adapt and implement the system in the acquiring organization (Markus and Tanis 2000). The adaptation of ERP systems is commonly referred to as configuration and can be compared to analysis, design and realization in traditional ISD; but the process is different to the development of IS from scratch (Borell and Hedman 2000; Rosemann 2001). However, little research has been carried out on COTS systems or COTS approaches. Even calls for such research have been made for over a decade (Davis 1988). This paper attempts to contribute to the understanding of ISD by analyzing the underlying assumptions of one COTS method. The analysis is based on Iivari's (1991) analytical framework and includes epistemology, ontology, methodology, and ethics of ISDA and later contributions, such as Iivari et al. (1998). The justification of applying Iivari's (1991) framework is that it builds on a research tradition focusing on improving the understanding of ISD and it enables comparison to previous research on "*contemporary*" (Iivari 1991) approaches and "*contrasting*" (Iivari et al. 1998) approaches.

The plan of the paper is as follows. The following section provides a background to and a review of research on the evaluation of ISDA leading up to the applied analytical framework. In section three, the research approach is presented followed by a description of ASAP. The fifth section presents the results of the analysis, which are followed by a discussion and limitations. The final section summarizes the results and provides suggestions for further research into COTS methods.

Background and literature review

The history of ISD reaches back about 60 years. Initially, there was no support for formal methods, but gradually practitioners began to develop and utilize methods. The purpose of ISDM is to improve the process of developing and implementing ISs and in due course increase the quality of the IS (Jayaratna 1994). The development of ISDMs is an incremental process. For instance, Information Engineering (IE) followed database technology while Object Oriented programming was followed by Object Oriented development methods (Wohed 2000). The diversity and innovation of ISs leads to an increased number of ISD methods and the continuous development of existing ones. For instance, Vigden (2002) enhanced Multiview for Internet-based ISs and the development of COTS systems has led to COTS approaches and methodologies (Nilsson 1991). Researchers' assumptions about the role of ISs in organizations have led to proposals for ISDAs (Iivari and Hirschheim 1996). For instance, ISDA such as the trade unionist approach initially and the infological approach are based on researcher's different assumptions (Iivari and Hirschheim 1996).

COTS methods remain unexplored in ISD research; see for instance (Iivari 1991; Iivari and Hirschheim 1996; Iivari et al. 1998; Iivari, Hirschheim and Klein 2001), where they have not been reviewed, even though they are commonly used in practice (George 2000). However, the issues of building or buying have been discussed. The term COTS is used mainly by British researchers (see for instance Maiden and Ncube 1998). In North America, the terms application package or software package are more commonly used (George 2000). In Sweden and Germany is the term 'standardsystem' used to denote COTS systems, e.g. Nilsson (1991), and Kirchmer (1998).

The analysis and validation of ISDM is limited (Nilsson 1991), but interest has increased (Nielsen 1990; Iivari 1991; Iivari et al. 2001). One of the first contributions was Taggert and Tharp (1977), according to Nielsen (1990). This was followed by, among other things, three conferences about Cooperative Review of Information Systems Design Methodologies in 1982, 1983 and 1986. The result of these conferences is a framework for comparing ISD methods (Olle 1991). Others have investigated the assumptions and purposes inherent in ISDA/M, which is the focus of this paper. For instance, Wood-Harper and Fitzgerald (1982), Nielsen (1990), Iivari (1991), Jayaratna (1994), Avison and Fitzgerald (1995), Iivari and Hirschheim (1996), Iivari et al. (1998) and Iivari et al. (2001) have all contributed to the understanding of ISDA/M. Table 1 presents some contributors and the analyzed ISDA/M. Several of the terms used in Table 1 resemble each other. The authors have used different terms to denote the approaches. For instance, SASS (Structured Analysis and Specification) in Jayaratna (1994) is labeled as the Structured Systems Analysis

Table 1 ISDA/Ms in the reviewed material.

Wood-Harper and Fitzgerald (1982)	Iivari (1991)	Jayaratna (1994)	Iivari et al. (1996)	Iivari et al. (1998)
General System Theory approach	Software engineering	SASS	Information Modeling	Interactionist approach
Participative approach	Database management	ETHICS	Decision Support System	Speech act approach
Human Activity Systems approach	Management information systems	SSM	Socio-technical approach	SSM approach
Traditional approach	Decision support systems		Infological approach	Trade unionist approach
Data Analysis approach	Implementation research		Interactionist approach	Professional work practice approach
Structured Systems Analysis approach	Socio-technical approach		Speech Act-based approach	
	Infological approach		Soft Systems Methodology	
			Trade Unionist approach	

approach in Wood-Harper and Fitzgerald (1982). ETHICS in Jayaratna (1994) is described as the Human Activity Systems approach in Wood-Harper and Fitzgerald (1982) and socio-technical in Iivari (1991) and Iivari et al. (1996).

Wood-Harper and Fitzgerald (1982) have developed a classification schema for ISDAs. They used 1) the underlying paradigm (specific way of thinking about problems which are acknowledged as the foundation for further practice (science/system)), 2) the conceptual model (refers to a subjective representation of reality which is implied in each methodology), and 3) objectives (analysis/problem solving) in their classification of ISDAs. The conclusion of Wood-Harper and Fitzgerald was that ISDAs are best understood in terms of their paradigm, conceptual model and objectives. This framework was later developed by Avision and Fitzgerald (1995) to comprise seven elements including: 1) philosophy (paradigm, objectives, domain, target), 2) model, 3) techniques, 4) scope, 5) outputs, 6) practice (background, user base, participants), and 7) products.

Jayaratna (1994) presents an approach to analyze and evaluate ISD. This approach is based on Soft System Methodology (SSM) and is labeled NIMSAD framework (Normative Information Model-based Systems Analysis and Design).

This framework is quite different from the previous one, since it is based on Soft System Methodology or the Human Activity Systems approach (Checkland and associates). This framework takes an ontological and epistemological standpoint, which the other ISD evaluation frameworks do not. In that sense, this framework is not value-free. The framework is general and can be used to understand any ISD method (Jayaratna, 1994). Three ISDM are analyzed, including SASS, ETHICS and SSM. The NIMSAD framework showed differences between the analyzed methods. For instance, the three methods address the design of the solution, but none of them provide any steps or procedures for implementing the solution. SSM emphasises the problem formulation, which the others do not address. The focus of the methods is also very different. SASS is task-driven and focuses on data related to task activities. ETHICS, on the other hand, is process-driven and focuses on involving people. SSM focuses on ill-structured problems and is thereby classified as issue-driven.

Iivari (1991) presents a paradigmatic analysis of seven contemporary ISD approaches or schools of thought, including software engineering, database management, management information systems, decision support systems, implementation research socio-technical and infological approaches. The paradigmatic analytical framework is based on the distinction between ontology, epistemology, methodology, and the ethics of research. The framework is summarized in Table 2. The ontological dimension consists of five levels; according to the view of 1) data/information, 2) data/information systems, 3) human beings, 4) technology, and 5) organization and society. Epistemology relates to knowledge and how this can be obtained. This dimension is based on Burrell and Morgan's (1979) distinction between positivism and anti-positivism, i.e. the nature of scientific knowledge. Methodology addresses the preferred research method of improving the ISDA. Three categories are used to distinguish between research approaches, including idiographic research methods (e.g. case studies and action research), nomothetic research methods (e.g. formal-mathematical analysis, experiments, field studies and surveys) and constructive research approaches (conceptual development and technical development). The two first research approaches (i.e. idiographic and nomothetic) are based on Burell and Morgan's (1979) illustration of two extremes in research. Constructive research methods on the other hand take into account the fact that IS science is also an applied science. In a later paper, Iivari et al. (1998) derive the constructive research approaches to Simon's work on the "*Science of the Artificial*" (Simon 1996). Ethics of research distinguishes between the role of IS research (means-end oriented, interpretative, and critical as potential roles) and its value (organization/management, end user, and others). The study showed great similarities between the seven approaches. The ontological dimension showed the greatest diversity. The seven contemporary ISD schools viewed IS mainly as a technical system. Data and information is descriptive facts. Viewing

Table 2 Summary of the paradigmatic framework, based on Iivari (1991).

Dimensions	Ontology	Epistemology	Methodology	Ethics role of IS research and values	
Level 1	The view of data and information	Positivism	Constructive research methods Conceptual and technical development	Means and end oriented	Organization/ Management
Level 2	The view of data and information system	Antipositivism	Nomothetic research methods Formal-mathematical analysis Experiments Field studies and surveys	Interpretative	End user
Level 3	The view of human beings		Idiographic Case studies Action research	Critical	Other
Level 4	The view of technology				
Level 5	The view of organization and society				

organizations in a structuralistic way and applying a positivistic epistemology. Using nomothetic and constructive research methodology to improve the approach and embracing a means and end oriented research ethics emphasizing organizational and management values.

Iivari and Hirschheim (1996) builds upon Iivari (1991) and studied two underlying ontological assumptions in eight ISDAs: information modeling, the decision support system, the socio-technical approach, the infological approach, the interactionist approach, the speech act-based approach, soft systems methodology, the and trade unionist approach. In comparison to Iivari (1991), Iivari and Hirscgheim (1996) focus only on one dimension of the paradigmatic framework. The first four approaches represent an old and established tradition while the four latter ones represent new ISDAs. The first assumption addressed is the perceived role of ISs in organization, i.e. the relationship and function of an IS within its context. The organizational role of the IS was further divided into three dimensions: technical (T), socio-technical (ST) and social (S). The technical view regards the IS as a technical artifact with well-defined input and output interfaces. The social view, on the other hand, primarily sees the IS as an organizational and social system, i.e. an integrated part of the whole. The socio-technical perspective regards an IS as an interdependent subsystem. The other assumption addressed what constitutes information requirements. The

Table 3 Orientation of ISDAs, based on Iivari and Hirschheim's (1996) tables four and five.

Methods	Organizational role			Information requirements		
	T	S-T	So	O	Su	I
Information Modeling	***		*	***	**	*
Decision Support System	***		*	**	***	
Socio-technical approach		***		***	*	
Infological approach	**	**	**	***	*	
Interactionist approach			***			
Speech Act-based approach			***	**		***
Soft Systems Methodology	**		**	**		**
Trade Unionist approach	***		*	**	*	**

T=Technical, S-T=Socio-technical, So=Social, O=Objectivism, Su=Subjective, I=Intersubjective
Note:*** Strong orientation, * Weak orientation

information requirements category contained objectivism (O), subjective (S), and intersubjective (I). Objectivism refers to the impersonal features, e.g. task position and organizational role. The subjective view, on the other hand, sees information requirements as personally based on the user's characteristics. The intersubjective view applies an emergent perspective of information requirements. In their analysis of the eight approaches, they used material from textbooks based on Kuhn's idea that books are important manifestations of existing paradigms. A summary of their findings is shown in Table 3. The first two traditions, i.e. information modeling and the decision support system, apply a mechanistic view of technology. The social-technical school views the IS as a social-technical system, whereas the infological approaches apply a combination of the three. The so-called new approaches emphasize the social nature of ISs. The view of information requirements did not provide the same variety of views. One of their conclusions was that new ISDAs have different sets of assumptions than the old ISDAs.

A fourth analysis of ISDAs is Iivari's et al. (1998) paradigmatic analyses of five contrasting ISDAs. These include the interactionist approach, the speech act approach, the soft system methodology approach, the trade unionist approach, and the professional work practice approach. The selection of these five approaches was justified by the fact that they assumably reflect different paradigmatic assumptions than the contemporary approaches analysed by Iivari (1991). Support for this hypothesis was also provided by the analysis. Iivari et al. (1998) based their analysis on Iivari's (1991) paradigmatic framework. The result of their analysis is presented in Table 4 and shows clearer differences than the contemporary ISDAs analysed by Iivari (1991). Lately, Iivari et al (2001) presented a four-tiered dynamic framework for classifying ISDA/M. These four levels are paradigm, approaches, methods, and techniques.

Table 4 Summary of the analysis presented by Iivari et al. (1998) and Iivari (1991).

	ISD approaches					
	Interactionist approach	Speech act based approach	Soft System Methodology	Trade unionist methodology	Professional work practice	Contemporary approaches (Iivari 1991)
Ontology	Social	Socio-technical	Socio-technical	Technical	Social technical	Technical view wherein data and information are descriptive facts
Epistemology	Positivist	Antipositivism	Dualistic	Positivist	Mostly antipositivism	Positivism
Research methodology	Idiographic, case studies	Nomothetic	Conceptual development and action research	Conceptual development, case studies and action research	Conceptual development and case and action	Nomothetic and constructive
Ethics	Interpretive	Means-end	Means-end and interpretive	Critical	Means-end	Means-end

There are differences between the ISDAs analyzed with regard to their ontological, epistemological, preferred research approaches and ethics preferences. Nevertheless, there is one common factor in the above-mentioned methods and approaches; they are all designed for scratch development - in-house or by an external party. The methods and approaches assume that ISs are

developed from scratch. The interactionist approach is excluded, since it has not yet been operationalised into methods for ISD (Iivari et al. 1998). The recent development and increased importance of COTS systems and the subsequent COTS approaches and methods have not yet been analyzed.

Research Method

Iivari and Hirscheim (1996) and Iivari et al. (1998) state that the best unit of analysis for ISD is the ISDA and not the ISDM, since the approach level conveys the essential characteristics or features of its instances. This makes it possible to analyze ISD independently if they are operationalised as methods or not.

COTS approach is not yet defined, thus we had to select a COTS method as an example or illustration of COTS approaches. The selection of a COTS method presented several difficulties. Firstly, most COTS methods are the proprietary products of vendor firms, e.g. SAP AG, Bann, Oracle and Accenture. Consequently, it is difficult to get hold of information about these methods.

Secondly, the research-based COTS methods are poorly documented e.g. PORE (Procurement Oriented Requirements Engineering) (Maiden and Ncube 1998). One exception is the SIV method. However, to our knowledge, this method is only applied in a Swedish context, which limits its practical relevance. In addition, the SIV method is mainly an acquisition framework and does not support configuration, which is a central task in COTS system implementation (Hedman and Borell 2000). Moreover, the SIV method builds on the infological approach (Langefors 1966) and its instance – ISAC (Lundeberg, Goldkuhl and Nilsson 1979; Lundeberg, Goldkuhl and Nilsson 1979). Another example of COTS method is the BIS (Business process oriented Implementation of Standard software) procedure model (Kirchmer 1998). BIS is the implementation method used by IDS Scheer – a German consulting firm, best known for its process modeling tool ARIS Toolset. This method integrates the conceptual thinking of Architecture of Integrated information System (ARIS) (Scheer 1998) and views the implementation of COTS systems as the introduction of a "*standard reference model*". Besides Krichmer (1998), other publications related to BIS are in German and, unfortunately, we have a language barrier here.

Iivari and Hirschheim (1996) justified their choice of ISDA based on the institutionalization of the ISDA in the scientific community. The degree of was based on the first three of Kuhn's (1970) criteria of institutionalization assessment: the existence of scientific journals, scientific conferences, textbooks, professional associations, informational and formal communication networks, and citations. The SIV method does meet one of the criteria, namely textbooks (Anveskog et al. 1983; Anveskog et al. 1984; Nilsson 1991; Nilsson 2000). One of the few vendor-developed COTS methods addressed by the research community is ASAP (Dolmetsch, Huber and Fleisch 1998; Borell and Hedman 2000; Rosemann 2001; Esteves, Chan, Pastor and Rosemann 2003) and is widely described in textbooks (Bancroft, Seip and Sprengel 1998; Hiquet and Kelly 1998; Miller 1998; Hernandez, Bueno, Servera and Elechiguerra 1999; Jacobs and Whybark 2000). In addition, there are professional associations promoting ASAP and there are newsgroups representing informal networks. ASAP is one of the few COTS methods which meet several of Kuhn's institutional assessment criteria.

The applied research method is literature and method analyses with the goal of uncovering the underlying assumptions in ASAP. In order to be able to compare the result of the analysis with previous work, we have chosen to apply the same methodological approach as Iivari (1991) and Iivari et al. (1998). The chosen research approach include three presumptions: 1) the COTS method is viewed as an artifact; 2) the artifact in forms of books and the actual methodology reflect the underlying assumptions that guided the design of the method; 3) by performing careful text analysis it is possible to infer those assumptions (Iivari et

al. 1998). To complement their approach, we have placed more emphasis on the ontological dimension and in particular the view on information requirements. This is based on Iivari and Hirschheim (1996). Following Iivari and associates, we have chosen textbooks (such as Hernandez et al. 1999; Hiquet and Kelly 1998; Jacobs and Whybark 2000; Keller and Teufel 1998) and the actual methodology (SAP 1998; SAP 1999). SAP (1998) is the official training material to become a certified ASAP consultant and SAP (1999) is the method packaged on a CD. The two sources, one a vendor product and professional textbooks are not the best choice from an analytical perspective. The point that Iivari and Hirchheim (1996) stressed was that the old established educational textbooks include "*theory in use*", due to the continuous development of educational material. However, in our case, the material only represents an "espoused theory", since it is not likely that the text books reflect actually use. The terms "*theory in use*" and "*espoused theory*" stem from Argyris and Schon (1974). Besides this limitation to our choice, there are arguments in favor of the selected method. First of all, it is well established on the market as regards implementing a market leading COTS system. Secondly, it is used in education via the university alliance program between SAP and about 400 universities around the world. Thus, the method has both practical and educational relevance.

The Case: AcceleratedSAP

In this section, we will be providing a review of ASAP, including a brief historical overview and a description of its phases. In addition, current research on ASAP is briefly reviewed.

The ASAP implementation methodology was introduced in 1996 with the specific goal of reducing the time to implement R/3 (Miller 1998). The previous, and to some extent competing implementation method Procedure Model, was introduced in 1995 and included four phases (organizational and conceptual design, detailed design and system setup, preparations for going live, and productive operations) with three levels of detail (project phases, work packages, and project activities). Hernandez et al. (1999) present the main differences between the two implementation methods. These are depicted in Table 5. The main difference between the two methods is that the Procedure model has a stronger focus on reengineering, whereas ASAP is more focused on short implementation projects. This is expressed as "*the absence of Business Process Reengineering*" (Hiquet and Kelly 1998, p. 18). The procedure model more resembles traditional ISD than ASAP. For instance, the focus on reengineering and the adaptation of the system to firms' requirements illustrate this. ASAP was initially developed by SAP AG's American subsidiary and is based on best practice by a number of implementation projects in the USA (Hernandez et al. 1999). There had been many customer complaints regarding the long

Table 5 Characteristics of the Procedure Model and ASAP, based on (Hernandez et al. 1999).

Name	Procedure Model	ASAP
Characteristics	Developed in Germany by the parent firm	Developed by the American subsidiary
	Integrated with R/3	Independent software tool
	High level of description	More detailed activities and tasks
	Four phases	Five phases
	Includes project management	External project management via MS Project and Excel
	Support online and via hypertext	Support via documents, templates, tools, presentations, models and databases
	R/3 Reference Model	R/3 Business Engineer, which includes R/3 reference model
	Implementation support	Lifecycle support
	Extensive reengineering	Limited reengineering
	Long implementation time	Short implementation time

implementations. Dolmetch et al. (1998) studied the implications of ASAP in four implementation projects. They concluded that the strength of the method lies in forcing companies to focus on essentials, on keeping implementation projects on time and within budget, on control of the projects organization, and on managing documentation. Two key areas were found to be insufficiently supported, including end user training and change management. Esteves et al. (2003) discusses required knowledge types along ASAP and Rosemann (2001) highlights problems when configuring R/3.

The ASAP method is packaged as an independent software application with connections to the IMG in R/3. IMG stands for Implementation Guide, which is used to configure the system. The ASAP software comprises four components the ASAP Implementation Assistant, the SAP R/3 Concept Check Tool, the Question and Answer (Q&A) database, and the ASAP Administration Tool. The administration tool is used to create and manage the projects and the users of ASAP. The concept tool is used to test and verify the system and the implementation project. The Q&A database is used to organize and document requirements. The implementation assistant structures and organizes the project, by stipulating what tasks are to be performed and when, as well as by whom.

The methodology consists of five phases presented as a roadmap. The roadmap only contains one road, making navigation much easier, but there are checkpoints:

Phase I. Project Preparations provide assistance in the initial planning and preparations for an R/3 project. This involves defining the project, specifying the scope, deciding on an implementation strategy, specifying the project schedule and sequence of implementation, establishing the project organization and steering committees, and assigning resources.

Phase II. The Business Blueprint is the requirements specification phase during which detailed documentation is gathered in from workshops. The Q&A database supports the creation of the Business Blueprint, documenting the business requirements and identifying the scope of the project. The Business Blueprint covers, for instance, business strategy, organizational structure, general settings, master data, and the documentation of business processes. The goal is to create a common understanding of how to run the business with R/3.

Phase III. Realization involves configuration of the system using guidelines decided in the Business Blueprint. Testing the system is important during this phase. Configuration is done in a two-step procedure. Initially, baseline configuration is done, which involves general configuration options, e.g. global settings such as currencies master data, the most important processes and the organizational structure. Final configuration involves configuring other processes, printing options, and background processing.

Phase IV. Final preparation mainly includes testing the system and end-user training on it. Loose ends from previous phases are also dealt with during this phase. The future system administration is set up and stress tests are performed.

Phase V. The Go Live and Support phase is when the actual installation takes place and the system comes into use. Initially, support for the users is essential since most problems are likely to arise at the beginning. The long-term goal is to optimize the system.

Each of the phases includes a large number of tools and utilities for simplifying work. The hierarchy of the methodology is that each phase includes a group of work packages, which are divided into activities consisting of groups of tasks that have to be completed. In some cases, the activities are structured into six hierarchical levels. Most of the activities are supported via Word, Excel, and MS project documents and files. For instance, there are documents for convening a start-up meeting including whom to invite and to organize a kick off meeting.

Result of the analysis

The assumptions of embedded into ASAP, related to its ontological, epistemological, research methodology, ethics, and view of information requirements, are presented and discussed in the following paragraphs.

In relation to the ontological position ASAP's view of data and information as descriptive facts. This is expressed in the method as references to the R/3 reference model. The reference model includes the conceptual design of R/3 (including process models, organizational models and data models) and

descriptions of data objects with their attributes and relationships. This is a reflection of a descriptive view of data and information, since the method takes for granted, and even presumes, what data and information are. It is a similar view to most of the contemporary ISDAs analyzed by Iivari (1991), see Table 4 last column. Information modeling approach as described in Iivari and Hirschheim (1996) show the strongest resemblance to ASAP in relation the view of data and information. A possible explanation for this is the strong link between R/3 and ARIS (Scheer 1998). The view on information requirements are further explored at end of this section.

The view of IS (technical versus organizational/social system), does ASAP not explicitly define. Implicitly, ASAP assumes the existence of one and only one IS, namely R/3 – thus there is no need for any other IS. This conclusion is based on a reversed logic, since there are no references to other ISs there is no need for other IS. The view of IS a technical view with organization implications. The implication of this is that the methods assumes that the organization is adapted to the system and the role of the ASAP is to support the organizational adaptation. ASAP express this as "*moving from an existing system and way of doing business to using R/3 to run the entire, or a part of, the business.*" The role and importance of ASAP is implicitly questioned by (Hernandez et al. 1999). They state that "*most of the methodologies … are good … most important to the project success is that the project manager and consultants working in a methodological framework are experienced and capable*". ASAP, on the other hand, defines how to succeed with R/3 implementations thus: 1) full commitment by the entire organization, 2) clearly defined and consistent project scope, 3) no customization of the system, 4) follow all SAP guidelines regarding implementation. Support, for ASAP's interpretation of success, can be found in research on ERP systems critical success factors (e.g. Somers and Nelson 2001; Parr, Shanks and Darke 1999). Hernandez et al. (1999) stress the skills the cognitive capacity of individuals is more important than the method. This might be an example of 'theory in use', when compared to ASAP's 'espoused theory'. The skills and cognitive capacity of individuals have Robey et al. (2002) and Kalling (2003) stressed as critical issues in overcoming problems related to the implementation of ERP systems. This view of ISs resembles mostly the management information systems view in Iivari (1991) and the information modeling and trade unionist approach in Iivari and Hirschheim (1996).

The view of the human being is deterministic, where humans have to adapt to the system. This can also be expressed as a Theory X view of the human being which assumes that most people have an in inherent dislike for work and therefore have to be controlled and directed in order to accomplish organizational goals. People are controlled by the 'order' enforced by R/3, which defines individual work tasks. The roles of humans are to perform tasks and roles and only those that the system cannot do. This is based on an instrumental

view of humans and organizations similar to information modeling. This might very well explain end users reluctance to use R/3 stressed by (Kennerley and Neely 2001) by creating an antipathy to the system (Aladwani 2001).

ASAP applies a general view of technology that is deterministic with casual effects, i.e. success will follow the use of ASAP, cf. the contemporary ISDAs. Technological choices are stressed during all phases of ASAP and the Concept check tool is mainly a technical test. The choice that organizations might have concerns using the system at all, and what parts or modules to use.

The organizational view inherent in ASAP is structuralistic, whereby the system is a reflection of the organization or more precisely the system is the organization. The organizational view is that the organization is subordinate to the system which also defines the organizational surroundings. Society is competitors, customers and suppliers, which the system knows how to manage.

The ontological stand point of ASAP show very strong resemblance to the contemporary approaches identified and studied by Iivari (1991) and can be summarized as data and information are descriptive facts, ISs are R/3, human beings have to be controlled, technology is deterministic, and a structuralistic view of organizations and society. This is a common view in IS research and the cause of many problems (Hirschheim and Smithson 1998). The technical interpretation of Enterprise Systems leads to the installation of a new technical system for data processing (Borell and Hedman 2001) and the institutionalization of Enterprise Systems as technical systems (Hanseth and Braa 1998).

The epistemological assumptions, which is deals with the nature of knowledge, include two opposite poles, i.e. positivism versus antipositivism, of ASAP are clearly positivistic. This is expressed in the method as "*it systematically guides you through the tasks involved in getting R/3 up and running in your business*" (Jacobs and Whybark 2000, p. 39). This can interpret as ASAP is the knowledge to implement R/3 and there is not need for complementary knowledge residing in human beings. ASAP include laws and procedures, which constitute the bases of a positivistic ISDA. The same view is inherent into all of the contemporary ISDAs (Iivari 1991).

The development of the method was initially conceptually based on surveys regarding implementation consultants and customer complaints. Further development has involved several research methodologies including surveys, case studies and action-based research. The research strategies for improving ASAP have included both nomothetic and idiographic research methods even though the methodology initially is based on a constructive research approach (March and Smith 1995). The same type of evolutionary are found in both contemporary approaches (Iivari 1991) and contrasting approaches (Iivari and Hirschheim 1996). The evolution of ISD is as stated by Wohed (2000) as an

evolutionary and path dependent process. Thus, it is likely that ASAP will continue to evolve and it is possible that future text books will include 'theory in use' and to only 'espoused theory'.

The ethics of ASAP, referring to the role of IS science and the value of IS research, indicate a clear means-end orientation, i.e. the role of IS research is to provide knowledge to improve the method. This openness up for interpretative and critical research on ASAP, which can be used to understand the human and organizational implications of the method. The value of research has a strong organizational/management orientation and thus neglecting end users and other aspects.

Moving towards the most distinguishing characteristic of ASAP compared to other ISDA/Ms. The difference between the ISDAs (e.g. the infological approach, the structured approach or the SSM approach) and the ASAP approach is that the latter support the implementation of COTS systems whereas the former are initially designed for the start from scratch development of ISs. This issue are often labeled as the built versus buy and is most evident in the information requirements analysis, based on Iivari et al. (1996). The view of information requirements, i.e. what constitutes or determines the information requirements, might be the most distinguishing aspect of ASAP in comparison with other kinds of ISDA/M, since there is no such need – the system provides the best solution to any firm's requirements. The view is clearly objective and emphasizes the organizational and task position of information requirements. However, there is one major difference between ISDAs in general and ASAP. In the traditional view of information requirements, e.g. in the contemporary ISDAs analyzed by Iivari (1991), it is the organizational role or task that determines the user's information requirements. In ASAP, on the other hand, this is presented in a similar way but in the reverse order. ASAP informs the user of the information options he or she has, so instead of user requirements, there is a system specification of information. This view of information requirements can be labeled as '**information predetermined**'. This is a composition of 'information' requirements and technology 'determinism'.

To summarize, ASAP is a technically-oriented ISD method with the specific goal of installing R/3 in organizations. The success of implementing R/3 depends on ASAP. It applies an instrumental view of humans and organizations. The guiding principle is to install the best technical solution, which will solve all data and information issues, both now and in the future. The overall view is that an effective and efficient organization is controlled and run by R/3, where all information requirements are pre-decided. This is in particular shown in the view of information requirements underlying ASAP – i.e. information determinism. This might be a fourth perspective on information requirements compared to objective, subjective and intersubjective (Iivari and Hirschheim 1996). ASAP's

view is similar to the objective view except for knowing what information requirements organizations have.

To what ISDA does ASAP belong to? Iivari et al. (2001) classified eleven ISDAs, both contemporary ISDAs (Iivari, 1991) and contrasting ISDAs (Iivari et al. 1998). Thus, providing a number of cases to compare ASAP's ontological, epistemological, research methodology and ethical assumption to. ASAP bear a strong resemblance to the contemporary approaches analyzed by Iivari (1991). This is not a major upset. Of the contrasting ISDAs analyzed by Iivari et al (1998), ASAP is closest to the trade unionist approach. Potentially this could be explained by the German heritage of both ASAP and the trade unionist approach. The trade unionist approach was initially inspired by Marx and ASAP is used to install another German system. As I see is R/3 is a modern version of Weber's theory of bureaucracy, He wrote:

> The decisive reason for the advance of bureaucratic organisation has always been its purely technical superiority over any former organisation. The fully developed bureaucratic mechanism compares with other organisations exactly as does the machine with non-mechanical modes of production (Weber, 1946).

Nevertheless, ASAP cannot be classified to any of the previously paradigmatically analyzed ISDAs, due to the underlying assumption of information predetermination. Thus, the proposal of the paper is that there is a category of ISDAs, which include information predetermination. This is contrasting to the contemporary ISDMs (Iivari 1991) and the contrasting ISDAs (Iivari et al. 1998). However, the proposal of a new and competing ISDA is problematic.

Like other studies on ISDA/M, our analysis is limited by the chosen research approach and analytical framework. The first issue worth discussing is whether or not our choice represents an ISDA/M at all? It is possible to interpret ASAP as a business and organizational change method thus it should be evaluated as such and not as ISD, cf. Alter's (2001) discussion of ISDM and organizational change programs. Based on Davis and Olson's (1985) definition of ISD as the analysis, design, realization, implementation, and evolution of information systems (p. 611), it is possible to conclude that ASAP is an ISDM which is labeled as COTS method, which belongs to the category of COTS approaches. The second issue that has to be raised concerns the generalization of the claim made. The conclusion builds on a generalization from one instance, i.e. an ISDM, to a population of ISDMs, i.e. ISDA. ASAP is used as a case, example or instance of an ISDA. This can be compared to ISAC (Lundeberg et al. 1979; Lundeberg et al. 1979) as an instance of the infological approach (Langefors 1966). Thus, the result should not and cannot be generalized to all instances

belonging to this ISDA. The research provided constructs that can be used in further investigation of COTS approaches – information predetermination.

Conclusions and Limitations

This paper contributes to the discussion on philosophical and conceptual assumptions underlying ISDA/Ms. The analysis of ASAP is based on Iivari's (1991) analytical framework of investigating underlying paradigmatic assumptions in ISD. The paper proposes a category of ISDA labeled as COTS approaches. The main distinguishing features of COTS approaches are the support the ISD of IS bought of the shelf and that they include an information predetermined view. In a sense COTS approaches supports the introduction of an external parties' 'world order' onto an organization. In this particular case, it is R/3.

Further research should involve other COTS methods than ASAP, e.g. the SIV method, the BIS procedural model, and ISDMs for COTS systems, such as CRM systems and SCM systems, as well as other ERP systems. This is justified by a need to build knowledge concerning COTS approaches in general, cf. Dolmetsch et al. (1998). An interesting question is how ASAP, i.e. theory in use, is used in practice. Are the underlying assumptions of the method also evident in practice or do consultants' assumptions takes the upper hand? In addition can IS research and the knowledge of, for instance, from contrasting ISDA's be incorporated into COTS approaches? The paper addressed the implementation methods of COTS systems. This process should not be confused with the development process taking place at the vendor of the COTS systems. However, the processes of developing COTS systems have not been addressed by the research community. This would involve a number of interesting research questions, e.g. how are generic systems developed (what methods are used?)? and whose requirements are being realized?

Limitations

An important limitation of this work is the fact that only one COTS method is analyzed. Thus, methods of other ERP vendors and other COTS systems are missed. This limits the possibilities of interpreting and discussing the results. Another limitation of the study is that the analysis was based on material published on the method and not how it is used in practice. The approach of using texts on ISDMs as empirical data have been used previously (Iivari and Hirschheim 1996; Iivari et al. 1998). The limitation of this is that the texts mostly include espoused theory and not theory in use. However, the approach is motivated by the possibility of comparing this analysis with previous analysis of ISDAs.

Another limitation is the choice of ASAP, which is an ERP system implementation method, can be questioned. The implementation of an ERP system might be so unique and require unique ISDA/M, leading to a category of ISD labeled ERP approaches consisting of instances such as ASAP. However, at this stage, it would be too early to propose ERP approaches as a specific category of ISDA. Thus, we have chosen to label it COTS approaches. The limitation of COTS is that it only stresses one feature, namely commercially off the shelf. Other aspects important to ERP systems, such as integration and process orientation, are not addressed.

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Paper III

The Business Model: A Means to Comprehend the Management and Business Context of Information and Communication Technology

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THE BUSINESS MODEL: A MEANS TO COMPREHEND THE MANAGEMENT AND BUSINESS CONTEXT OF INFORMATION AND COMMUNICATION TECHNOLOGY

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ABSTRACT

This paper presents a conceptual business model, which aims to improve the understanding of the business context of Information and Communication Technologies (ICT). We argue that research into how ICT generates economic value is limitedly valid due to lacking comprehensive knowledge of strategy theory and lacking abilities to integrate strategy perspectives, and the fragmentation of strategy theory. We discuss the main strategy perspectives as well as ICT research within each of these perspectives and conclude that in order to improve the understanding of the ways in which ICT generates value, research must integrate different perspectives. We also review some of the new e-business texts that addresses business models. The business model is broader than any individual strategy perspective (such as Industrial Organisation, the Resource-Based View or the Strategy Process Perspective) and includes market factors, offering, activities, organisation and resource bases as well as longitudinal management processes. In addition, we illustrate how the management and business context of ICT (such as ERP and CRM systems) can be viewed through the business model.

1. INTRODUCTION

In order to understand how Information and Communication Technologies (ICT) create or erode economic value of business and strategy, we argue that it is important to understand the logic and structure of the *business context* of ICT. Within information systems research, there is a range of different approaches and frameworks to explain ICT and business strategy, we assume, because, 1) the field of business strategy as a theoretic field is relatively fragmented and has not been particularly interested in ICT, 2) there is a lack of knowledge about strategy theories (Sambamurthy, 2000), and 3) because of lacking abilities to integrate disparate strategy models and theories within information systems research (cf. Flatten et al., 1992; Applegate et al., 1999). Existing information systems research tends not to be able to measure the bottom-line contribution of ICT investments – the so-called IT Productivity Paradox (e.g. Strassman, 1985; Brynjolfsson, 1993; Barua & Mukhopadhyay, 2000; Sambamurthy, 2000).

We believe this may be due to a shortage of models that explain the impact of ICT on other resources (e.g. knowledge, people, and structure), on different activities and functions, and subsequently on product offerings, and the longitudinal management process. Within the field of strategy there are few holistic models which incorporate the finer aspects of strategy, e.g. resource-bases, competences, activities, organisational structure, culture and politics, products, markets, competitors, environmental factors etc. In fact, strategists still tend to argue about what it is that make companies successful, e.g. whether it is firm-internal resources (Barney, 1991), whether it is successful reconfiguration of the value chain (Porter, 1985) or generic strategy (Porter, 1980). This problem is extended into ICT research.

For the purpose of understanding better the economic context of ICT, it would be valuable to integrate the different theories and frameworks into one model, i.e. a *business model*. It would probably be good for other types of resources as well, e.g. knowledge, brand names, machinery etc, but we believe it is particularly important for ICT resources. They are complex in nature, they are supposedly creating value on the product market, they impose their own logic of the world on activities, structure, and strategy, and they are financially and technically demanding (cf. Davenport, 2000). We also believe that one integrative model should incorporate the management process dimension of ICT. Although there is always a rationalistic idea about how to analyse, decide and implement ICT, many political and cultural obstacles lie in the way between the investment and economic success. Hence this paper describes how such a *business model* could be outlined and which theories it could draw upon.

Another reason for addressing the business model is empirical. Today, it appears as if many business ventures have a limited interest in formulating *strategies* (Brown & Eisenhardt, 1998). Instead, they formulate business models, which are broader in terms of subject areas. This can be observed in the recent surge in the demand for start-up objects to invest in, which requires that the founders present and market their business models in order to raise financial capital. But it appears to bear some truth also in relation to more traditional businesses, such as industrial companies. It could be that business managers in general regard strategy changes as difficult. They can only manage smaller modifications, such as entering a new geographical or demographical market, innovating new products or processes, or extend their knowledge – they are becoming path dependent. Radical strategy changes, such as 'strategic leaps', seem to appear more seldom – and in those cases changes are so radical that the entire business model is changed anyway (Upton & McAffe, 2000). In addition, it is always difficult to discuss strategic *management* if one excludes such things as competence management, knowledge management, organisation, politics, and culture etc, because these are the elements that business managers (have to) work with. The concept of business models is frequently used in conjunction with e-business research (e.g. Timmers, 1998; Rappa, 2000; Afuah & Tucci, 2001; Applegate, 2000; Weill & Vitale, 2001). However, few of these discuss the theoretical sub-constructs of their models, but from solely in 'specific' empirically identified business models. Theoretical literature on the business model is relatively scarce, even though the concept is becoming increasingly popular, albeit criticised (cf. Porter, 2001)

This paper intends to propose the conceptual underpinnings of a business model by which managers and researchers can understand the causal relationship between ICT and economic value. Before presenting the business model we will review three strategy perspectives: Industrial Organisation (I/O), the Resource-Based View (RBV), and the Process Perspective. Following this we will present a generic business model, and exemplify how it could be used as an analytical tool to increase the understanding of ICT and economic value.

2. STRATEGY THEORY

Strategy theory concerns the explanations of firm performance in a competitive environment (Porter, 1991). In an attempt to briefly sketch the history of strategic management, Rumelt et al. (1994) state that strategy is about 'the direction of organisations'. and that it "includes those subjects of primary concern to senior management, or to anyone seeking reasons for success or failure among

organisations" (p. 9). There are many strategy perspectives, but we will as a starting point discuss three dominant overarching perspectives, Industrial Organisation (I/O), the Resource-Based View (RBV), and the Process Perspective. I/O and RBV are both interested in competitive advantage. But their views on what competitive advantage is and on what it is based differ. Although some thinking is clearly conceptually connected within the two perspectives, there are fundamental differences, which will be described in this section. While both RBV and I/O may be seen as content-based approaches to strategic management, the process-based view on strategy focuses on the processes through which strategy contents are created and managed (cf. variance and process theories in Markus and Robey, 1988).

2.1 Industrial Organisation

Porter (1980) brought in the I/O perspective (cf. Bain, 1968) to business strategy, by claiming that *external industrial forces* affect the work of managers. Substitute products, customers and suppliers as well as potential and present competitors affect the possible choices of actions for firms. The possible strategic actions are the so-called 'generic strategies', i.e. 1) to differentiate the product so as to enable a premium price, or 2) to produce with low-cost and compete with a low price rather than quality. Porter's work was further developed in 1985, when he introduced the *value-chain model*, in which focus is put on the activities and functions of the firm. Porter sought to understand the underlying factors of competitive advantage, i.e. the drivers of cost and differentiation advantages, and found that thorough control over activities would enable firms to utilise cost and differentiation potentials. Appropriate grouping of related activities and an active approach towards integration of external and disintegration of internal activities may lead to possibilities to reap scale advantages or to create innovative forums. Porter's model also emphasises the significant organisational component in strategic management. As will be discussed, the I/O framework has some serious shortcomings in their relative neglect of firm internal factors.

Porter's analysis of external industrial forces (1980) and the value chain (1985) enable analysis of how ICT can be used for competitive advantage. McFarlan (1984) suggests that ICT can be used to lower the switching cost of suppliers raise the switching cost of buyers, or erect barriers to entry. Porter and Millar (1985) argue that information pervades every element of the value chain activities in organisations. Therefore, ICT can be used to enhance the conduct of value chain activities in managing the industry forces and gaining a competitive advantage, e.g. role of ICT in competitive pricing strategies (Wiseman, 1985; Beath & Ives, 1986), customer relationship management (Ives & Mason, 1990), ERP systems impact on organisational effectiveness (Hedman & Borell, 2001), and business partner relationships (Johnston & Vitale, 1988). Further, ICT can also be deployed in sustaining the generic competitive strategies of cost leadership, differentiation, or niche positioning (Rackoff et al., 1985).

2.2 The Strategy Process Perspective

If strategy and various fields within were concerned with *what* firms did, a redirection took place during the mid-1970's, towards *how* firms did whatever they did. Strategy was, for a long time, biased towards planning, and long term planning in particular (Rumelt et al., 1994). But with the problems firms and their decision-makers encountered following the oil embargo, the deregulation of industries, internationalisation, and so forth, long range planning lost much of its practical significance. With a focus on the strategy process (rather than the strategy content) followed a growing body of work criticising the ex ante and normative approach of the strategy field (Mintzberg, 1978; 1994, Quinn, 1978). Uncertainty about the future leads to incrementalism, shorter planning horizons, less revolutionary strategic actions, tentative and searching moves. The pattern of action visible ex post makes up the 'emergent strategy' (Mintzberg, 1978). The main divergence here is between formulation and implementation: strategies emerge and they are what firms actually do.

The increased environmental uncertainty and the criticism towards long term planning were not the sole factors behind the growing interest in strategy processes. Also, the focus on strategy contents such as competitive position, the relation between competitive position and performance (or any other content concepts, e.g. independent variables such as structure, size, degree of diversification etc), was becoming less interesting in relation to research on *how* firms created the favourable positions or whatever characteristics that rendered them a particular performance (Chakravarthy & Doz, 1992). Although process and content strategy research are both concerned with performance, process research focuses on *how* firms reach the positions (Chakravarthy & Doz, 1992). The independent variables of content research become the dependent variables in process research. The independent variables in process research are found in management- and organisation-related fields. Two assumptions make strategy process research unique, according to Chakravarthy & Doz, and that is the acceptance of bounded rationality and the pluralistic view on the organisational unit. The process-based interest has progressed with an even more sophisticated focus on the managerial and decision-making function, and prospered from the research field of cognitive processes of managers (Weick, 1979; Prahalad & Bettis, 1986; Ginsberg, 1994). The process view on strategy has also been brought in to RBV (e.g. Amit & Schoemaker, 1993; Oliver, 1997; and Sanchez & Heene, 1997).

Process approaches are also promoted in ICT research (Robey & Boudreau, 1999). Process approaches are viewed as "valuable aids in understanding issues pertaining to designing and implementing information systems, assessing their impact, and anticipating and managing the process of change associated with them" Kaplan (1991, p. 593). One of the first ICT process models was the Nolan stage model (Gibson & Nolan, 1974, Nolan, 1979). The model has been criticised by several researchers, e.g. Mohr (1982) and Wiseman (1985). More recent developments are the MIT90s framework (Scott-Morton, 1990) and the subsequent strategic alignment movement (Henderson & Venkatraman, 1993). Lately, approaches including both process, RBV and Organisational learning have been applied to explain the cognitive, cultural and political processes by which complex organisations develop and utilise ICT (Ciborra, 1994; Andreu & Ciborra, 1996; Kalling, 1999).

2.3 The Resource-Based View

Whereas I/O states that environmental pressure and the ability to respond to the threats and opportunities are the prime determinants of firm success, RBV states that idiosyncratic and firm-specific sets of immobile resources determine which firm will and reach above-normal performance (Wernerfelt, 1984; Barney, 1991; Dierickx & Cool, 1989; Conner, 1991; Peteraf, 1993). RBV emphasises the characteristics of the underlying, factors behind low-cost or differentiation; i.e. the resources of the company. Resources (e.g. physical, human and organisational resources such as "all assets, capabilities, organisational processes, firm attributes, information, knowledge etc", Barney, 1991) that are strategic are in themselves competitive advantages (Barney, 1991). This does not imply that RBV is incapable of explaining differences in firm performances on product markets. Successful firms have resources with greater total value than their competitors. Logically, low-performing firms may have competitive advantages, albeit with lower total value than more successful competitors.

The RBV literature descriptions of resource attributes that render a firm competitive advantage are numerous, although we follow the concepts introduced by Barney (1991) including value, rareness, and imperfect imitability and substitutability. A firm's resources are *valuable* if they lower costs or raise the price of a product. In addition, certain resources have a better fit with certain organisations, and hence expectations – and value – are different depending on who is considering resource investment (Barney, 1986, Dierickx & Cool, 1989). Both resource and firm heterogeneity affect relative resource value. A key resource attribute, within RBV is rareness. Peteraf (1993) claims that superior productive resources often are quasi-fixed because "their supply cannot be expanded rapidly". Since they are scarce, inferior resources are brought to the market. A valuable and rare resource also needs to be *costly to imitate or to substitute* to *sustain* the competitive advantage of the resource. A valuable and rare resource that could be acquired at an imperfect market price will only remain a source of advantage as long as competitors fail to realise the potential. A resource and its outcome can

be imitated either by building/acquiring the same resource (duplication) or by creating the same intermediate or final outcome by a different resource (substitution). According to Barney (1991), the measurement of imitability is the costs required for a competitor to imitate. These costs depend upon three factors: *Unique historical conditions, causal ambiguity* and the s*ocial complexity of resources*.

Whereas the RBV certainly extends the theoretical understanding of the relation between ICT and competitive advantage, RBV too has limitations. Critics of RBV put focus on the potential of tautology (Eisenhardt & Martin, 2000), the lack of empirical studies (Williamson, 1999), the neglecting of the demand-side of resources (Priem & Butler, 2001), the relative lack of process-orientated approaches (Foss, 1997), the shortcomings in explaining hyper-competitive industries (D'Aveni, 1994), the inconsistency of the theoretical discourse (Kalling & Styhre, 1999). A practical issue concerns the object of analysis: what, exactly, is it that should be unigue: the resource, its impact on operations or the profit? Mosakowski & McKelvey (1997) and Chatterjee (1998) suggest that the relevant unit of measurement is the so-called *intermediate outcome*. An intermediate outcome, in this case, may be a product feature that increases quality and has the potential to generate increased sales turnover, i.e. something between the resource and the product offering. Chatterjee (1998) also claims that "a unique resource does not create competitive advantage, but a unique and valuable outcome does" (p 80).

Following RBV, Clemons & Row (1988), (1991), Mata et al. (1995), Powell & Dent-Micallef (1997), Andreu & Ciborra (1996), Bharadwaj et al. (1999), Wade (2001) etc have illustrated the power of applying RBV on ICT. Clemons & Row (1988) studied the sustained competitive advantage of McKesson through ICT use. Similarly, in an empirical analysis of the competitive advantage due to ICT use at 30 firms that had been acclaimed for their pioneering role in ICT-based strategic differentiation in their respective industries, Kettinger et al. (1994) found that "the pre-existence of unique structural characteristics are an important determinant of strategic ICT outcomes" (p 46). In frustration over the shortcomings of I/O in explaining the sustainability of advantages, these researchers emphasised the difference between strategic advantage and necessity, and claimed that in order for ICT to generate sustained competitive advantages, they need to be 'embedded' with other unique resources or organisational properties (e.g. scale, scope, structure). Interestingly, these RBV researchers never saw ICT as being able to generate advantage on its own, only by facilitating other resources (cf. Powell & Dent-Micallef, 1997).

2.4 Strategy Perspectives

To conclude, the field of strategy is fragmented. The three dominant fields as well as different sub-fields are developing in different directions, meaning there is no such thing as *one* theory of strategy. The strategy concept means whatever phenomenon we subjectively attach to it, such as choice of 1) industry, 2) industry position, 3) customer segment, 4) geographical markets, 5) product range, 6) structure, 7) culture, 8) position in the value chain, 9) resource-bases, 10) knowledge bases, 11) technologies and so forth. We believe, however, that it is possible to integrate the relevant components into one model. This model is too large to be referred to as a strategy model. It includes business activities as well as the resources they deploy, the structure under which they are conducted, as well as the products resulting from these activities, i.e. all business activities between factor and product markets. The business model is described further below.

3. THE BUSINESS MODEL CONCEPT

3.1 Previous Approaches

One comprehensive, yet neglected, text on business strategy is by Porter, 1991. In this article, Porter claims that the low-cost and differentiation advantages that firms enjoy on the product market (i.e. in relation to customers and competitors) ultimately stem from some sort of 'driver'. Porter's chain of causalities starts with 'initial conditions' and 'managerial choices'. Decisions taken affect so-called

drivers (resources, or properties such as scale and scope), which build up *activities*, which in turn enable *low cost* production and/or product *differentiation*, both of which enable specific strategies and positions in markets/industries and firm success. It is not referred to as being a business model, but it incorporates many features that should be included in such a model. Porter was not very specific about the contents of the different components, but the model summarises most of the ideas presented in his 1980 and 1985 books, yet it adds the causal interrelations between resources and firm success.

Inherent in this model is also the strategic process, as the managerial choices are seen as taking place in a *longitudinal dimension* and is thus a response to criticism from the Process perspective field (e.g. Mintzberg, 1978, Quinn, 1978). The inter-relation between factor markets, the firm and the product market encompasses both RBV and I/O, and highlights the complementary nature of the two viewpoints – a complementarity based on causality. So Porter's integrative causality model is also a response to the criticism from RBV. The model is a metaphor of how factors are transformed to products. RBV focuses on resources, or 'drivers' in Porter's terminology, and use the resource attributes (value, rareness etc) as determinants of 'firm success' in the causality model. Ironically, Porter's criticism of the business model concept (2001), claiming that the definition of 'business models' is 'murky' and that the concept excludes important variables such as the industrial forces, could well be resolved by using his 'causality chain' (1991).

Others have described conceptually similar models (and occasionally refer to them as business models), including Normann's work on the *business idea* (1977; see also 2001). Normann used the business idea concept to describe businesses, much like a theory of the firm, and excluded neither resource bases nor environmental factors. The overall principle of the business idea is fit; it is systemic in nature. Although it contains many different components, Normann (2001) distinguishes between three different parts: 1) the external environment, its needs and what it is valuing – what is crucial to the environment. 2) the offering of the company, 3) internal factors such as organisation structure, resources, organised knowledge and capabilities, equipment, systems, leadership, values. The systemic nature of the business idea requires that there is coherence. The relation to the external environment depends on the offering, which in turn is dependent upon internal factors, such as resources and activities. Again, the resemblance between the business idea (Normann, 1977) and the aggregation of Porter's models (1980, 1985) into the causality chain model (Porter, 1991) is obvious.

The research on entrepreneurship, often resting intellectually on the fundamentals of Schumpeter (1934, 1950), have produced many models that are free from the RBV – I/O dichotomy and inherently longitudinal and process-orientated in nature. These approaches normally focus on the evolution and life-cycle of entire business operations in a holistic fashion. McGrath & MacMillan (2000) include "the way an organisation organises its inputs, converts these into valuable outputs, and gets customers to pay for them" in the business model concept. Schumpeter himself claimed that entrepreneurship included the combining of previously disconnected 'production factors' (Landström, 2000) and put focus on the competitive behaviour of firms in markets that are in states of disequilibrium.

Close resemblance to business models are found in Alter's (1999) theory of Information Systems. The focal point of the theory is the distinction between the information systems and the 'work system(s)' it serves. Alter (1999) defines a work system as "a system in which human participants and /or machines perform a business process using information, technology and other resources to produce products and/or services for internal and external customers" and the elements of a work system is: business process, participants, information technology, products, and customers.

Components of the business model could be found in the emerging e-business research, an area where the concept of business models has been used more extensively. Amit & Zott (2001) concluded that in order to understand the factors behind value-creation in e-business (efficiency, complementarity, lock-in and novelty), a range of different theories had to be used and integrated into a *business model*. They used value chain analysis (Porter, 1985), Schumpeterian innovation (Schumpeter, 1934), RBV (Barney, 1991), strategic networks theory (Burt, 1992) and transaction cost economics (Williamson, 1975) to be able to capture the factors of e-business value creation and construct the business model,

which includes the content (exchanged goods and information and the resources required to facilitate the exchange), structure (the transaction stakeholders and how they are linked), and governance of transactions (the control of the flows of goods, information and resources and the legal association form). All three components are important to understand business models, yet what is included in each may be dependent upon the nature of the business, i.e. it is not generic. Rappa (2000) identified nine generic e-business models and Afuah & Tucci (2001) presented a comprehensive description of the components of a business model: customer value, scope, price, revenue sources, connected activities, implementation, capabilities, and sustainability. These models try to explain today's fast moving environment in a more appropriate way than previous models based on strategy or ICT. Weill & Vitale (2001) state that a business model describes roles and relationships among consumers, customers, allies and suppliers as well as the major flows of product, information and money. Upon selecting a business model, firms must consider strategy, organisational structure, business process, value chain, and core competencies. At least 33 different business models have been presented within the field of e-business research (Cherian, 2001), e.g. Timmers, 1998; Rappa, 2000; Afuah & Tucci, 2001; Applegate, 2000 Rappa, 2000; Weill & Vitale, 2001).

3.2 An Alternative Business Model

Based on the existing literature review above, we would propose a business model that includes the following causally related components, starting at the product market level: 1) Customers, 2) Competitors 3) Offering, 4) Activities and Organisation, 5) Resources and 6) Factor and Production Input suppliers. The components are all cross-sectional and can be studied at a given point in time. To make this model complete, we also include a longitudinal process component (cf. Porter, 1991), which covers the dynamic of the business model and highlights the cognitive, cultural, learning, and political constraints on purely rational changes of the model. It could be illustrated as in figure 1.

The model integrates firm-internal aspects that transform factors to resources, through activities, in a structure, to products and offerings, to market. The logic is that in order to be able to serve the product market, businesses need activities, as well as input from the factor market (capital and labour) and the supply of raw material etc. The same resource-base and activities and organisation can produce different products and hence have a scope of different offerings (e.g. cars in two or more colours), but at some point during diversification, new activities are needed (e.g. cars in two or more versions) and potentially also new resources (e.g. diversification to include lorries), thus forcing the development of business models. With this view, a firm can have many different business models. However, the more profound the differences between products, the higher the probability that the businesses are organised independently from each other (cars and lorries make out distinct business units in most vehicle-based corporations).

There are causal relations between the different components. In order to serve a particular customer segment and compete with the products within that segment, the offering must have a favourable quality/price position. In order to achieve this, firms need to offer customer-perceived quality of physical product features and service, which in turn requires effective activities (e.g. large scale, competence) and organisational structure (efficient communication and division of labour and authority). This requires human, organisational and physical resources that have to be acquired on factor markets and from suppliers of production inputs. Although not depicted in the model, external actors are potential partners or competitors in all aspects of the business: in the bundling of products (e.g. computers and software), in activities (e.g. outsourcing ICT, buying services from advertising agencies) and in the configuration of resources (e.g. banks and insurance companies share customer data bases). Change can appear both in exogenous or endogenous processes. A poor offering (e.g. too high price/quality) may initiate change programmes that result in reformed activities and reconfigured resource base, but it can also work the other way. Firms take stock of their resource base and may find new ways to combine resources, and new ways to dispose of activities as a result of resource modifications. This can result in new products and improved product market positions. So change can take either direction, and the depth of change will vary. Logically it seems that resource bases are

more difficult to change than products and activities. What is important though is the realisation that whatever the modification, it will affect other components of the model.

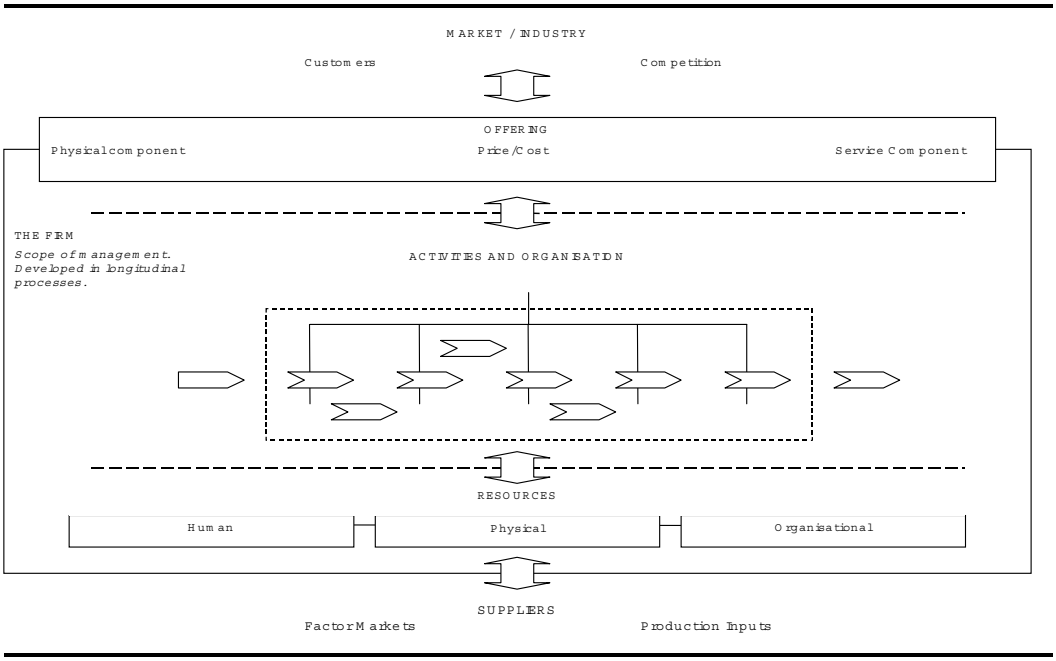

Figure 1. The Components of a Business Model

One important aspect is that the business model has to be managed and developed. This is how the Process perspective is included. The model can be studied in a cross-sectional dimension (the causal dimension, vertical in the outline of the model) but it also evolves over time (the longitudinal dimension, horizontal in the outline of the model) as managers and people from the inside, and as customers and competitors on the outside, continues to evolve. These processes include the bridging of cognitive, cultural, political obstacles, and are issues that managers deal with on a regular basis, for all components of the model (scope of management is depicted in figure 1). This model incorporates RBV and I/O and Process perspectives and solves potentially many RBV questions about what is the unit of analysis in terms of value and uniqueness. Is it the resource, the intermediate activities or the product that should be analysed? One way to approach this issue – if one is interested at all – is to use the business model. Certain parts of it may be more valuable and unique than others, be it a product feature or a particular type of knowledge, and that is what matters.

4. DISCUSSION: ICT AND THE BUSINESS MODEL

Assessing three particular properties can validate a model such as the business model proposed here: the integration of the model, its practical and theoretical relevance, and explanatory power (Glaser, 1978). Integration refers to the logical coherence of the model, and shall not be further discussed. However, we shall briefly discuss the relevance of the model by exemplifying how different ICT systems interrelate with the business model components. We also discuss the explanatory power of the model by comparing to existing models, most of which have been discussed above.

4.1 Examples

CRM (Customer Relationship Management), for instance, is an ICT resource consisting of data and the knowledge to process customer data that sales and customer service use to improve customer relations and sales. The economic logic of a CRM system as seen through the business model is the following:

- Like all ICT, the system itself is a resource. CRM relates and is related to and draws on other resources, such as financial resources (it costs to invest in and maintain it), physical resources (you need hardware and network as well), human cognition (you need knowledge to manage the system and to interpret the data from the system), and organisational resources (cooperation is required between individuals and between organisational units). The system will also integrate with other ICT resources, e.g. ERP systems, as input and output sources for data, e.g customer order might first be entered into the CRM in some cases and in other cases the CRM will collect data from and ERP system.
- In the next step, i.e. activities, the CRM system directly affects sales and customer service activities, since the system design reflects the vendors view on how to conduct CRM. The system will provide the information processing capabilities for sales and customer service. The quality of the information provided by means of the aggregation of data in the system should improve the daily as well as the long-term decisions on customer strategies.
- The improved knowledge about customers will affect the product offering (the next step in the model) as well. Costs for the offering will be reduced, which means that the company will improve its profitability. The customer-perceived quality of the offering might be improved as well, due to better communication and possibly more accurate and timed offers. Competitors that are not able to match the offering will be at a disadvantage. This in turn improves price and/or sales volume, which increase profitability.

ERP (Enterprise Resource Planning) systems as another example, they too affect activities, offering, and resources in a specific way:

- They integrate the activities within a business model or between business models by integrating the information flows (e.g. procurement, order entry, production planning, human resource planning, accounting, controlling). They contain a common data repository (e.g. customer data, supply data accounting data, and bill of materials), which if properly made, will enable a faster and more correct communication of data and information. ERP systems are also real time system, which enables quicker and improved decision-making both on a strategic and daily/operative basis. Furthermore, ERP systems integrate these activities in both horizontal and vertical dimension, sometimes to the extent that a new organisational structure is imposed to reflect the proprietary solution of the ERP system. The reorganisation itself creates value by synergy and by improving quality and efficiency of work - hopefully.
- In terms of the offering, an ERP system enables firms to cut costs and increase quality through improved information processing and in reorganisation, and to improve the sales turnover by means of improved throughput processes and by better decisions. The same is true for SCM (Supply Chain Management) systems, which integrate all activities from procurement, inbound logistics, internal logistics in sequential production steps, outbound logistics and distribution.
- Finally, the resource aspect of ERP system. Davenport (1995, p. 32) described the implementation of ERP as “perhaps the world’s largest experiment in business change” and for most organizations “the largest change project in cost and time that they have undertaken in their history”. The investment and implementation of ERP systems is a challenge for most mangers and a risky project that will affect all other resources, see for instance Markus and Tanis (2000).

The economic value of systems such as CRM, ERP and SCM grows exponentially if they are networked externally to suppliers, customers and alliance partners. Collaborative product development, online quotation making, order information available through the value chain are services that will improve the value of individual systems resources since they link up firms externally. Extending that line of thought, e-Business resources, which enable trading over the Internet, can also be viewed through the model. Depending on the product or service offered, it can enable reach of new customers, it can create complementary services to existing products/services, it can automate parts of the selling process, and, if the scale of trading is sufficient, data on customer

behaviour might be analysed and materialised in new strategic and operative decisions. e-Business firms can build almost entirely new business models (e.g. Amazon), if they innovate individual products and services (e.g. software upgrade over the internet, music, news, ticket sales, home banking) that require resources and activities other than what is required for the existing, 'bricks and mortar' business model.

All ICT can be viewed through the business model lens: they are resources, they affect, directly and indirectly, one or more activities, which in turn if well implemented, will improve the offering in terms of cost or quality, which will lead to higher profitability, higher economic value. This is true not just for contemporary ICT resources such as those described above, but also for more classical applications: financial systems automate accounting which reduces costs and improves decision-making and improves the offering. Payroll systems automate activities in the HR department and improve the information on salary notes to employees. Decision-support systems and data mining enforce analytical activities both by generating novel slices of data and by automating search processes. Better decisions and swifter decisions, as well as less time consumption, will improve the offering in relation to the industry, ceteris paribus. For managers, the challenge is to manage not only the system but also the fit with resources, activities, organisation and the product on the market in longitudinal processes. Developing the business model over time is likely to encounter the bridging of cognitive limitations (bounded rationality), to norms and values and to politics.

Let us look at a simple example:

- Resource level: A company acquires a CRM system and an ERP system. They cost 1 EURM each in software, hardware upgrades and training. At the same time, old systems are sold, rendering 100 EURK. Thus, the net one-off investment is 1.9 EURM. Thus, ICT affects resources such as money, existing ICT resources and people (carriers of both knowledge and culture).
- Activity level: The CRM system is embedded in Sales operations, and as staff learns to use it, its data contents and how to improve their work tasks, activities are improved. For instance, customer analysis is sped up, meaning less staff is needed. In addition, communications with customers might be improved, due to a better overview of purchasers, goods receiving etc. The ERP system, on the other hand, is successfully implemented and because processes are reengineered and the organisation is restructured, the order-entry sub-process is made in 2 minutes instead of 10, and production planning is improved to the extent that stock can be reduced and that deliveries become more accurate. Both systems require extensive maintenance, and training is continuous, averaging a cost of 200 EURK per year. Still, improvements have been made, but they have not been materialised through reduced costs or increased sales turnover.
- Offering level: The improvements in activities following the two investments should also improve actual result by increasing price per unit or volume sold or by reducing cost per unit. A unique offering (price/quality in relation to competing offerings) is the ultimate effect of good resource utilisation. Resources do not always materialise in this way, though, since organisations may refrain from making staff redundant (hoping, possibly, that the overall volume shall grow) or they might be afraid of actually reduce buffers of goods and stock, and since there might be difficulties in communicating to customers that the business has improved, the actual improvements may not affect the offering. If they do, let us say the cost reduction equals 400 EURK on an annual basis, and that the increased revenue equals 100 EURK per year. That means that net annual flow of cash in is 500, meaning the time period required to pay the initial investment of 1.9 EURM is four years. If it is sustained further, it will generate annually 500 EURK, to be discounted to net present value. Simple investment logic, which could be coupled with a sunk cost approach if the initial investment needs to be neglected for, say, political purposes.

An important aspect of the model is the intermediary level, activity and organisation, i.e. what the firm actually does with its newly acquired resources. Failure to use the ICT resource to improve activities, failure to organise in a suitable way, and/or failure to materialise on improvements made in activities, will render an intact or possibly worse offering than before the ICT investment was made. Potentially,

this also clarifies some of the practical problems with RBV and what it is that should be unique in relation to resources. A common system (off the shelf) can be uniquely well applied and thus create uniquely low costs or unique customer-perceived quality – and hence generate a competitive advantage. A unique system (built in-house possibly) can be applied in an ineffective way and thus not enable improved offerings, even if it improves activities. Apart from the cross-sectional causalities between resource, activities and offerings, the model we suggest also takes into consideration the fact that the inclusion of new ICT changes the entire business model – if implemented and employed effectively. If not, the only change brought about was the actual installation of an idle, costly resource. The process of identifying and investing, as well as implementing and employing and ICT is longitudinal and intended to transmigrate the existing business model (at t_0) into a better one (at t_1), hence the longitudinal management dimension of our model. Whether it is successful or not depends on the ability to manage cognitive as well as cultural and political constraints, which are extremely important variables that are often neglected. If users and managers and consultants cannot be successful in identifying, developing and using ICT to improve activities in a way that is visible in the profit statement and the individual offering, nothing significant will happen with the business model.

All in all, the model proposed should be seen as a generic tool to understand the business context of all types of resources, ICT included. The actual value of an ICT system is dependent upon how well it is applied and used in relation to the business in question. Economically, its value is determined partly by the costs associated with investing and maintaining it, and partly by the payback that the system brings in terms of cost reductions or profit improvements. The payback stream, in turn, is dependent upon the uniqueness of the system and the effectiveness of the process of managing the deployment of the system in activities, in organisation, in the offering and in possible diversification of the offering.

4.2 The Business Model in Comparison

The business model is characterised by an integration of various theoretical perspectives such as I/O, RBV, Strategy Process, and ICT research, and addresses the interdependency between the components of the business context of ICT. There are other studies addressing the same issue both within ICT and strategy research. The advantage with the model described here is the broader integration, the level of details on causalities between the components (see section 3), and the integration of longitudinal management processes and constraints on change. The model is applicable on ICT in general.

Research into ICT has been based on a deterministic view of ICT. A consequence is that the object under investigation is studied based on variance theories (Markus & Robey, 1988). Thus important aspects of how ICT affects organisations may be missed, e.g. business models changes over time. Research on ICT (e.g. Scott-Morton, 1991, Alter, 1999) is not explicitly addressing how ICT is contributing to economic value. This is only done implicitly since there is a belief that ICT will improve organisations. Most studies of ICT and competitive advantage have applied an I/O view of strategy or simply practical checklists. Studies based on an RBV perspective and the process view of strategy are focusing on sustainable competitive advantage, but are often biased towards development or usage. It is also unclear what in the business model that should be unique. This is resolved with the model presented here. Other studies that have an explicit focus on ICT and economic value (productivity) have been based on single theoretical frameworks (cf. Brynjolfsson, 1993). The business model addresses these issues by taking an integrative perspective on ICT and business.

5. CONCLUSION

Research into what makes ICT valuable to business and organisation, like strategy research in general, tends to focus on a selection of specific aspects of business, rather than an integration of them. In addition, much ICT research uses obsolete strategy models fragmentally and as a consequence finds it difficult to explain certain phenomena in relation to ICT and value, for instance sustainability of competitive advantage and the strategy processes by which ICT are developed and embodied with other resources and with activities and the product offering.

With this paper, we provide a business model that gives structure to the broader business context of ICT. ICT is at best a potential resource, i.e. something with a potential value, acquired on a market or developed internally. Theoretically, the bottom line is that the economic value is determined by a firms' ability to trade and absorb ICT resources, to align (and embed) them with other resources, to diffuse them in activities and manage the activities in a way that creates an offering at uniquely low cost or which has unique qualities in relation to the industry they compete in. We argue that any empirically defined ICT application can be viewed through the business model, but that a contingency view must be applied: the economic value and the relations within the business model vary between different ICT applications, and between different businesses. Yet as a generic model it captures the relevant aspects to consider for any ICT decision-maker or student of ICT and business.

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Paper IV

Enterprise Resource Planning Systems: Critical Factors in Theory and Practice

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Enterprise Resource Planning Systems: Critical Factors in Theory and Practice

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Abstract

This paper reports the findings of a research project investigating the utilization and continuous improvement of Enterprise Resource Planning (ERP) systems. Adopting the aspects of a resource management framework and Critical Success Factor research, an initial framework is developed. The framework is developed through a survey of ERP system expert consultants. A number of factors and causalities are identified, including the positive role of use by top management and the role of corporate culture. Two factors were found to have a negative impact on utilization. The first is the unreflective use of ERP system implementation methods, which can 'kill' the visions and ideas of implementing ERP systems, while the second is the vanilla implementation strategy.

Introduction

Enterprise Resource Planning (ERP) systems constitute one of the most important developments in corporate information systems during the last decade (Davenport 1998; Hitt, Wu and Zhou 2002; Upton and McAfee 2000). The business interest in ERP systems can be explained by the benefits associated with the implementation and utilization of ERP systems (Robey, Ross and Boudreau 2002). The benefits are only related in part to the technology, most of these stemming from organizational changes such as new business processes, organizational structure, work procedures, the integration of administrative and operative activities, and the global standardization of work practices leading to organizational improvements, which the technology supports (Hedman and Borell 2003). The benefits are documented in a study which showed that the selection and acquisition decision of the market-leading ERP system (SAP R/3) leads to increased market value and the use can lead to increased productivity over time (Hitt et al. 2002).

The implementation of ERP systems is a difficult and costly organizational experiment (Robey et al. 2002). Davenport (1996) described the implementation of ERP systems as "perhaps the world's largest experiment in business change"

and for most organizations "the largest change project in cost and time that they have undertaken in their history". The costs and time frame related to implementing an ERP system can be illustrated by the case of Nestlé, which will have invested, by the end of 2003, US$ 500 million in an ERP system. In 1997, the American subsidiary started the project and in 2000 the global parent decided to extend the project into a global solution (Worthen 2002).

The implementation of information systems is a necessary but insufficient prerequisite for benefits and value. Business value can only be derived from the efficient and effective utilization of information (Agarwal, Ratan and Ghosh 2000). The management of ERP system utilization is, thus, of critical importance and involves development and implementation, as well as usage of resources (Kalling 1999).

Given the increased importance and the potential benefits of ERP systems, it is critical that research focuses on utilization. This paper reports upon the results of a study focusing on factors affecting utilization. The overall research question addresses how organizations can better utilize ERP systems. Improved utilization can refer to either cognitive improvements or diffusion improvements. Cognitive improvements address the individual user of ERP systems, e.g. whether the user can improve and extend his or her use of ERP systems. Diffusion improvements, on the other hand, address the organizational side of utilization and refer to the scope of the system and internal distribution. This paper builds upon and expands Kalling's (1999; 2003) IT resource management (ITRM) framework, which is used to analyze the empirical findings and to theorize ERP system CSFs.

The outline of the paper is as follows: The following section presents the ITRM framework and a literature survey of Enterprise Systems CSFs. An initial framework is presented as a synthesis. The third section presents the research method. The following section presents the empirical observations followed by the result and discussion. The final section concludes the paper and proposes further research.

Theoretical Ground and Literature Review

An initial framework is developed based on an integration of Kalling's (1999; 2003) ITRM framework and ERP System CSFs research. A number of factors and causalities emerge as critical to the management of ERP systems, mostly related to the early phases, e.g. development and implementation.

IT Resource Management Framework

Kalling's (1999) ITRM framework is mainly based on an integration of the resource based view literature, e.g. Barney (1991), and strategy process research, e.g. Mintzberg (1994; 1998). The framework is empirically verified and further enhanced in a comprehensive case study of the development and use of an integrated sales, manufacturing and logistics system. The framework includes two main phases (the resource and employment phases) and five tasks (identification, development, protection, internal distribution and usage). The phases and tasks are depicted in Figure 1. The arrows indicate the causality between the tasks. In Figure 1, the problems related to each task are underlined and the management activities aimed at resolving the problems are italicized. The components of the framework are described below.

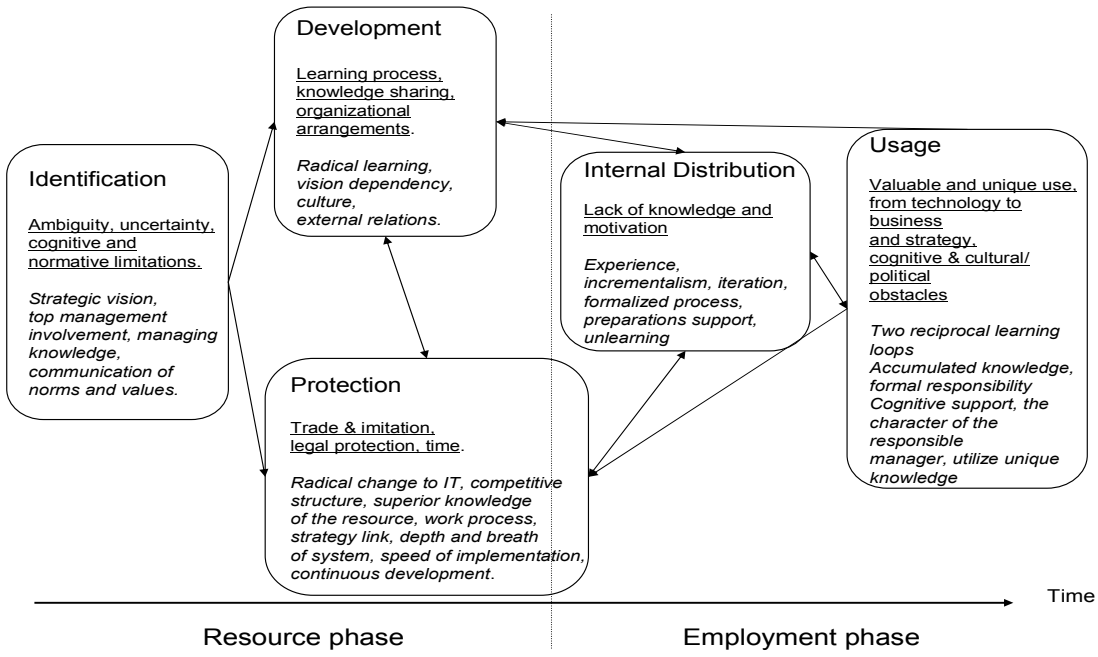

Figure 1 The ITRM Framework (adapted from Kalling 1999).

According to Kalling (1999; 2003), the resource phase involves three distinct tasks, which include the identification, development and protection of resources. Identification involves the search and decision process leading to the decision to develop a resource. Problems related to identification tasks are; ambiguity concerning what resource is required and the uncertainty of how to develop the resource. Ambiguity and uncertainty can be managed by means of a strategic

vision of the resource's fit, top management involvement and management of knowledge. The development tasks aim to create the resource and resemble traditional analysis, design and realization. This is viewed as a learning process involving knowledge sharing and organizational arrangements. Issues related to learning can be resolved through the acquisition of knowledge from an external party, e.g. a consultancy firm developing the resource. One critical factor promoting learning is the organizational culture, including norms and values. The strategic vision has the role of a control and support tool for the management and project group responsible for the development. The composition of the project group and its relationship with external consultants is important factors during the development. The protection task's aim is to protect the resource from trade, imitation and substitution. This can be managed by means of legal protection or insulating the resource in different ways. Legal protection can provide durable protection. Insulating mechanisms, such as causal ambiguity and social complexity, can create temporary protection. In order to protect resources, firms have to develop and implement these quickly, as well as continuously improve their utilization. As illustrated in Figure 1 protection occurs continuously during the resource and employment phases.

The employment phase's aim is internal distribution and usage of the resource. Internal distribution refers to the diffusion of resources. Implementation is difficult and is affected by unwillingness, poor communications, a lack of knowledge, and conflicts of interests etc, which have to be managed. The obstacles encountered during this phase can be managed through extensive training, preparations, support, unlearning the old system, and phased implementation. Usage involves using the resource in work processes. The resource can affect existing work procedures which then have to be changed, leading to resistance in the users. To overcome such problems, iterative learning is a key tool and, in particular, the interplay between the resource and the processes, i.e. how do new processes work with the resource (Kalling 1999; 2003).

Besides the two phases and five tasks of the ITRM framework, there are relationships and causalities between the phases and tasks. This is illustrated by the arrows. The time axis in Figure 1 illustrates the longitudinal aspect. The overall logic of the ITRM framework is that the requirements of a particular resource are identified. Commitment is essential during identification, through organizational and financial commitment to the project. The commitment provides a causal link with the development and protection tasks. The development of resources creates a need for protection, and the need for protection affects the development. The developed resource has to be distributed, prior to usage. The distribution or implementation has to be

protected. The actual usage can lead to requests for changes and recurrent development, protection and distribution. In order to create long-term value, the resource has to be continuously improved.

The ITRM framework has some limitations. The first is the perspective being applied, which is a management perspective. The limitation of a management view of ITRM is an issue, not related to management, is included, e.g. technical issues. Another limitation of the framework is the empirical case, which was the development of one unique information system's resource developed from scratch. This setting should be contrasted with ERP systems, which are generic systems bought off the shelf. However, the limitation paves the way for extensions and elaborations of the framework.

ERP Systems Critical Success Factors

The concept of CSF is well established and widely used in ERP systems research and information systems research (Somers and Nelson 2001), but is also criticized (Robey et al. 2002). Robey et al. (2002) criticize CSF research for being based on variance models, speculating on the antecedents that predict and explain ERP system success, and lacking theoretical ground, which explains why project and business outcomes occur.

Table 1, presents all CSFs included in the review. One of the first publications on ERP systems was Davenport (1996). He described six CSFs, including top management support, the use of one consulting firm, cross functional steering, cross functional implementation, rapid implementation, and the communication of the holistic nature of ERP system implementations.

Parr et al. (1999), on the other hand, identified 10 factors necessary for successful implementation. Three factors were found to be "of paramount importance" including management support, a balanced project team, and organizational commitment to change. The remainder of the CSFs included best people, empowered decision makers, deliverable dates, champions, vanilla ERP (not changes to the system), smaller scope, and the definition of scope and goal. In addition, Parr et al. (1999) grouped the CSFs into four categories of CSF, management (Management support, deliverable dates, empowered decision makers), people (best people, champions), software (vanilla ERP), and project factors (smaller scope, definition of scope). Parr et al.'s (1999) list was used in Parr and Shanks' (2000) study of the varying importance of CSFs. Nine of the ten CSFs proposed by Parr et al. (1999) were used – smaller scope was not included. The successful company perceived more CSFs as important over a longer period of time, compared to the less successful company.

Skok and Legge (2002) applied a stakeholder perspective and identified four stakeholders: management, consultants, developers, and users. They used CSFs from Bancroft, Seip and Sprengel (1998), see Table 1. Bancroft et al.'s (1998) list was one of the first and was also used in Parr et al.'s (1999) study. Skok and Legge (2002) contribute to understanding ERP system projects by claiming that some CSFs are related to ERP systems projects (cultural and business change, managing consultants, managing conflicts), whereas others are general to information system projects (user involvement, user acceptance), and others apply to projects in general (planning and control, project champion, top management support, team working). The study of Skok and Legge (2002) is the only CSF research paper applying an interpretative research approach.

Holland et al. (1999) contribute to CSF research by identifying legacy systems as CSFs. The role and importance of legacy systems are related to problems with existing legacy systems, e.g. Y2K problems and problems with upgrades and functionality. Umble, Haft and Umble (2003) on the other hand propose post evaluation and end-user training programs as CSFs. Al-Mashari, Al-Mudimigh and Zairi (2003) also stress the role of post evaluation in achieving long-term success.

The most comprehensive list of CSFs is presented by Somers and Nelson (2001). They identified 22 CSFs. Their list is based on both a literature study and a survey of 86 organizations. They applied Cooper and Zmud's (1990) technological diffusion model in order to illustrate the varying importance of different CSFs. This model includes six stages: initiation, adoption, adaptation, acceptance, routinization, and infusion. Table 2 presents the five most important factors of each stage. Top management support and communication are the two most important factors across the phases.

Nah et al. (2001) analyze ten articles and presents a list of eleven CSFs. In their analyses, they apply Markus and Tanis' (2000) Enterprise Experience life cycle to show when a CSF is relevant. The first seven factors presented by Nah et al. (2001) in Table 1 are applicable throughout the resource and employment phases; according to Kalling's terminology, the following three are critical from internal distribution to usage. The monitoring and evaluation of performance is the additional CSF, compared to Parr et al.'s list, and was perceived to be important during usage.

Table 1 Critical Success factors in Enterprise Systems literature, presented in alphabetic order

Al-Mashari et al. (2003)*	**Davenport (1996)***	**Hong and Kim (2002)**	**Parr et al. (1999)**	**Somers and Nelson (2001)**
Enterprise System package selection	Top management support	Organizational fit of Enterprise System	Management support	Top management support
Management & leadership	Use of only one consulting firm	Enterprise System adaptation level	Balanced team	Project team competence
Visioning & planning	Cross functional steering	Process adaptation model	Commitment to change	Interdepartmental cooperation
Project management	Cross functional implementation	Organizational resistance	Best people	Clear goal and objectives
Training and education	Rapid implementation		Empowered decision makers	Project management
Communication	Inform people about the holistic nature		Deliverable dates	Interdepartmental communication
System integration			Champion	Management of expectations
System testing			Vanilla ERP*	Project champion
Legacy systems management			Smaller Scope	Vendor support
Process management			Definition of scope and goal	Careful package selection
Cultural & structural change				Data analysis & conversion
Performance evaluation & management				Dedicated resources
				Use of steering committee
				Business process reengineering
				Partnership with vendor
				User training on software
				Education on new processes
				Minimal customization
				Architecture choices
				Change management
				Use of vendors' tools
				Use of consultants
Bancroft et al, (1998)*	**Holland et al. (1999)***	**Nah et al. (2001)***	**Skok and Legge (2002)**	**Umble et al. (2003)***
Communication	Legacy Systems	ERP teamwork and composition	General projects	Strategic goals with the system
Top management support	Business Vision	Top management support	*Planning and Control*	Commitment of management
Understand the corporate culture	ERP Strategy	Business plan and vision	*Project Champion*	Project management
Organizational change prior to implementation	Top Management Support	Communication	*Top management commitment*	Managing change
Empowered project manager	Project Schedule/plans	Project management	*Teamworking*	The team
Balanced team	Client Consultations	Appropriate business and IT legacy systems	IS projects	Data accuracy
Project methodology	Personnel	Champion	*User involvement and acceptance*	Education and training
Training	Business Process Change	Minimum BPR and customization	*Hybrid skills*	Focused performance measures
Expect problems	Software configuration	Software development, testing	ERP projects	Selection of system
	Client acceptance	Change management program and culture	*Cultural and Business Change*	Post implementation audit
	Monitoring and feedback	Monitoring and evaluation of performance	*Managing Consultants*	
	Communication		*Managing Conflicts*	
	Troubleshooting		*Staff retention*	

* These papers do not provide any ranking of the CSFs.

Table 2 Ranking order of CSFs in relation to the phases of Enterprise Systems (based on Somers and Nelson 2001).

Phase	CSF
Initiation	Architecture choices; Clear goal and objectives; Partnership with vendor; Top management support; Careful package selection
Adoption	Top management support; Project team importance; Use of steering committee; Partnership with vendor; Dedicated resources
Adaptation	Interdepartmental communication; Interdepartmental cooperation; Project team competence; Dedicated resources; Use of vendors' tools
Acceptance	Interdepartmental communication; Interdepartmental cooperation; Top management support; Project team competence; Education on new processes
Routinization	Interdepartmental communication; Top management support; Interdepartmental cooperation; Vendor support; User training on software
Infusion	Interdepartmental communication; Interdepartmental cooperation; Top management support; Vendor support; Partnership with vendor

Hong and Kim (2002) approached CSFs quite differently. They applied an organizational fit perspective to CSFs to explain failures in Enterprise System implementations. In their research, they put forward a research model which examines the relationship between the organizational fit (data fit, process fit, user fit) and Enterprise System implementation success (cost, time, performance, benefits) and the impact of contingencies (Enterprise Systems adaptation level, process adaptation level, organizational resistance). They tested the model using a factor analysis based on responses from 34 organizations. They found strong support for the organizational fit of Enterprise Systems and its positive affect on the outcome and the perceived implementation success. The contingency factor's impact did not provide a clear result.

Observations and Synthesis of CSF review

Despite deviations in CSFs, they show clear similarities. For instance, management support, balanced team, and communication are identified as CSFs. These factors are also to be found in the ITRM framework – using a slightly different terminology. All in all, 109 CSFs have been found, 95 of which with unique labels; see Appendix 1 where the entire list is presented in alphabetic order with references.

A number of observations can be made from the review: There are CSFs covering the entire process from selection to usage, with a strong predominance of factors related to project management and implementation (Parr et al. 1999).

This can be explained by the maturity of research and the maturity of utilization. Another explanation is that researchers tend to put less focus on the use and utilization of information systems. Kalling (1999) provides support for such an explanation by claiming that there are few theoretical contributions related to usage. Parr et al. (1999) and Somers and Nelson (2001) suggest that some factors are more important than others, see Table 1 for the ranking order of some CSFs. For instance, according to Parr et al.'s (1999) study, technical factors are more important during the early phases, whereas project factors are more important during configuration and implementation, and organizational factors are equally important throughout the life cycle.

Several of the 95 factors refer to the same aspect, but using different terms. For instance, management support is also referred to as top management support (Somers and Nelson 2001), management & leadership (Al-Mashari et al. 2003), commitment of management (Umble et al. 2003) top management commitment (Skok and Legge 2002), and top management involvement (Kalling 1999). Thus, it is possible to synthesize the CSFs. The four groups presented by Parr et al (1999) can be used. However, the management and people groups are confusing and difficult to distinguish. The ITRM framework (Kalling 1999; 2003) can be used, but due to the management perspective in the ITRM framework, Wixom and Watson (2001), three implementation categories are chosen. Wixom and Watson's (2001) study of data warehousing success included three factor categories, including organizational, project and technical. The organizational category includes the issues and problems addressed by the ITRM framework. Support for organizational, project and technical factors is also found in Skok and Legge (2002). In Table 3, the 95 factors were synthesized into 28 factors and grouped according to Wixom and Watson's (2001) categories.

Table 3 contains 11 organizational factors, including the role of management and in particular how management manages the overall process of implementing Enterprise Systems. The importance of management has been stressed and studied. For instance, Wixom and Watson found a strong correlation between management support and data warehousing success. Management support can overcome organizational resistance and encourage people to participate. In addition, management allocates resources to the project, e.g. financial and human.

Information system projects are often complex and include a number of tasks and roles to be performed. In the case of Enterprise Systems, the role of the project manager is crucial since he or she organizes a project which, in some cases, lasts for several years and involves internal and external stakeholders. This is affected by the size and complexity of the project including vanilla ERP and

Table 3 Organizational, Project and Technical CSFs

Organizational factors	
1. Business plan and vision including clear goals and objectives, definition of scope and overall planning and control	Somers and Nelson (2001), Al-Mashari et al. (2003) Parr, Shanks et al. (1999; 2000), Holland et al. (1999), Nah et al. (2001), Skok and Legge (2002)
2. Top management support including commitment and leadership of management	Somers and Nelson (2001), Al-Mashari et al. (2003), Bancroft et al. (1998), Parr, Shanks et al. (1999), Holland et al. (1999), Nah et al. (2001), Umble et al. (2003), Davenport (1996), Skok and Legge (2002)
3. Communication internally to inform people and manage expectations	Davenport (1996), Holland and Light (1999), Nah et al. (2001), Al-Mashari et al. (2003), Bancroft et al. (1998), Somers and Nelson (2001)
4. Selection of system to ensure organizational fit	Al-Mashari et al. (2003), Hong and Kim (2002), Umble et al. (2003), Somers and Nelson (2001)
5. Training on software and new processes	Somers and Nelson (2001), Al-Mashari et al. (2003), Bancroft et al. 1998) and Umble et al. (2003)
6. Organizational and cultural change including business process reengineering, cultural and structural change during the entire life cycle	Holland and Light (1999), Al-Mashari et al. (2003), Bancroft et al. (1998), Parr et al. (1999) and Somers and Nelson (2001)
7. Change management involving commitment to change, degree of process adaptation	Hong and Kim (2002), Al-Mashari et al. (2003), Skok and Legge (2002), Nah et al. (2001), Somers and Nelson (2001), Umble et al. (2003)
8. User acceptance	Holland et al. (1999), Skok and Legge (2002)
9. Expect problems	Bancroft et al. (1998), Skok and Legge (2002)
10. Staff retention	Skok and Legge (2002)
11. Evaluation of performance changes and provide feedback	Al-Mashari et al. (2003), Nah et al. (2001), Umble et al. (2003), Holland et al. (1999)
Project factors	
12. ERP Strategy including clear implementation plan with goals	Holland and Light (1999), Umble et al. (2003)
13. Project management must include empowered project manager and decision makers	Al-Mashari et al. (2003), Nah et al. (2001), Parr et al. (1999), Umble et al. (2003), Bancroft et al. (1998), Somers and Nelson (2001)
14. Project team competence involving a balanced team with hybrid competence based on the best and most dedicated people	Somers and Nelson (2001), Bancroft et al. (1998), Parr et al. (1999), Nah et al. (2001), Umble et al. (2003), Al-Mashari et al. (2003), Skok and Legge (2002), Holland et al. (1999)
15. Minimum BPR and customization	Somers and Nelson (2001), Holland et al. (1999), Nah et al. (2001)
16. Cross functional steering, and interdepartmental cooperation	Davenport (1996), Somers and Nelson (2001)
17. Champion	Nah et al. (2001), Skok and Legge (2002), Parr and Shanks (2000), Somers and Nelson (2001)
18. Managing consultants	Skok and Legge (2002)
19. Vendor relationship and consultants from one firm	Davenport (1996) and Somers and Nelson (2001)
20. Project plans with deliverable date	Somers and Nelson (2001), Al-Mashari et al. (2003), Holland et al. (1999), Nah et al. (2001), Umble et al. (2003), Parr et al. (1999)
21. User involvement	Holland et al. (1999), Skok and Legge (2002)
22. Cross functional implementation	Davenport (1996), Al-Mashari et al. (2003)
23. Rapid implementation	Davenport (1996)
24. Smaller scope	Parr et al. (1999)
Technical factors	
25. Vanilla ERP and fit between Enterprise System and organization	Parr, Shanks et al. (1999), Hong and Kim (2002)
26. Appropriate business and IT legacy systems with correct data and the right architectural choice	Somers and Nelson (2001), Umble et al. (2003), Al-Mashari et al. (2003), Holland et al. (1999), Nah et al. (2001)
27. Software configuration and system integration with completed testing	Al-Mashari et al. (2003), Holland et al. (1999), Nah et al. (2001)
28. Project methodology and vendor tools	Bancroft et al. (1998), Somers and Nelson (2001)

minimal reengineering effort. Promoting factors are champion and cross functional steering. The time span of the implementation and clear goals for completion also affect the project. Thirteen factors out of the 28 are identified as project factors (see Table 3).

The third category is technical factors, e.g. data analysis and conversion, architecture choices, system integration, testing, legacy systems management, and project methodology. There are only four technical factors. The role of tools such as project methodology and configuration tools, e.g. IMG (Implementation Guide is the configuration tool of R/3), is important in the completion of the project. The degree of fit between system and organization affects the implementation by making it simpler. The quality and documentation of old information systems, so-called legacy systems, also affect the implementation success.

ERP Systems Management Framework

The concluding part of this section is the integration of the ITRM framework and the CSF research leading to a proposal for an ERP system Management framework (ERPM). The main difference between the ITRM framework and the proposed ERPM framework concerns the resource. ERP systems are generic resources that can be purchased from external providers, whereas the resource studied during development of the ITRM framework is a unique resource.

The selection of ERP systems and the development of a unique IT resource illustrates the issue of 'buying versus building' (Davis 1988). Buying information systems is basically a question of choosing between solutions. This leads to a change of terminology and the replacement of the term 'identification' with 'selection' (see Figure 2). The selection of ERP systems involves other types of ambiguity and uncertainty than the identification of a resource need, since ERP systems include most functionality and are pre-developed, leading to ambiguity as to what system to select (Umble et al. 2003) and an uncertainty regarding the fit of the system (Skok and Legge 2002).

The 'protection' task in the ITRM framework involved three main issues: trade, imitation and time. Trade and imitation are not found in the review of CSFs. Time, on the other hand, is addressed in CSFs in terms of 'rapid implementations' (Davenport 1996). The interpretation of time in CSFs is related to the success of the implementation project, whereas time in the ITRM framework refers to protecting the unique value of the resource. This leads to the exclusion of the 'protection' task and the inclusion of time issues in the 'development' and 'internal distribution' tasks. The management protection tasks

are incorporated into usage tasks, since these tasks are mostly related to usage, e.g. continuous development, cf. Figure 1.

The next enhancement of the ITRM framework relates to classification of the CSFs, according to Wixom and Watson's (2001) three categories. Classification includes three groups (organizational, project and technical factors). Given this, the ERPM framework's phases are enhanced. Besides the organization factor, including the management perspective, the resource phase is enhanced with project and technical factors and the employment phase is enhanced with project factors. In Figure 2, the three factor groups are illustrated using 'O', 'P' and 'T'.

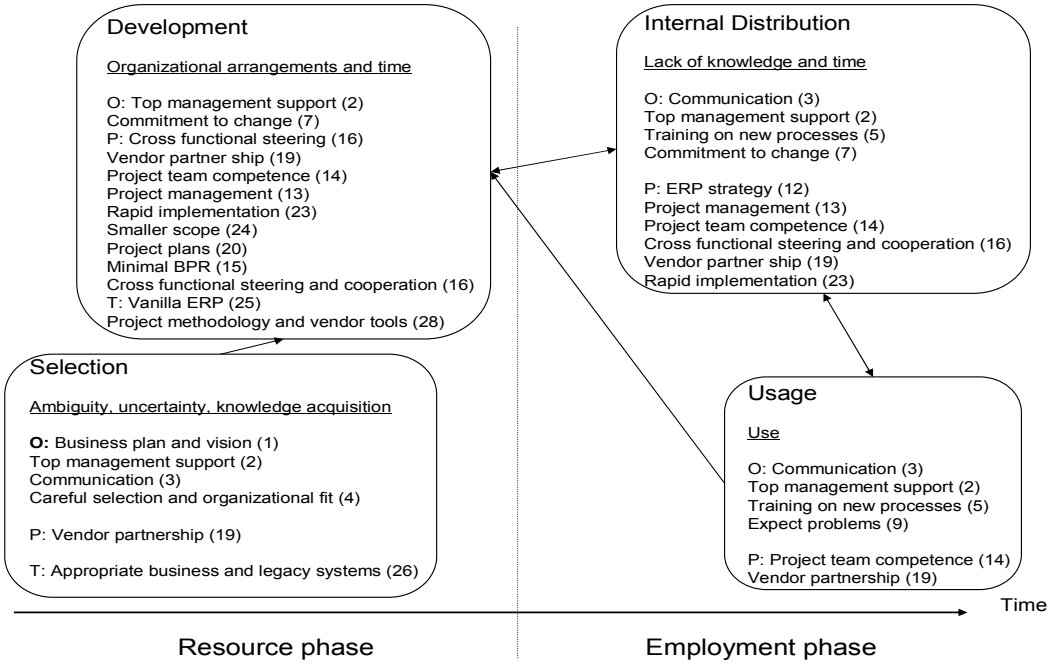

Figure 2 An initial ERP system management framework.

The 'development' task is mainly viewed as a learning process in the ITRM framework. This is not stressed in CSF research. One possible interpretation is that the selection of pre-made systems is knowledge acquisition from an external party leading the issue of knowledge acquisition during the selection task. Instead of learning, project management is stressed as important, e.g. project management, empowered project managers, champion, minimal customization, communication etc. The project factors are mostly related to the issue of the organizational arrangements of the ITRM framework.

The task of 'internal distribution' or implementation seems to be most similar between the ITRM and CSFs and is characterized by issues such as a lack of knowledge and motivation. The motivation aspect is not addressed in CSF research. The lack of knowledge, on the other hand, is expressed as dependency on consultants.

Somers and Nelson (2001) have stressed usage by outlining interdepartmental communication and cooperation, management support, vendor support, user training on software, and partnerships with vendors as related factors. The issues stressed in the ITRM framework, such as unique use, moving from technology to business, and cultural and cognitive obstacles, are not stressed in the CSF literature, apart from by Skok and Legge (2001).

The final enhancement of the ITRM framework is the mapping of some CSFs. Parr et al. (1999) and Somers and Nelson's (2001) proposals regarding the varying importance of CSFs throughout the ERP systems life cycle are used to depict the CSFs on the framework. Several CSFs from Table 3 have thus not been included in the ERPM framework, e.g. factors 6, 8, 10, 11, 17, 18, 21, 22, and 27, due to not being ranked or related to an life cycle.

The literature review, including the ITRM framework and CSFs research, has led to the proposal of an ERPM framework. The next section addresses the methodological issues related empirically enhance and further develop the ERPM framework.

Methodology

One of the objectives researched is to increase understanding of the factors affecting the utilization of ERP systems and in particular how firms can improve utilization. This has also involved the investigation of 'current use' and 'as is improvement efforts', and 'ought to improvements'. The main focus is on ought to improvements and the relationship between phases, tasks and CSFs, where 'current use' and 'as is improvements' function as contextual backgrounds to 'ought to improvements'. In order to pursue the objectives of the research, a survey of ERP system expert consultants was selected. The survey strategy is justified by the broad experience of implementing ERP systems in different organizational settings and with different scopes. An alternative research strategy could have involved case or multiple case studies. However, in favor of the chosen strategy is the fact that ERP system consultants have a broad experience of several ERP systems and implementation contexts. ERP system consultants have been employed in research into ERP system CSFs (see for instance Somer

and Nelson 1999). In addition, they represent an important stakeholder group which is seldom surveyed (Skok and Legge 2002).

The research question centered upon factors affecting the utilization of ERP systems elicited from the literature review and factors proposed during the investigation. Seven expert consultants were interviewed in order to understand how ERP systems are utilized and how organizations can improve their use of ERP systems. The respondents had, on average, 8 years' experience of ERP systems, varying from 16 to 5 years' experience, and had been involved in 75 implementation projects. Most of the respondents had held different positions, e.g. consultant, project manger, account manger, and sales manager. One of the respondents had no experience as a consultant, but was included since he had been an account manager in an industry that had large ongoing ERP system implementation and improvement programs. The experts have mainly been working in Scandinavia, but several of them have been involved in large global projects. The experts have experience from a wide range of implementation projects involving vanilla implementation strategies, rolling implementations, and massive customizations in multi-national corporations, subsidiaries and small and medium sized firms.

The interviews were conducted in person and by telephone, during May to August 2003, and a semi-structured interview method was used. Follow-up calls were made on several occasions. Prior to each interview, an interview guide was sent to each respondent. The interviews were mostly held in public places and hand-written notes were taken. The interviews were summarized and the respondents all had the opportunity to comment, change, clarify or rephrase themselves. The interviews lasted between 1½ and 2½ hours. In addition, several of the respondents provided internal material related to the issues concerned. Altogether, 200 pages of written material have been included.

Initially, questions addressing current use were posed, i.e. how consultants perceive the organizational usage of ERP systems. These questions were posed in order to verify an initial assumption that organizations are not using their IT resources optimally. The consultants were asked to elaborate on their perception of current use. For instance, questions included why the system is not used more extensively and whether there are any differences among organizations relating to size, industry, culture, management style, perception of IT etc. This was followed by questions focusing on events leading to improvement programs, e.g. what triggers improvement programs, what are the obstacles, when do improvement programs occur, how are such programs initiated and about the role of internal and external stakeholders. The last section of the questions addressed how organizations should manage ERP systems during usage with the

Table 4 Matrix for data analysis

Evidence	Data captured	Examples
Current use	Cognitive	'As a typewriter.'
	Diffusion	'Only 10% of the potential users.'
Factors affecting use	Tasks	'The degree of customization.'
	Issues	'Lack of theoretical concepts.'
As is improvements	Events	'New employees.'
	Process	'Ad hoc.'
Ought to improvements	Events	'Continuously attempt to improve the business.'
	Process	'Work systematically.'
	Organizations*	'Create a forum which organizes and manages all business-related IT.'

* This type of data was added after the first interview.

specific goal of improving use. This was followed by questions focusing on obstacles and promoting factors relating to improvement efforts, e.g. who can and should trigger the process, the role of management and culture etc.

To analyze the data, it was summarized and entered into a matrix for the purposes of data analysis. The matrix is shown in Table 4, with examples. For each interview, the author summarized the recorded data on the perception of 'current use' (such as cognitive and diffusion aspects) and factors affecting 'current use' (such as tasks and issues), 'as is improvements' (such as events and processes) and 'ought to improvements' (such as events, processes, organizations). Each interview was analyzed and then combined into one matrix. The final matrix was used to identify similarities and differences between the interviews.

Results

The rows of the data analysis matrix were used to find contrasts and similarities based on their use, factors affecting use, as is improvements, and ought to improvements.

Current Use

The expert consultants perceived ERP system use as poor, both in relation to cognitive and diffusion terms. Several consultants expressed the opinion that only 10% of potential users use the system – i.e. poor utilization. The extent or scope of the system used was also perceived as limited, including the degree of the package and the degree of internal distribution. For instance, most firms do not use the human resource management and quality management functionality of the system. One of the consultants provided a comparative example of the degree of diffusion from two projects he had been involved in.

Two market-leading firms in an industry have implemented the same ERP system. One of the firms (A) uses the accounting functionality whereas the other firm (B) uses the entire package. The strategy of firm B is to use every piece of the package, whereas firm A does not have an explicit strategy related to the usage of the system in the future.

The implication for the organization, such as A, is no critical mass of users. The cognitive aspect of use was also perceived as limited. In general, there are minor differences between hierarchical levels. Poor use was exemplified by one of the experts as:

> Firms use R/3 as a typewriter for procurement orders. It's a good typewriter, but expensive.

Factors affecting use

In order to understand why organizations utilize ERP systems in a limited way, several questions were posed aimed at understanding current use. The experts provided a number of factors including organizational, project and technical factors. The organizational factors affecting use span across 'development', 'internal distribution' and 'usage' tasks. The main factors leading to limited utilization are a lack of understanding of the technology and an underestimation of the organizational implications of implementing ERP systems – i.e. the interdependency between technology and business, cf. for instance factor 9 in Table 3 (Skok and Legge 2003). Several examples were provided to illustrate the lack of understanding, e.g. managers do not understand the impact of integrated systems, process orientation (most firms are still function-oriented – at least in their minds and their function). A lack of theoretical concepts, such as accounting and logistics models, and a poor understanding of IT were provided as the main explaining factor for the lack of understanding of the technology and the technology's interdependent nature. One of the consultants expressed it thus:

> Managers know the terms (process orientation and integration), but do not understand the implication of process orientation or integration for their business – i.e. the consequences.

The lack of understanding of ERP systems and IT in general is often related to the perception of IT's role. For instance, firms using the entire packages manage IT proactively; signaling commitment, top management support, the importance of the system etc. Other firms applying a reactive view of IT view the implementation of a system as the end per se, leading to poor utilization. Consequently, managers that do not understand technology and its implications cannot communicate the role of IT to the rest of the organization, leading to a lower level of utilization by others. In addition, systems are often purchased on the basis of a top management decision, i.e. R/3 is our strategic solution, and the vision, if there is one, is not communicated throughout the business. The following issues are not communicated, enough: Why was the system selected, what problems is it intended to solve, what are the implications of the implementation, why must work practices change, why does the business have to adapt to the system and not vice versa? Thus, no one knows why they have a certain IT solution and people and businesses are forced to work and function in accordance with the systems. The communication shortcomings create antipathy toward the system.

A problem related to the lack of understanding is that users become afraid of the system and do not try to experiment with it, inhibiting improved use and learning. Consequently, firms are looking for alternative solutions to new problems, instead of finding out whether existing technology can solve these problems. Another tendency, explaining the poor utilization of ERP systems, is that firms seek the optimal solution for each problem leading to sub optimization.

Project factors also affect utilization, and in particular the implementation strategy and project management. Implementation starts out with good ambitions, but the implementation project tends to become an IT project focusing on the technical issues. Thus, people and business issues are forgotten (change management). Top down and bottom up implementation strategies work, but they require different skills and competencies.

The top down approach often involves large numbers of external consultants. This is the best approach for consulting firms, since they can act as filters within the organization and control information flows. For instance, consultants decide which information will be presented to top management, leading to issues of lower relevance being addressed by top management, which could have been addressed by low level management. Issues that top management addresses

become "important once" and quickly lead to crises. For instance, how to label invoices and orders. In addition, this approach probably leads to long implementations. Another disadvantage of top down implementation approaches relying on external consultants is that they do not know the business - business knowledge resides with the people working in the business.

The bottom up approach, on the other hand, requires an empowered project manager with the executive power to make difficult decisions, which the line must follow. An internally empowered project manager can deal with many issues, leading to quicker implementation – every decision does not have to be endorsed by top management. Another benefit of the bottom up approach is the internal acceptance and organizational endorsement of decisions. None of the implementation strategies leads to immediate success, i.e. in the short or long run. Each implementation is unique.

One technical factor was mentioned as affecting utilization.

> One problem with ASAP (ASAP is the proprietary development and implementation method for R/3, author's note) is that it kills visions, the 2,500 Q&A questions limit the scope of the system, people's minds become shadowed by the possibilities of the system. But the implementation project will be a success – measured in terms of time and budget.

The implementation methods used do not support human issues, since a method is only a guideline for how to do things. Hence, there is a need for skills that exceed the methods and the technical aspects of implementing the system.

The experts perceive current use to be poor, both in cognitive and diffusion terms. But, they are optimistic regarding utilization in the future. The experts have observed improvements over the years, which were explained by increased experience and maturity of integrated systems, e.g. some organizations are in their second generation of integrated system. Increased experience is closely related to maturity of utilization, which is dependent on the time of use.

As is improvements

The next issue addressed during the interviews was how firms attempt to improve use. The largest potential for improvements lies in procurement. This part of ERP systems was perceived not to be optimized, due to a lack of management involvement and a lack of focus on procurement issues. In addition, people working with procurement are often good at their jobs but lack theoretical constructs or models. The lack of such models can lead to poor requirements, since the consultants cannot specify or realize the requirements

when configuring the system. There are also potentials for improvements in inventory and production.

One consultant outlined two categories of firms, cf. firm A and B above. The first one is proactive and attempts to improve its business through the system. These firms use BPR and AS-IS analysis to understand the current business and to guide improvements efforts. They work in a systematic way with pre-studies to identify problem areas and they prioritize what areas to improve. This type of firm views IT as a support tool for its business. The other types of firms are reactive, mostly applying a technical interpretation of IT and viewing it as an end in itself. Their improvement efforts are mainly oriented toward improving the IT. These firms have more frequently applied a vanilla implementation strategy - with as little adaptation of the systems as possible. The degree of adaptation of the business and system is a sign of the organizational view of change and thus a sign of a certain culture. The point being stressed was that firms that make initial changes to their systems, during development, will also continue to make changes to their systems, or organizations, in the future.

In most cases, improvement programs are initiated because of some change in the organization, e.g. new employees or reorganization. New employees tend to be more questioning and open than people with a long working experience in the same position. However, in general, improvement programs are not triggered by a formalized process, but are based on a gut feeling and new people – i.e. they are an ad hoc process. When embarking upon an improvement program or the upgrading of a system, business cases are prerequisites both for consultancies and organizations.

Without business cases, there is no business.

Corporate culture is important and particularly if it is characterized by questioning and openness. However, the experts expressed concern regarding firms in general, that firms are short-sighted; i.e. they do not risk their day-to-day business since they are focused on their quartile reports. One consequence is the postponement of improvements programs, since these cost money. The quartile focus leads to organizations requiring a return on investment on everything, leading to no one assuming responsibility for the whole and resulting in small uncoordinated improvements efforts.

The way a firm attempts to improve its current use differs from firm to firm. The main characteristics differentiating firms attempting to improve from those not systematically improving their use lie in the perception of ERP systems, which is culturally rooted and top management involvement and use.

Ought to improvements

Another issue is how firms should manage ERP systems, with the specific goal of improving utilization. Ought to improvements address several aspects and issues addressed in the previous sections and some new aspects are introduced. The following issues constitute a summary of the suggestions made by the consultants; each of them are explored, including top management support – management use, communication of visions and ideas concerning the technology, training, let people have fun, and evaluate IT use and performance changes. The section will be structured in accordance with organizational, project and technical factors.

Most of the mentioned factors related to improvement efforts are organizational. Besides training during internal distribution, the most crucial factor is continuous training. Training should be focused on the business and how the system supports the business – not the system as such. Training courses should be small and specific, addressing one topic. Courses have to be evaluated and followed up. Courses can also involve theoretical concepts, e.g. accounting and inventory management principles. Training should be organized in networks of users – on the same hierarchical level to ensure an open discussion. A positive factor is whether there are users from different departments with varied problems and issues. The networks can be internal and external as well as formal and informal. Independent user groups are important external networks. Besides the actual hands-on training provided, training has other important roles, for instance showing organizational commitment and communicating the long-term strategy and vision of the system. An important part of training is fun - let people have fun. Fun in this context is related to experimental training in sandbox systems using real data to play around with. This enables people to test new ways of working with and using the system. The trainer should be a person with experience of the business and preferably of the old systems as well; for instance an efficient educator can ask the user; Do you remember the old system - this was labeled xxx and now it is yyy.

Management use was perceived as a very positive factor. The two main impacts of management use were an increased management reputation and an important manifestation of management commitment. One example

> A new manager at a large production site within an MNC, became the super user of R/3 and used this knowledge to get a reputation and acknowledgement from the business, due to his knowledge he could overcome his uncertainty and lack of knowledge about the business.

Time is another important factor – it takes time to understand the system, it takes time for the system and the business to initially stabilize, training takes time etc. The time issue was illustrated as

> It takes 3-5 years to forget the old system.

Evaluation is stressed as being important. The role of evaluation is to track improvements and to communicate these. This should not only be related to the system, but to changes in the business. For instance, a training course in sales should be measured against sales measurements, e.g. customer satisfaction. The Business Engineer (a tool of R/3) can be used to analyze transactions and to enhance improvement efforts. Based on this tool, it is possible to track how the system is used.

Project factors are related to the complexity of developing, distributing, and using the system. One way to decrease the complexity is to manage one project at a time, e.g. do not include shared service centers at the same time - people get confused. Hire only one type of consultant (e.g. IT consultants as opposed to organizational consultants) at a time, since different consultants have varying agendas. Controlling the consultants is important – do not sit on their laps. Consequently, it will be necessary to have internal consultants – in-house competence is crucial.

System and IT knowledge represent important skills in the project manager and system owner. In addition, the skills of the project manager affect the impact of the implementation. For instance, if the project manager follows all the rules of the implementation methods, this can lead to catastrophes. However, a skillful project manger can pick and choose his or her methods, adapting them to new circumstances and applying them as useful support tools. The system owner takes over during usage and is crucial since this person functions as a window between business and IT by transforming business requirements into IT specifications.

The overall organization of IT activities is important when structuring improvement programs. IT activities should be organized at corporate level and responsible for all business IT, including ERP systems, CRM systems, and SCM systems Separate the forum from the corporate board and use people in the business, IT department, the board, external expertise, and let suppliers present their cases. The objective and role of the forum is to amass knowledge and learn IT. Be the part that synthesizes requirements, negotiates with external parties, environment, the long term focus and short term, as well. The forum must be open-minded – to learn from others – instead of knowing what is best

themselves. In addition, a new corporate function should be created for managing master data.

> One of the benefits of R/3 is the ability to use the same set of master data (business partners, products etc.) across the enterprise. The benefits may be obvious to most firms, but the organizational consequences - the need to establish sufficiently empowered central functions for master data maintenance - are frequently neglected. The necessary organizational changes may go against short-term cost-cutting objectives (cut down on corporate staff functions), or may be 'politically' sensitive.

Besides managing IT applications, the organization of IT activities should be responsible for master data as well.

One important factor for achieving improved use is the initial configuration.

> R/3 can be configured and run in a number of different languages, but there is a very strong case for doing it in English only if the firm is likely to ever implement the system in foreign affiliates, or to use non-Swedish consultants: The English (and German) versions are released before all others, and they are the only complete language-versions. The effort of maintaining consistent descriptions of configuration parameters, master data, report texts etc. in several languages in parallel is often far greater than expected.

To summarize, the long-term business value stems from the comprehensive utilization of the ERP system supporting the main processes. Critical mass is important, leading to commitment and extended use. Nevertheless, improvement efforts are often easier than the initial implementation. As one consultant expressed this;

> You enjoy the scenery much better on the second trip.

Integration and Discussion

This section integrates and discusses the empirical findings and proposes enhancements to the ERPM framework. To structure the section, it will be divided up into the resource phase and the employment phase.

Resource phase

The resource phase, including the selection and development tasks, is to some extent elaborated upon. The selection task has not been further enhanced. None of the experts has mentioned any aspects related to the selection process or the selection of a specific system. One possible explanation for this is that the

experts are specialized in one ERP system. The only implicit exception is that the whole life cycle has to be well managed, including a clear vision of the system motivating the selection. This is consistent with the initial ITRM framework and Davenport's (1996) suggestions for managing ERP systems using a holistic approach. Another possible explanation is that there are so few competing ERP systems (Robey et al. (2002) defines four major ERP systems, including SAP, Oracle, Baan and PeopleSoft), leading to little ambiguity concerning the choice of system. However, selecting an ERP system is not only about choosing a system; it is also about selecting a consultation partner. The importance of selecting right consulting partner is stressed in Bhattacherjee's (2000) case study at Geneva Pharmaceuticals and is stressed by Skok and Legge (2002). This might be the main source of ambiguity and uncertainty in this type of project and is of critical importance. The changes into the ERPM framework are shown in Figure 3. In the identification task, the factor appropriate business and legacy system is deleted since no technical aspects or issues have been stressed in the empirical part of the study.

The development tasks can only commence if a system has been selected, providing the link between the tasks. The main issue is organizing the project, which involves creating a balanced team and selecting the project management and the competence and skills of the project leader and project team is emphasized. In addition it is crucial to communicate the role of the system, so that the project does not turn into a technical project that loses sight of the business objectives. Consistent with prior research into ERP systems, the use of vendor tools, minimal BPR, the vanilla implementation strategy constitute CSFs for a successful implementation, e.g. Davenport (1996), Somers and Nelson (2001) and Skok and Legge (2001). However, these factors might only be applicable to the success of development and internal distribution – not usage and utilization. Several of the experts stressed the potentially negative influence of the vanilla implementation strategy, minimal BPR, and the stringent use of vendor implementation methods on utilization. This leads to factors having a negative impact on utilization.

Implementation strategies involving organizational change and changes into the systems suggested as factors promoting improved long-term utilization. This is explained by organizations that dare to take risks during development and which will also take risks during usage. The role of management is also revised based on the empirical findings. Instead of top management involvement, it should be support and commitment. Too much involvement by top management is negative for the success of the implementation project. Vendor partnership, in Figure 2, has not been stressed as a factor, rather as an issue and is thus incorporated as an issue. The time issue based on the ITRM framework and the

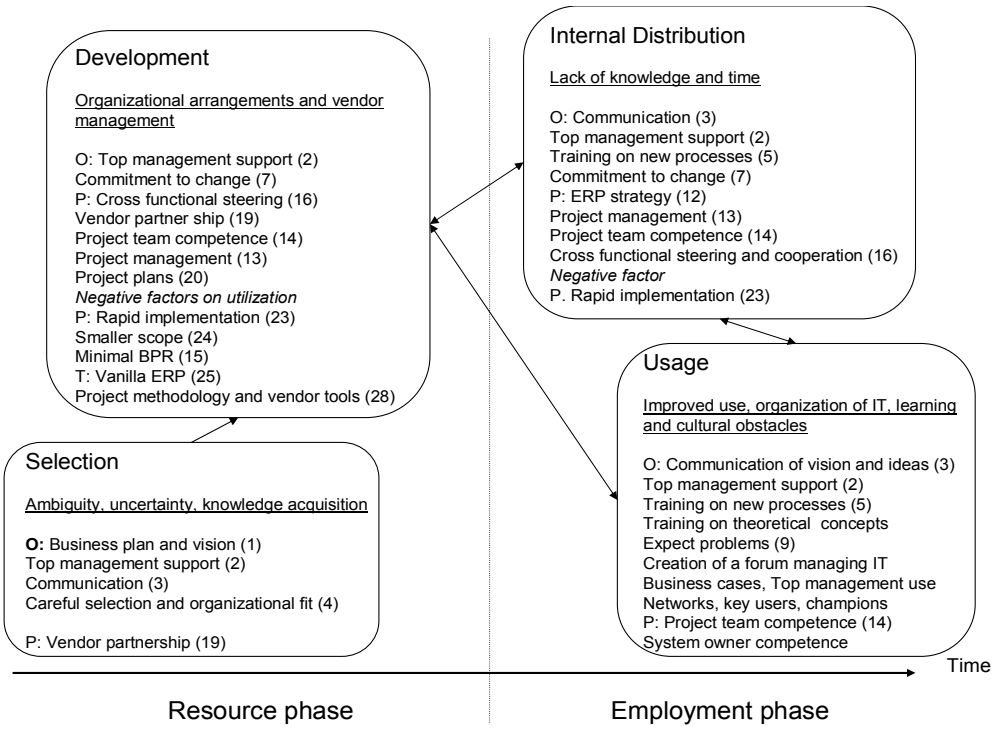

Figure 3 The enhanced ERPM framework.

CSF literature review has not been found during the empirical investigation, thus leading to the exclusion of this issue, i.e. it is not important as regards improving utilization. Parr et al. (2000) describes different implementation strategies and also speculates on different strategies CSFs.

Employment phase

The employment phase, including internal distribution and usage, is enhanced on the basis of the findings. The interrelationship between development and internal distribution tasks remains and thus the view of development and implementation is as an iterative process with feedback loops. The main enhancement of the internal distribution task is the exclusion of the vendor partnership which has not been stressed. Rapid implementation is changes to a potential negative factor. Davenport (1998, p. 126) expressed the problem with rapid implementations as "A speedy implementation of an enterprise system may be a wise business move, but a rash implementation is not". The remaining factors and issues are retained, e.g. communication, top management involvement, training on new process and commitment to change.

Usage tasks are supplemented with several aspects. The causality between usage and development is still the same as in Figure 2. An improvement in the system

leads to development and internal distribution. This involves several related issues, e.g. learning and managing cultural obstacles, and tasks. The overall CSF for improved use is well-organized and structured activities, i.e. the organization of IT activities. This was stressed as creating a forum for managing IT resources such as ERP systems, CRM systems, and SCM systems. The role of the forum is to organize and fund the management of IT and its continuous improvement. Communication of IT's role is important. In addition, the requirements specification, the alignment to business and the termination, and selection of IT resources can be managed by the forum. The forum consists of internal and external people with different backgrounds and competencies, e.g. top management, project leaders, system owners, vendors, users etc, to ensure a broad spectrum of competencies. Essential is the involvement of top management – not only with support and commitment, which the participation and creation of the forum signals. In Figure 3, these issues and CSFs have been incorporated. Similar conclusions are provided by Agarwal and Sambamurthy (2002) article on the role of the IT function.

The culture of the organization is a prerequisite for creating this type of forum, since it will lead to the centralization of all IT activities and could thus encounter resistance from business. For instance, the costs of the forum can be allocated to the different business units and thus affect their profit, which the business unit can oppose. Thus, it is a culture that has to be open to opinions and ideas, participation in different networks being an example of this. Previously has Cooper (1994) discussed the role organizational culture an important factor in the implementation of information technology and suggested that more successful organizations are more open than those failing.

The next issue that has to be managed is learning. In the ITRM framework learning was the main issue during development. In relation to ERP systems it seams to be during usage. In the ITRM framework, learning was perceived as radical learning. However, the findings support the role of experimental learning instead. Robey et al. (2002) comparative study of dialectic learning processes in 13 firms supports both radical and experimental learning. Sandboxes, such as the IDES client, can be used to give people a platform to test new things on. Learning processes are supported by informal and formal training, within the organization and through networks. Consultants have the role of external agents on training courses by bringing experience from other organizations, but they also act as the distributors of internal knowledge. It is important that theoretical concepts, e.g. accounting systems, are integrated into courses. Networks, such as the forum, have important roles in improved utilization. Key users can take on the role of internal teacher and inform others about how to use the system. Management's use of ERP systems is crucial, leading to increased utilization. If

managers use ERP systems, their subordinates will have to use these systems, since people on lower hierarchical levels feed the system with data that is used by managers. Obstacles to efficient use have to be managed, for instance the vision of use and the interdependence between IT and business are crucial to communicate.

Summary

The aim of this paper is to improve our understanding of how ERP systems can be used 'better', referring to cognitive and diffusion aspects. Better, can only be judged by the specific context. The explanatory power of the ERPM framework stems from the theoretical foundation of the ITRM framework (Kalling 1999). The ITRM framework has been used to guide the investigation, both the empirical and the synthesis of the CSF literature. An initial framework was proposed and is presented in Figure 2. This was further enhanced by the empirical findings, leading to the proposed ERPM framework. The ERPM framework bears a strong resemblance to the ITRM framework, but is differentiated by the type of resource, i.e. specific or generic. Thus, the main difference lies in the selection and development tasks. The ITRM framework addresses the built option and the subsequent scratch development whereas the ERPM framework addresses IT resources that are acquired from external providers. Another difference in the ERPM framework is the exclusion of protection tasks, which are not perceived as important to ERP systems, probably due to their being generic systems. However, continuous improved use is as critical to the ERPM framework as it is to the ITRM framework. The goal of improved use has different objectives in these two cases. In relation to ERP systems, improved use is aimed at increasing the long-term business value of the system. In the other case, improved or unique use is aimed at creating sustainable competitive advantages. Another difference between the frameworks is that some issues, in particular learning, seem to be more important during other tasks than in the ITRM framework.

Another contribution made by the study is the theorizing of CSF research, which has not previously been theorized (cf. Robey et al. 2002), with a few exceptions. The theoretical and practical usefulness of the ERPM framework includes some issues that are of general interest. The framework presents an overall life cycle from the selection to the usage of ERP systems, which can be used to frame future research into ERP systems. The focus on usage tasks during the employment phase is a central contribution made by the paper. This is an area which has been relatively unexplored. In relation to the ITRM framework, the ERPM framework provides other, complimentary and new issues and tasks, which can enhance our understanding of the management of ERP systems.

Limitations

The limitations of the research primarily concern two aspects. The first is the number of expert consultants participating while the second is related to the national context of the study. More expert consultants would increase the validly of the claims made. The experts interviewed thus far have a broad experience of ERP system implementations, but an increased number of experts, and in particular those with experience of other ERP systems, would enhance the study. The context of the study – one Scandinavian country – also limits the validity. In particular, one factor is related to this, namely configuration in English or German. This factor is probably important to all non-English and German speaking countries, i.e. most of the world. Other limitations to the study are the initial ITRM framework and the selection made in the literature review.

Conclusions and Future Research

The paper has reported on the results of a research program aiming to understand and improve the utilization of information systems, and ERP systems in particular. The result and contribution of the paper are threefold: This first is the focus on the usage phase, which has been under-researched (Gattiker and Goodhue 2002; Kalling 2003). Several interrelated factors have been identified, e.g. training, top management use/commitment/involvement, culture, communication, time and evaluation, administration models, the competence of project and system managers, and configuration in one language. The second contribution is the development and enhancement of the ERPM framework, including the selection, development, internal distribution and usage tasks and the causalities between the tasks, issues and CSFs. The third contribution is the theorizing of CSFs through the ITRM framework.

The conclusions reached are similar to findings from research into IT done in the past. However, future research should investigate additional factors and causalities between tasks and issues. Three approaches seem appropriate for such research. The first is to complement the conducted study with more expert interviews. Future respondents could have international experience as well as experience of other systems. The causalities and importance of the CSFs could be tested through a LISREL analysis, thus requiring the operationalization of the ERPM framework. The third approach can be in-depth case studies, which can be used to enhance the framework. In particular, comparative case studies of different perceptions of IT.

Thus, the value of Enterprise Systems, or any other artifacts or resources, to organizations lies in their long-term use, leading to improved activities, offerings, and a better market position (Kalling, 2003), or to improvements in organizational effectiveness (Hedman and Borell 2002). Efficient use which leads to improvements is difficult to achieve, due to a lack of understanding of the artifact, the use of COTS methods, long term payback, management of the system, poor user acceptance, and shortcomings in improvement efforts.

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Appendix 1 95 CSFs

1.	Appropriate business and IT legacy systems (Nah et al. 2001)	*2.*	*Managing Consultants (Skok and Legge 2002)*
3.	Architecture choices (Somers and Nelson 2001)	*4.*	*Minimal customization (Somers and Nelson 2001)*
5.	Balanced team (Bancroft et al. 1998; Parr et al. 1999)	*6.*	*Minimum BPR and customization (Nah et al. 2001)*
7.	Best people (Parr et al. 1999)	*8.*	*Monitoring and evaluation of performance (Nah et al. 2001)*
9.	Business plan and vision (Nah et al. 2001)	*10.*	*Monitoring and feedback (Holland et al. 1999)*
11.	Business Process Change (Holland et al. 1999)	*12.*	*Organizational change prior to implementation (Bancroft et al. 1998)*
13.	Business process reengineering (Somers and Nelson 2001)	*14.*	*Organizational fit of Enterprise System (Al-Mashari, Al-Mudimigh et al. 2003)*
15.	Business Vision (Holland et al. 1999)	*16.*	*Organizational resistance (Al-Mashari, Al-Mudimigh et al. 2003)*
17.	Careful package selection (Somers and Nelson 2001)	*18.*	*Partnership with vendor (Somers and Nelson 2001)*
19.	Champion (Nah et al. 2001) (Parr et al. 1999)	*20.*	*Performance evaluation & management (Al-Mashari, Al-Mudimigh et al. 2003)*
21.	Change management (Somers and Nelson 2001)	*22.*	*Personnel (Holland et al. 1999)*
23.	Change management program and culture (Nah et al. 2001)	*24.*	*Planning and Control (Skok and Legge 2002)*
25.	Clear goal and objectives (Somers and Nelson 2001)	*26.*	*Post implementation audit (Umble et al. 2003)*
27.	Client acceptance (Holland et al. 1999)	*28.*	*Process adaptation model (Al-Mashari, Al-Mudimigh et al. 2003)*
29.	Client Consultations (Holland et al. 1999)	*30.*	*Process management (Al-Mashari, Al-Mudimigh et al. 2003)*
31.	Commitment of management (Umble et al. 2003)	*32.*	*Project Champion (Skok and Legge 2002) (Somers and Nelson 2001)*
33.	Commitment to change (Parr et al. 1999)	*34.*	*Project management (Umble et al. 2003; Somers and Nelson 2001; Nah et al. 2001; Al-Mashari, Al-Mudimigh et al. 2003)*
35.	Communication (Al-Mashari, Al-Mudimigh et al. 2003; Bancroft et al. 1998; Holland et al. 1999; Nah et al. 2001)	*36.*	*Project methodology (Bancroft et al. 1998)*
37.	Cross functional implementation (Davenport 1996)	*38.*	*Project Schedule/plans (Holland et al. 1999)*
39.	Cross functional steering (Davenport 1996)	*40.*	*Project team competence (Somers and Nelson 2001)*
41.	Cultural & structural change (Al-Mashari, Al-Mudimigh et al. 2003)	*42.*	*Rapid implementation (Davenport 1996)*
43.	Cultural and Business Change (Skok and Legge 2002)	*44.*	*Selection of system (Umble et al. 2003)*
45.	Data accuracy (Umble et al. 2003)	*46.*	*Smaller Scope (Parr et al. 1999)*
47.	Data analysis & conversion (Somers and Nelson 2001)	*48.*	*Software configuration (Holland et al. 1999)*
49.	Dedicated resources (Somers and Nelson 2001)	*50.*	*Software development, testing (Nah et al. 2001)*
51.	Definition of scope and goal (Parr et al. 1999)	*52.*	*Staff retention (Skok and Legge 2002)*
53.	Deliverable dates (Parr et al. 1999)	*54.*	*Strategic goals with the system (Umble et al. 2003)*
55.	Education and training (Umble et al. 2003)	*56.*	*System integration (Al-Mashari, Al-Mudimigh et al. 2003)*
57.	Education on new processes (Somers and Nelson 2001)	*58.*	*System testing (Al-Mashari, Al-Mudimigh et al. 2003)*
59.	Empowered decision makers (Parr et al. 1999)	*60.*	*Teamworking (Skok and Legge 2002)*
61.	Empowered project manager (Bancroft et al. 1998)	*62.*	*The team (Umble et al. 2003)*
63.	Enterprise System adaptation level (Al-Mashari, Al-Mudimigh et al. 2003)	*64.*	*Top management commitment (Skok and Legge 2002)*
65.	Enterprise System package selection (Al-Mashari, Al-Mudimigh et al. 2003)	*66.*	*Top management support (Bancroft et al. 1998; Davenport 1996; Holland et al. 1999; Nah et al. 2001; Somers and Nelson 2001)*
67.	ERP Strategy (Holland et al. 1999)	*68.*	*Training (Bancroft et al. 1998)*
69.	ERP teamwork and composition (Nah et al. 2001)	*70.*	*Training and education (Al-Mashari, Al-Mudimigh et al. 2003)*
71.	Expect problems (Bancroft et al. 1998)	*72.*	*Troubleshooting (Holland et al. 1999)*

Appendix 1 95 CSFs (contd.)

73.	Focused performance measures (Umble et al. 2003)	*74.*	*Understand the corporate culture (Bancroft et al. 1998)*
75.	Hybrid skills (Skok and Legge 2002)	*76.*	*Use of consultants (Somers and Nelson 2001)*
77.	Inform people about the holistic nature (Davenport 1996)	*78.*	*Use of only one consulting firm (Davenport 1996)*
79.	Interdepartmental communication (Somers and Nelson 2001)	*80.*	*Use of steering committee (Somers and Nelson 2001)*
81.	Interdepartmental cooperation (Somers and Nelson 2001)	*82.*	*Use of vendors' tools (Somers and Nelson 2001)*
83.	Legacy Systems (Holland et al. 1999)	*84.*	*User acceptance (Skok and Legge 2002)*
85.	Legacy systems management (Al-Mashari, Al-Mudimigh et al. 2003)	*86.*	*User involvement (Skok and Legge 2002)*
87.	Management & leadership (Al-Mashari, Al-Mudimigh et al. 2003)	*88.*	*User training on software (Somers and Nelson 2001)*
89.	Management of expectations (Somers and Nelson 2001)	*90.*	*Vanilla ERP (Parr et al. 1999)*
91.	Management support (Parr et al. 1999)	*92.*	*Vendor support (Somers and Nelson 2001)*
93.	Managing change (Umble et al. 2003)	*94.*	*Visioning & planning (Al-Mashari, Al-Mudimigh et al. 2003)*
95.	*Managing Conflicts (Skok and Legge 2002)*		

Paper V

The Impact of Enterprise Resource Planning Systems on Organizational Effectiveness: An Artifact Evaluation

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Jonas Hedman and Andreas Borell

Paper VI

An Assessment of a Role-Based Information Portal

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An Assessment of a Role-Based Information Portal*

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Abstract
Information portals (IPs) create a single personalized entry point for its users to internal and external applications, information, and services necessary for the users to perform their jobs. Using an artifact-evaluating approach we assess one specific IP—SAP AG's mySAP Workplace. The competing values model, developed by Robert Quinn and associates, was used as the assessment model. The assessment suggests some of the strengths of current IPs, e.g., their internal and control focuses, and some of their weaknesses, e.g., their lack of external focus and lack of support for top-managers.

1. Introduction

Business portals (BP) can provide support for e-business goals in the context of a portal Webtop. According to consulting and marketing research firms (e.g., Delphi Group and Butler Group), organizations have a growing interest in new business portals to provide employees, business communities of partners, customers, suppliers, and other stakeholders with suitable info-media for managing the enormous and increasing flows of business information, processes and transactions (Delphi Group 2001). Examples of business portals include e-business portals (incl. consumer, community, and market portals), information portals (IPs), enterprise portals (EPs), and business intelligence portals—there are no excepted names for the different types of portals. Literally, a portal is designed to be a single entry point to internal and external applications, information, and services necessary for completing specific tasks and activities. Information portals (IPs) are designed to manage the access to organizations' computer-based communication and information systems. The set-up and design of the "user interface" control access in an IP; this design will most likely affect the organizational impact of IP use. Although there is a growing interest in IPs—and BPs in general—they have not been researched. Hence, the aim of this paper is to present one model for evaluating IPs as well as applying the model to a specific IP. Hence, the paper will use an artifact-evaluating approach (Järvinen 1999, 2000; March and Smith 1995).

The remainder of the paper is organized as follows. The next section presents different types of portals and briefly the specific artifact we will evaluate, i.e. SAP AG's mySAP Workplace. This is followed by a presentation of our research approach, artifact-evaluation. The following section presents the model we will use for the evaluation: Quinn and associates' competing values model (CVM). Section 5 presents our assessment of mySAP Workplace. The final sections discuss the results and present limitations and recommendations for further research.

* The authors contributed equally to the paper.

2. From Enterprise Resource Planning to Information Portals

The "traditional" Enterprise Resource Planning (ERP) systems implemented from mid to late 1990's were in most cases based on a 2/3-tier client/server architecture. (There is a body of literature related to traditional ERP systems addressing general implementation issues (e.g., Markus and Tanis 2000; Ross and Vitale 2000; Davenport 2000a; Shanks et al 2000; Holland et al 1999) and product specific implementation issues (e.g., Curran and Ladd 2000; Bancroft 1996), but also empirical research on different aspects of ERP implementation, use, and effects (e.g., Davenport 2000a; Shanks et al. 2001).) Traditional ERP systems have primarily an internal focus and address to a large extent back-end processes. Many of these systems have reference models built on internal process models. For many organizations these systems were a great aim when they tried to become more process-oriented—the systems were also a major aim in solving the Y2K-problem. In the last years, most ERP providers have extended and developed their offerings (Davenport 2000b). In the first "wave" extensions were done by:

- Web-enabling the ERPs—in many cases by adding a tier.
- Enhancing the ERPs with analysis capabilities, for example, by Data Warehouses and more than rudimentary decision and business intelligence support capabilities—e.g., SAP's Business Information Warehouse (BW) and Strategic Enterprise Management (SEM).
- Linking back-end and front-end organizational processes.

The next "wave" can be characterized as Web-centric (browser/server) using portal technology and offering business portals with different focuses. The offerings of the second wave have both internal and external views and have extended reference models (incl., for example, e-business process models). Consulting and marketing research firms (e.g., Butler Group) suggest that BPs will reshape the future of information services and information sharing and there is a growing interest in portals, primarily among software providers, consultants, and firms implementing portals. The early portal market (1998-2000) was dominated by portal application framework startups and the offerings of portal access to specific ERP applications—the latter above described as web-enabling ERP (Delphi Group 2001). Beginning in 2000, ERP systems providers like SAP (SAP 2000 & 2001), PeopleSoft (PeopleSofte 2000), and Intentia and other platform software providers like IBM, Oracle, and Sun came on stream. The providers offer platforms targeting the portal requirements of e-business firms. The providers' moves signal a broad acceptance of portal computing as the next model for enterprise knowledge and information work. It should also be noted that SAP recently announced its intention to create a new company (SAP Portals) to develop and market comprehensive, open enterprise portal and intelligence products (Market News Publishing, June 8, 2001). SAP has in developing its portal concept and applications in the last two years worked with TopTier Software and will acquire the company.

BPs are designed to provide a single access point to internal and external despaired applications, information, and services for an organization's employees, partners, customers, and suppliers. Often an IP is an entry point to information available via the Web and in some cases accessed by a mobile device; IP creates a single entry point for its users to all the internal and external information necessary for their jobs. The information, e.g. company newsletters, financial statements, departmental purchasing histories, customer orders, and product shipments, made available through an IP can be personalized depending on what role(s) or function(s) a person performs. The applications made available in an IP are the capabilities found in ERPs, for example in SAP R/3, and the extended versions of them including, for example, e-commerce

tools, SCM, CRM, business intelligence tools, and communication tools. An IP keeps track of who in the organization is authorized to do what; the IP presents to each user only those resources the user is allowed to see and use. For instance, a customer service representative might have access to certain sell-side e-commerce tools, self-service human resources services, and perhaps, with very low spending limits, to the "company store" for purchasing office supplies. An accounting manager might have access to financial systems, data, and decision support tools, to the store, to the administrative applications, and to communication and personal productivity software.

Traditional ERP systems have been criticized for being costly, hard to implement and change (inflexible), having an overly rigid and hierarchical organization, using antiquated technology, etc. (Markus and Tanis 2000; Markus 2000; Davenport 2000a). The first and second wave of extensions and enhancements of traditional ERPs have implications related to the critique of ERPs. Theoretically, the development signals a move away from "strategic leaps" implementation towards more of "continuous improvement". The latter, a path-based approach to IT implementation and improvement, is advocated for today's ERP-enabled organizations (Upton and McAffe 2000; Davenport 2000b). Results from studies addressing how IT can facilitate continuous improvement can be abstracted into three design principles: 1) *modularity*, to facilitate improvement after installation, 2) *accessibility*, to provide for easy change of parameters etc. in a system, and 3) *inclusiveness*, to decrease the likelihood that a system is perceived as a black box by its users (Upton and McAffe 2000). The providers' new offerings seem to:

- Have a higher degree of modularity, which means that there are larger possibilities to change one element of a system without having to change throughout the whole systems or in other systems. In SAP's case, for example, BAPIs (business application programming interfaces) pre-defined methods enabling communication between R/3 and other applications and support for CORBA.
- Have a higher degree of accessibility, meaning that the ease with which people can change parameters of a system because of new requirements, experimentation, or tuning of the system has improved.
- Still be too inclusive. Even if the users are trained to use the systems and are involved in the implementation use of "best practice" processes (or in the case of IP "best practice" roles) might lead to less of inclusiveness than if the system is developed from "scratch" for a specific organization. At the same time research suggests that the use of "best of practice" can improve both effectiveness and efficiency.

2.1 SAP AG's mySAP Workplace

SAP AG the world leading ERP provider has during the past years released several products and concepts in response to the demands for e-business solutions and is today providing a wide range of e-business products. One of their products is mySAP Workplace, which is in part SAP's answer to the growing BP market in. It is also a "user interface" to SAP's other products, e.g. R/3, CRM products, and collaborative planning, forecasting, and replenishment (CPFR) products. mySAP Workplace is not limited to SAP's products. A mySAP Workplace user organization might link other applications to the portal and these applications can be accessed through the Web. mySAP Workplace is both a product and a concept. The actual software—mySAP Workplace—functions as an Internet transaction server and can be compared with

Microsoft's transaction server.

In building a specific IP an organization can create its own roles or use the templates for single roles and composite roles that are supplied by SAP. Using the templates ("best of practice") an organization modifies these to suit the organization's requirements. Access to applications, information, and services provided to the mySAP Workplace users is based on a role based design, with a strong emphasizes on the tasks a user has to perform to complete her work. mySAP Workplace includes some 200 role templates. SAP's homepages do not provide information on how this role-based "GUI" was designed and has evolved. However, German organizational theory has traditionally a strong link to tasks (Kosiol 1962 according to Keller and Teufel 1998, p. 27), which is a common design feature of all roles. Hence, we can hypothesize that this has had an impact on how the system was designed, but in what way we do not know. The structure of the roles in mySAP Workplace is to be found on their homepage and in the software version 2.11 (www.sap.com).

Most organizations implementing ERP (incl. R/3) use the key business process scenarios (business process templates) coming with the software. Hence, it is reasonable to assume that organizations implementing mySAP Workplacewill use the generic roles, i.e. templates, in building the organizations' specific IPs—the same assumption holds for the use of other providers' IPs. The generic roles, which control the access to applications, information, and services, are dived into different functional categories (cross-industry templates) and different industry solutions that SAP supports. (Roles can be adapted according to: 1) component, 2) industry, or 3) country version.) In designing an organization-specific IP based on mySAP Workplace's role-based concept, the organization can pick and chose from all roles.

A role is defined as:

> *"... a collection of activities that an employee carries out in one or more business scenarios of an organization. Users access the transactions, reports and Web-based applications in a role via a series of menus. Roles are specific to individual employees and match their specific tasks and service/information needs."* (www.sap.com)

Each role within the workplace is described in a task-oriented manor, for example:

> Role: Manager Generic
>
> Tasks: "*The Manager Generic is responsible for controlling and monitoring goal-oriented planning and decision-making processes and for pursuing strategic goals in his/her area of responsibility.*
>
> *He/she fulfils the function of a line manager who can be placed on various hierarchical levels in an enterprise and - with the exception of the activities of the project manager, for which there is a separate composite role - can cover many different task areas. He/she controls personnel management processes in his/her area, and is responsible for a cost center and for project assignments of the people in that area.*" (www.sap.com).

Further each role is unique in some sense, since an organization or the actual user may configure the role by adding or deleting functionality to ones own specific requirements, for example, information reports, access to other applications, or even add other roles into the existing role. In a role it is possible to include the following (www.sap.com):

- Transactions
- Reports
- MiniApps
- URLs (Web addresses or files)
- Predefined URLs from directory

- BW (Business Information Warehouse) report
- Web source from Drag&Relate Servlet
- External mail system
- Knowledge Warehouse link

3. Artifact-Evaluation

The aim of this paper is to assess IP and this is done through an assessment of the role-based mySAP Workplace. The research approach taking belongs to research stressing artifact utility, which can broadly be dived into artifact-building and artifact-evaluation approaches (Järvinen 1999, 2000). Although critical, this type of research is not well represented in IS research (Järvinen 1999, 2000; March and Smith 1995; Lee 2000; Orlikowski and Iacono 2001). Artifact-building focuses on questions like: Is it possible to build a certain artifact; how ought a certain artifact be and how can we build a certain artifact? An artifact can be, for example, a construct (concept), model, method, technique, or instantiation of an information system. In evaluation of an artifact some criteria are used and some measurements performed. In general, questions like ”How effective and efficient is this artifact” are asked and answered. In artifact-evaluation one can use a model to evaluate the effectiveness and efficiency of an artifact. In order to make the evaluation of the roles and thereby the IP we had to make a choice of an evaluation model. We chose Robert Quinn and associates' competing values model (CVM) (Quinn and Rohrbaugh 1981; 1983; Quinn et al. 1996). There were two main reasons for using the CVM. First, it is a well-established framework and model and it has been developed and empirically tested in organizational (Buenger et al. 1996), management (Hart and Quinn 1993), and IS research (Sääksjärvi and Talvinen 1999). Second, it is related to a critical construct: individual and organizational effectiveness. Later versions and extensions of CVM for assessing management competence and diagnosing organizational culture were considered. They were found to not be proper for this evaluation, due to their shortcomings regarding roles and lower level efficiency.

4. The Competing Values Model

The competing values model (CVM) is a framework of organizational effectiveness and includes some theoretical underpinnings of organizations (Buenger et al. 1996; Quinn and Rohrbaugh 1983). First, CVM views organizations as purposeful systems that exist to achieve certain goals or ends (Daft 1992; Perrow 1986; Scott 1992). Second, CVM acknowledge the existence of simultaneously and conflicting goals, which an organization must attain at the same time in order to be effective (Hart and Quinn 1993). Furthermore, CVM is based on the hypothesis that there is a tension between existing underlying values in organizations (Buenger et al. 1996; Quinn and Rohrbaugh 1983). The first value is focus; internal focus puts emphasis on well being in the organization while external focus puts emphasis on the environment. Structure is the second value dimension; stability refers to the need of top management to control and flexibility refers to adaptation and change. The last value concerns ends versus means in effectiveness criteria (Quinn and Rohrbaugh 1981; 1983). The values reflect similarities to four organizational models with respect to different constructs of organizational effectiveness. The four models are human relations model (HR), open systems model (OS), internal process model (IP), and rational goal model (RG). Based on the four organizational models (HR, OS, IP, and RG) and the underlying value dimensions different organizational effectiveness criteria has been linked to each model—

see Figure 1.

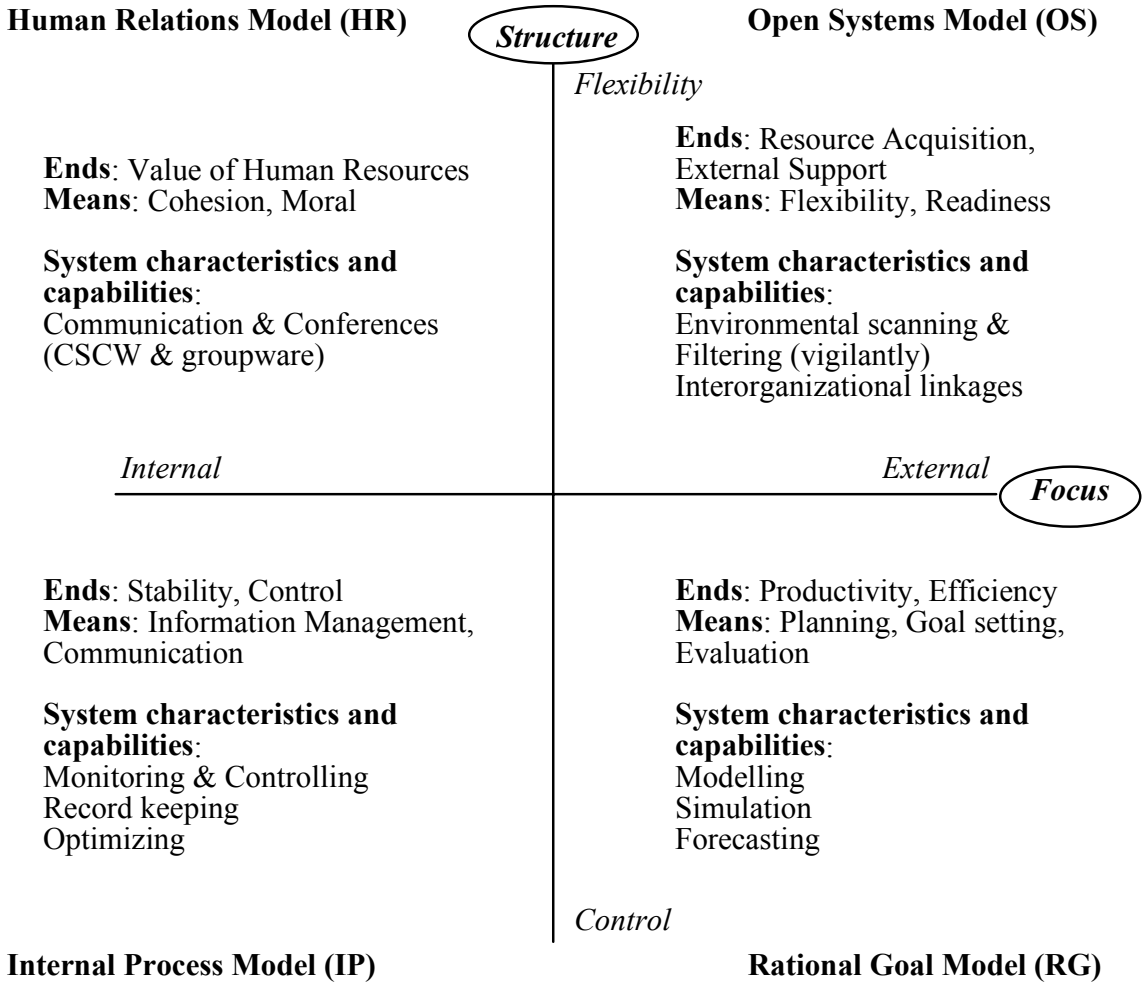

Figure 1. Competing Values Model (Quinn & Rohrbaugh 1981; 1983: Rohrbaugh 1981).

The HR model is characterized by a focus on internal flexibility to develop employee cohesion and morale. It stresses human resource development, participation, empowerment, teambuilding, building trust, conflict management, listening and being supportive, internal communication, developing individual plans, feedback to individuals and groups, and developing management skills (Quinn 1988).

The OS model is characterized by a focus on external flexibility and relies on readiness and flexibility to gain growth. Important issues are acquisition of scarce resources, support of interaction with the external environment, identification of major trends, business intelligence, developing mental models, facilitates changes, research and development, identification of problems, influencing the environment, and maintaining external legitimacy through a network of external contacts (Quinn 1988).

The IP model is characterized by a focus on internal stability and uses information management, information processing, and communication to develop stability and control. This is done by collection of data, mainly internal and quantitative information used to check

organizational performance, enhance the understanding of activities, ensure that standards, goals, and rules are meet, maintaining organizational structure and workflow, coordinating activities, as well as collecting and distributing information internally (Quinn 1988).

The RG model is characterized by a focus on external control and relies on planning and goal setting to gain productivity. This includes clarification of expectations, goals and purposes through planning and goal setting, defining problems, generating and evaluating alternatives, generating rules and polices, evaluation of performance, and decision support, quality control, motivation of organizational members to enhance productivity, sales support, and profit maximization (Quinn 1988).

Quinn (1988; Quinn et al. 1996) translated the construct of effectiveness into managerial roles—two for each of the four organizational models. In the monitor role (IP) a manager collects and distributes information (mainly internal and quantitative information), checks performance using traditional measures, and provides a sense of stability and continuity. In the coordinator role (IP) a manager maintains structure and flow of the systems, does scheduling, organizes and coordinates activities (logistic issues), solve house keeping issues, and sees that standards, goals and objectives, and rules are met.

In the director role (RG) a manager clarifies expectations, goals and purposes through planning and goal setting, defines problems, establishes goals, generates and evaluates alternatives, generates rules and policies, and evaluates performances. In the producer role (RG) a manager emphasizes performance, motivates members to accomplish stated goals, gives feedback to members, and is engaged in and supports the action phase of decision making.

In the innovator role (OS) a manager interacts with the environment, monitors the external environmental (environmental scanning), identifies important trends, is engaged in business and competitive intelligence (relying on induction and intuition), develops mental models, convinces others about what is necessary and desirable, facilitates change, and shares “image and mental models.“ In the broker role (OS) a manager obtains external resources, is engaged in external communication, tries to influence the environment, and maintains the unit’s external legitimacy through the development, scanning, and maintenance of a network of external contacts.

In the facilitator role (HR) a manager fosters collective efforts, tries to build cohesion and teamwork—building the “trustful organization“, facilitates participation and group problem solving and decision making, pursues “moral“ commitment, and is engaged in conflict management. In the mentor role (HR) a manager is engaged in the development of employees by listening and being supportive, is engaged in the development of individual plans, and gives feedback—for individual development.

5. Assessment of mySAP Workplace

Few firms have implemented IPs using the role-based concept to a large extent. We decided to assess the "whole package" of roles provided in mySAP Workplace. We used SAP’s web pages to find the different roles and description of the roles. Altogether we found 433 individually labeled roles. Of these approximately 200+ roles are implemented (the data collection was done in the fall of 2000). From the 433 roles, we excluded all roles associated with the industry solution of SAP Healthcare and were left with 359 roles. Then we took away doublets and non-classifiable roles and ended up with 329 roles. The assessment of the remaining 329 roles was done in a four-step process:

1. We listed the 329 individual roles found on SAP’s web pages. The roles are listed under each

industry solution and are structured into categories.

2. Each role was categorized along the value dimensions - internal versus external and stable versus flexible. An example of a role is billing clerk. The tasks a billing clerk moderates is:
   "*the entire procedure for billing document processing, that is, the processing of invoices, credit memos, debit memos and cancellation documents. He is responsible for insuring that the invoices are correct and complete. The billing clerk carries out the following tasks:*
   - *Entering and processing of invoices, credit memos and debit memos*
   - *Invoice verification*
   - *Creation of invoice lists, lists for credit memos and rebate agreements*
   - *Creation of lists for sales orders blocked for billing*
   - *Release of sales orders blocked for billing*
   - *Settlement of rebate agreements.*" (www.sap.com)

   These tasks where classified as belong to the IP model, since the task is measured mostly with internal effectiveness measures.
3. Each role was mapped into the CVM regarding the value dimensions—i.e. into the four organizational models.
4. Each role was evaluated regarding its hierarchical level using the following five levels: top-management, middle management, operative and support personnel, experts and specialists, and outsiders.

Two researchers did the assessment and classifying independent of each other (working through step 2-4 independently). The two classification and assessment outcomes were compared. Approximately there was an 80% agreement between the two assessment (some roles were question-marked in the assessment). Where non-agreement existed, the two researchers assessed the roles again and a final classification and assessment decision was made. The outcome of the classification and assessment of the roles is depicted in Table 1.

CVM	Top	Middle	Operative	Experts	External	Total
Internal Process	3	77	83	21	0	**184**
Rational Goal	4	33	46	23	8	**114**
Human Relations	1	2	2	2	0	**7**
Open Systems	5	8	2	9	0	**24**
Total	**13**	**120**	**133**	**55**	**8**	**329**

Table 1. Evaluation of the role based concept

5.1 Outcomes of the IP assessment

Most of the IP roles map to the internal process (IP) model and the rational goal (RG) model, with more roles mapped to the internal process model. Accordingly, most of mySAP Workplace roles support IP- and RG-associated organizational goals. Hence, the mySAP Workplace roles primarily support roles related to efficiency and productivity, and means such as coordination and planning. The hierarchical evaluation showed that primarily operative and middle management roles are supported. Reasonable since these hierarchical levels are likely to primarily support the same goals as the IP and the RG model. The strong support of internal process (IP) model is natural since one primary task ERP has and that also underlies these roles is master data, which refers to the work of creating master data records for e.g. customer, vendor,

and material etc. This capability is used as a repository for datum and makes it possible to communicate information through an organization; this is what makes integration possible. However the lack of support of the human resource and open system models was a surprise.

6. Discussion

Our assessment suggests what organizational models, with their associated roles, are supported by the evaluated IP (mySAP Workplace). The assessment suggests that the CVM-roles associated with the IP and RG models are the roles primarily supported by mySAP Workplace. It would be tempted to suggest that the IP (mySAP Workplace) is less good because it seems that there exists an unbalanced support of CVM-roles. Such a suggestion would be based on that a well-balanced support is good. But, such a suggestion misses an important aspect: the context of where the IP is to be used. Studies within the CVM framework suggest that all roles are not equally important and critical. There are changes in the importance of the roles in relation to hierarchical levels and what state a firm is in. Quinn and Cameron (1983) found, in relation to the CVM framework, four different states a firm can be in, namely: 1) entrepreneurial, 2) collectivity, 3) formalization and control, and 4) elaboration of structure state. In the entrepreneurial state the roles in the OS model are the critical roles and in the collectivity state the roles in the HR model are the critical roles. In the formalization and control state the roles in the IP and RG models are the critical roles. The elaboration state has a more balanced emphasis of the roles. Based on Quinn and Cameron's findings, we can hypothesize that the assessed IP will be more effective in firms in the two latter states.

In another study it was found that there is also a difference in the importance of the roles in relation to hierarchical levels (Quinn 1988). Two major findings in the study were that: 1) there exists an equal emphases for the monitor (IP), coordinator (IP), and director (RG) role, and 2) the importance of the two OS-roles increases as we move up the hierarchical levels. In relation to our classification, the first finding suggests that although the IP (mySAP Workplace) seems to support the IP and RG roles it does so better for middle and lower level managers than for top-managers. The second finding and our classification suggest that an important improvement of the IP (mySAP Workplace) for top-managers would be to better support the roles associated with the OS model. Another improvement, important to all levels, would be to enhance the IP in its support of the roles associated with the HR model.

7. Limitations and Further Research

This paper presents an assessment of the role-based concept of an IP (mySAP Workplace) using an accepted framework of organizational effectiveness. The purpose of the assessment was to understand how IP systems might support organizational effectiveness.

Important delimitation of the approach is that the following aspects are not taken into account in the assessment of the IP. First, the value of the roles in context—some roles are more important than others. Second, the impact of the environment and technology of the user—some roles are more important than other depending on the environment and technology of the specific organization. Third, the number of each roles in an organization—its likely that some roles will have several users.

The evaluation of the roles can in future studies be done by field studies of actual use. Due to the newness of mySAP Workplace it was hard to find actual use cases that could be related to

Quinn et al's effectiveness construct. Further research on IPs might include studies on the design and use of roles in both context and development environment. Research on actual implementation and use and effects of use is critically needed. Other evaluation models could of course also be possible to use, for example, TAM (Technology Adoption Model) or Perceived Characteristics of Innovation (PCI).

Our model for evaluating IPs can be used as a tool for supporting implementation by enhancing or enabling a better communication between designers and users. This is achieved by using the evaluation for discussing organizational requirements of IPs and related improvements. The focus is on organizational requirements, motivated by organizational effectiveness.

mySAP Workplace can be considered as one approach to personal information management. In future studies it can be compared with other approaches to personal information management. mySAP Workplace's possibility to support users' mobility can also be addressed in future studies. In this case, mobility will include both technical mobility (to different places) and social mobility (out and in of different roles and contexts).

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Paper VII

Narratives in ERP Systems Evaluation

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