Understanding Role-Oriented Enterprise Systems

From Vendors to Customers

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ABSTRACT – ENGLISH

Enterprise Systems (ES) are generally considered the price of entry for running a business. With the increased scope of ESs to encompass nearly every function or business process of a modern organization, an increasing number of different users are adopting and using the systems. These users occupy a number of different organizational roles which include a wide variety of different tasks in organizations and have very different requirements for ESs. To ensure a better fit between users and ESs, a number of ES vendors have begun to focus on reflecting the concept of organizational roles of users in their systems. Limited research has, however, addressed these “role-oriented” ESs; this dissertation attempts to provide a better understanding of them by studying their design, implementation, and use.

The research design for this dissertation is based on Case Studies and the Grounded Theory Method with qualitative empirical data collected across three types of actors in an ES ecosystem: Vendors; partner companies; and customers. The findings are primarily presented in six appended research papers that are aimed at both researchers and practitioners. The main contribution of the dissertation is an improved understanding of: Representation of organizational roles in the deep and surface structures of ESs; the mapping, configuration, and tailoring of predefined systems roles to fit actual roles of users in organizations; and the potential benefits and role-related misfits of role-oriented ESs. Through discussion of the findings, the dissertation also illustrates how the design of role-oriented ESs is influenced by the different actors in an ecosystem. The dissertation also illustrates how systems, organizations, processes, and roles can be aligned during implementation by shifting basis and conceptual focus in the requirements analysis. Finally, the dissertation explains the impact of role-oriented technology on organizational performance and how this technology may influence the existing perception of the role taking process in organizations.

RESUMÉ - DANSK

Forretningssystemer bliver ofte betragtet som en nødvendighed for at kunne drive en moderne virksomhed. I takt med at forretningssystemer udvides til at inkludere næsten alle funktioner og forretningsprocesser i virksomheder, adopterer og anvender et stadigt større antal brugere med forskellige behov disse systemer. Brugere udfylder en række forskellige roller som led i deres daglige arbejde i virksomheden, og de har mange forskellige krav til forretningssystemerne. Som led i et forsøg på at skabe bedre tilpasning mellem systemer og brugere, er en række producenter af forretningssystemer begyndt at fokusere på at repræsentere rollebegrebet i deres systemer. Der er dog kun en begrænset mængde forskning som har undersøgt ”rolleorienterede” forretningssystemer, og denne afhandling forsøger således at tilvejebringe en bedre forståelse af disse systemer.

Undersøgelsesdesignet for afhandlingen er baseret på case studier og Grounded Theory Method med kvalitative empiriske data indsamlet fra tre slags aktører i et økosystem af forretningssystemer: Producenter, partnere og kunder. Resultaterne af undersøgelsen er hovedsageligt præsenteret i seks vedhæftede artikler som er henvendt til både forskere og erhvervsfolk. Undersøgelsen bidrager primært til en bedre forståelse af: Repræsentation af organisatoriske roller i dybe og overfladiske strukturer i forretningssystemer; afbildning, konfiguration og tilpasning af prædefinerede systemroller til de faktiske roller i organisationer; og potentielle fordele og rollerelaterede mangler i rolleorienterede forretningssystemer. Gennem diskussion af resultaterne illustrerer afhandlingen hvordan design af rolleorienterede forretningssystemer bliver påvirket af aktørerne i et økosystem. Afhandlingen illustrerer også hvordan systemer, organisationer, processer og roller kan blive afstemt i implementeringsfasen ved at skifte mellem forskellige grundlag og konceptfokuser i kravspecifikationen. Endeligt forklarer afhandlingen, hvordan rolleorienteret teknologi

kan påvirke organisationers ydelse, og hvorledes denne teknologi påvirker rolledannelse i organisationer.

Table of Contents

1 Introduction and frame

This chapter introduces the topic and sets the scene for the dissertation. The chapter: 1) motivates the research by providing the background of the study; 2) presents an overview of the evolution of Enterprise Systems; 3) describes the structure for the remaining parts of the dissertation; 4) provides an overview of the Enterprise Systems life-cycle; 5) presents the main research question that guided the research project; and 6) provides an overview of the contribution of the appended papers.

1.1 Background of the study

Throughout half a century, Enterprise Systems (ES) have developed from simple office computing jobs to enterprise wide Information Systems (IS), supporting nearly every aspect of the modern business organization (Caminer 1998; Adam and Sammon 2004; Jacobs and Weston 2007). While early implementations of ESs relied on bespoke development to fit individual organizations, commercial-off-the-shelf (COTS) systems have now become the dominant method of acquiring ESs (Campbell-Kelly 2003; Wu, Shin and Heng 2007). The standardized nature of COTS ESs is based on a universal fit between system and organization (Davenport 1998; Voas 1998) – also known as "best practice". The systems may thus contain more than a thousand predefined business processes to accommodate for various practices and industries (Koch 2001).

The promise of software packages that seamlessly integrate information and business processes has entailed widespread adoption of ESs over the past decades (Davenport 1998), and have become a multi-billion dollar industry with expected revenues of $357 billion by the year 2015 (Gartner 2011b). However, ES implementation projects have significant organizational impact and have been notorious for running over budget, over time, and with a high risk of failure (Davenport 1998; Trunick 1999; Markus and Tanis 2000; Robey, Ross and Boudreau 2002). Studies of ESs have also pointed to a number of gaps and misfits when implementing the systems in organizations (Soh, Kien and Tay-Yap 2000; Hong and Kim 2002; Wu et al. 2007). The focus on Business

Process Re-engineering (Davenport and Short 1990; Hammer 1990) has especially sparked a significant interest in the fit, or lack thereof, between the universally designed best-practice business processes of the ESs and the business processes of the customer organizations they are implemented in (e.g., Ng, Ip and Lee 1999; Koch 2001; Huq and Martin 2006).

While the fit of business processes is undoubtedly of major importance to the success of ES implementation, IS research has long held user satisfaction as another important measure of IS success (Bjørn-Andersen, Hedberg, Mercer et al. 1979; Melone 1990; DeLone and McLean 1992; Seddon 1997) and user fit and user satisfaction has been shown to be among the key critical factors for successful implementation of ESs (Aladwani 2001; Hong and Kim 2002; Sedera and Tan 2005). Ease of use, usefulness, and ease learning has also been reported as some of the significant determinants of user satisfaction and adoption of ESs (Calisir and Calisir 2004; Seymour, Makanya and Berrangé 2007; Al-Jabri and Al-Hadab 2008), indicating the importance of considering the match between ESs and users. However, reports from both industry and academia have pointed to a number of usability issues in ESs, such as information overload, difficulties of identifying and accessing needed functionality, and cluttered screens (Soh et al. 2000; Aladwani 2001; Gilbert 2003; Light 2005; Topi, Lucas and Babaian 2005).

In the fall of 2008 I attended the annual Microsoft Dynamics Convergence[1] conference in Copenhagen. The conference is the premier conference for customers wanting to know about new and upcoming releases of Microsoft's ESs, and more than 4000 representatives from customers and partners attended the conference in Copenhagen. The main event at the conference was the release of Dynamics NAV 2009. What was noticeable about this release was, that although some architectural changes had been

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[1] See www.microsoft.com/dynamics/convergence/ for additional information.

made from the previous version of the NAV system, the 2009 version did not include support for any new major functions or business processes. Instead, the main feature emphasized at the grand opening session was the inclusion of a ‘role-tailored client’ (RTC). Microsoft’s argument for the new RTC client was rather straight forward: The increase of supported functions and business processes supported in modern ESs entails an increase in the diversity of the users interacting with the systems. Users should thus be presented with the information and functions that they use frequently. To support this design philosophy, the NAV 2009 RTC included 21 predefined ‘role centers’ which synthesized information and functions according to the *organizational roles* of the users.

Coming from a background as project manager of internal development of ESs for a large Danish real estate chain, I recognized the issue of diversity in user roles all too well. My development team had often struggled with designing user-friendly interfaces based on requirements from a group of users with a particular organizational role, such as the real estate agents, only to find that when we evaluated the user interfaces with users occupying other roles, such as the administrative personnel, it turned out that they had completely opposite requirements for which functions and information that needed highlighting.

Intrigued by Microsoft’s focus on representing the organizational roles of users through different user interfaces, I approached a representative from the vendor at a session at the conference and started asking questions about the new client. While the representative kindly answered my question as well as he could and referred me to the marketing material and documentation accompanying the NAV 2009 RTC, the conversation left me with more questions than it had answered, and my following visits to the booths of partner companies at the conference sparked even more questions. How would the RTC account for users occupying multiple roles simultaneously? How would Microsoft persuade the traditionally process-oriented implementation consultants to focus on roles? And what were the benefits and challenges of this role-oriented approach for users in the client organizations[2]?

When I engaged in conversations with customer and partner representatives in the following days at the conference, multiple dichotomous opinions were expressed. Some were very excited about the RTC and perceived it as the biggest innovation in the history of NAV since the shift from DOS to Windows. Others openly criticized the new client, arguing that the new client would just create confusion on how to use the system. The common denominator was that everyone had an opinion about the RTC and everyone agreed that it would have a profound impact on the implementation and use of the NAV system. Especially since Microsoft had announced that the role-oriented client would be included in their other systems, such as AX, and that coming versions of NAV would discontinue support for the old client that had a single unified user interface.

A look at the marketing material and documentation from some of the other major ES vendors, like SAP and Oracle, revealed that these vendors all incorporate the notion roles in their ESs, to some extent. SAP has long used roles for access control to system resources and has since 2000 reflected organizational roles in the user interfaces of its Enterprise Portals (Carlsson and Hedman 2004), to "allow [users] easy access to the content they need, when they need it" (SAP AG 2010). Oracle's Fusion Application claims support for more than 170 user roles based on a role-oriented approach to design of user interfaces so that "[e]very item on the screen has been considered for what a particular role needs to know to best do their job"(Oracle 2010a; Oracle 2010b). According to the ES vendors, these "role-oriented" ESs were aimed at a better fit

[2] The notions of 'client organization' and 'customer' are used interchangeably in the dissertation for describing the organization that acquires the ES.

between ESs and users, but how had academic research addressed the concept of organizational roles in ESs?

Turning to the organizational literature, I found that the notion of organizational roles had been extensively addressed in the field of organizational role theory (e.g. Katz and Kahn 1966; Pugh, Hickson, Hinings et al. 1968; Mintzberg 1979; Handy 1993; Pareek 1994). Looking at the IS literature I found that a focus on organizational roles had already been suggested as a means to identifying, separating, and presenting information and tasks to ES users (Ammenwerth, Ehlers, Eichstadter et al. 2002; Carlsson and Hedman 2004; Worley, Chatha, Weston et al. 2005; Johansson 2009) and that the role concept had been applied to various areas, such as access control (Ferraiolo, Cugini and Kuhn 1995; Oh 2003; She and Thuraisingham 2007), modeling (Barros, Duddy, Lawley et al. 2000; Steimann 2000b; Almeida, Guizzardi and Santos 2009), and user interface design (Greenberg 1991; Shneiderman and Plaisant 1994). However, surprisingly little research had addressed the design, implementation, and use of role-oriented ESs or even their very definition.

With this initial background of the study I move on to describe the structure for the remaining parts of the dissertation.

1.2 Structure of the dissertation

The dissertation consists of two parts: This “cover” paper and six independent research papers that are appended to this document. Due to reasons of copy right, the research papers are appended as pre-print versions. The overall structure of the cover paper is divided into five chapters. The first chapter provides the frame for the research by describing the life cycle of ESs, ES ecosystems and a short overview of general ES research, before moving on to the purpose of the study and the research questions that guided it. Chapter one concludes with an overview of the appended research papers and their contribution to answering the research questions.

Chapter two presents the research design. The chapter explains how the research for the framing of the study was conducted and how the research was designed to answer the research questions. The chapter explains: 1) the participation in the 3gERP project; 2) the overall research approach and the applied methodologies, 3) the design for framing and answering the research questions; 4) the data collection; and 5) the analysis of the data or the role of existing theory.

Chapter three presents the findings from the study, integrates them with a review of existing literature, and answers the research questions. Chapter four discusses the findings to arrive at more theoretical level of understanding and contribute back to the theoretical constructs that lay the foundation for the findings. Chapter five presents a reflection on the research study and discusses the relevance of the dissertation by highlighting the contributions and the implications for practice before rounding up with suggestions for future research.

1.3 The Enterprise System (R)evolution

The conceptual idea of an ES is often credited to Sherman Blumenthal (1969) and his framework for planning and developing Management Information Systems (MIS). While the idea of ESs thus dates back more than 40 years, the technological development of what we today term as ESs can be traced back even further, to the world's first business program on the LEO I at J. Lyons Co. in 1951 (Caminer 1998; LEO Computers Society 2011).

The introduction of computers into businesses in the 1950s automated manual tasks, such as bookkeeping, invoicing and reordering, for the purpose of forecast and inventory management (Møller 2005). The early inventory and control systems (ICS), and bill-of-materials (BOM) processors gradually evolved into Materials Requirement Planning (MRP) systems in the late '60s and early '70s (Møller 2005; Jacobs and Weston 2007). MRPs primarily focused on optimizing manufacturing planning and control (MPC) to reduce production costs and enable high volume production (Jacobs and Weston 2007). While the industry for computerized machinery was heavily dominated by IBM at that time (Mahoney 1989), many of the companies that have shaped the evolution of ESs were founded during this period (SAP in ’72, Lawson in ’75, J.D. Edwards and Oracle in ’77, and Baan in ’78). The birth of these companies sparked the evolution towards *packaged* software (Jacobs and Weston 2007), also referred to as commercial-of-the-shelf (COTS) ESs, increasingly separating the software from the underlying hardware (Boehm 2006). The release of IBM’s System 34 with an integrated suite of Manufacturing, Accounting and Production Information, and Control System (MAPICS and COPICS) in 1978, and SAP’s R/2 the same year, signaled the transition to Manufacturing Resource Planning (MRP II) systems (Jacobs and Weston 2007). MRP II extended the traditional focus on materials to planning of the entire production through support for closed-loop planning and capacity constraints (Møller 2005).

In the 1980s, the availability of commercial relational databases, such as Oracles SQL, and cheaper and more flexible computers, such as the IBM’s System/36, the IBM 4300 series and the Personal Computer (PC), increased the attractiveness of MRP II solutions for SMEs (Jacobs and Weston 2007). The ‘80s thus saw the birth of a number of companies focusing on enterprise software solution for SMEs, including SAGE in 1981 (Sage 2011) and PC&C, which would eventually become Navision, in 1984 (VisionData 2011). In 1983, the Danish brothers Preben and Erik Damgaard founded Damgaard A/S and in 1986 the company released its first version of Concorde Finance, which would eventually evolve into the Axapta product suite (The Docherty Partnership 2010). On the international scene, Dave Duffield and Ken Morris founded PeopleSoft in 1987 to offer Human Resource Management Systems (HRMS). The 1980s also saw the emergence of a systems approach to supporting Supply Chain Management (SCM) for controlling the materials information flow from the raw materials to the final customer, although the major impact of this evolution did not materialize until the ‘90s (Møller 2005).

The early ESs were thus designed with a focus on optimizing productivity in *functional areas*, such as accounting and manufacturing and later on human resource and sales. This design was aligned with a *function-oriented* view of organizations which focused on optimizing productivity in individual functional areas (Kirchmer 1999). The function-oriented view on organizations is often associated with a pronounced hierarchical structure of the organization where the strategic planning of cross-functional activities is carried out by top-level management while the majority of the workforce focuses on specialization of skills to optimize efficiency in completing individual tasks (Mintzberg 1979). However, the function-oriented structure of the organization complicates the integration between functional areas and optimization of one functional area could even lower the productivity of another functional area, as optimization is often done in isolation without regards to other functional areas (Kirchmer 1999).

1.3.1 From function-oriented to process-oriented Enterprise Systems

To improve business productivity by overcoming the disadvantages of a function-oriented perspective, a (business) *process-oriented* perspective on organizational structuring began to catch on in the late 1980s and early 1990s (cf. Porter 1985; Davenport and Short 1990; Hammer 1990; Hammer and Champy 1993), although Davenport and Stoddard (1994) argue that the business process perspective has been around since the mid-1940s. Juxtaposing the process-oriented perspective with the function-oriented perspective, one may think of the function-oriented perspective as focusing on optimizing functional areas *in isolation* and the process-perspective as focusing on processes that span *across* multiple functional areas to optimize productivity (Kirchmer 1999).

At the end of the 1980s IBM launched an update to their Communications Oriented Production Information and Control System (COPICS) which introduced the acronym CIM – Computer Integrated Manufacturing (Jacobs and Weston 2007). CIM initiated a shift in focus to support management *across* the enterprise and automate parts of the manufacturing process (Møller 2005). By the early 1990's MRP II systems had thus evolved from the traditional focus on internal production to other business functions, such as order processing, distribution, and personnel, *across* the enterprise (Chen 2001; Adam and Sammon 2004). The further expansion of MRP II to include *external resources* in the supply chain and scheduling based on customer demands led Gartner Group to coin the term Enterprise Resource Planning (ERP) (Chen 2001). ERP systems emphasized integrating both *within* and *across* functional silos, and reflection of transactions to the general ledger in all links of the internal value chain, from inbound goods over production to shipping and receiving of payment – in real-time (Møller 2005; Jacobs and Weston 2007). The greater focus on enterprise wide system integration and inclusion of client/server architecture, graphical user interfaces, use of fourth generation language, computer-aided software engineering tools in development, and open-systems portability, further marked the transition from MRP II to Enterprise Resource Planning (ERP) systems (Adam and Sammon 2004). Bingi et al. (1999) thus sums up the definition of ERP by stating:

> "*An ERP system can be thought of as a companywide information system that integrates all aspects of a business. It promises one database, one application, and a unified interface across the entire enterprise.*" (p. 8)

ERP systems are thus one, but not the only, type of ESs (Shang and Seddon 2002). The release of SAP R/3 in 1992 manifested the transition into the EPR systems era. The system used a three-tier client-server architecture (as opposed to the single mini-computer or mainframe architecture), was able to run on a variety of computer platforms, had and open architecture allowing third-party companies to develop software that would integrate with the system, supported extension through the fourth generation ABAP (Advanced Business Application Programming), and reflected transactions to the general ledger in real-time (Jacobs and Weston 2007; SAP AG 2011). In 1993 Thomas Siebel and Patricia House founded Siebel Software, which focused on producing Customer Relationship Management (CRM) system, and by the late 1990's the company had become the dominant player in the market for sales automation (Business Wire 2002). The year 2000 (Y2K) compliancy issue of legacy systems caused widespread adoption of ERP systems in the 90's (Soh et al. 2000; Themistocleous, Irani and O'Keefe 2001; Møller 2005) and the technological possibilities provided by the emergence of the Internet in the 90s further increased the focus on integrating SCM across organizational boundaries (Wang, Chang and Heng 2004). By the end of the 90s, a number of packaged systems, each with their own three letter acronym, thus catered to the needs of enterprises. Encompassing all these systems, Davenport (1998) coined the term 'Enterprise System', and indirectly defined the term as:

"*These commercial software packages promise the seamless integration of all information flowing through a company – financial and accounting information, human resource information, supply chain information, customer information*" (p. 121)

During the "golden age" of ERP systems in the 90s, market dominance shifted from IBM to SAP, J.D. Edwards, Oracle, PeopleSoft, and Baan (Jacobs and Weston 2007) and sales of SAP soared from less than $500 million in 1992 to approximately $3.3 billion in 1997, making it the fastest growing software company in the world (Davenport 1998). By 1997 the worldwide market for ERP systems was thus estimated at $15.68 billion, according to AMR Research (Holland and Light 1999). In the local Danish market, Navision grew from annual revenue of Kr. 87 million (approx. $15 million) in the fiscal year 1995/1996 to Kr. 836 million (approx. $139 million) in the fiscal year 1999/2000 (Navision Software 2000) and Damgaard went from a revenue of

Kr. 180 million (approx. $32 million) in 1995 to Kr. 467 million (approx. $70 million) in 1999 (Damgaard A/S 1999; Damgaard A/S 2000).

On the organizational management side, the transition to ERP systems was complemented with a *process-oriented* view on structuring organizations, through business process reengineering, (Hammer 1990), or redesign (BPR) (Davenport and Short 1990). From the very beginning IT was viewed as one of the key tools for executing BPR. Commenting on IT's role in BPR, Davenport and Short (1990) thus argued that:

> "*IT should be viewed as more than an automating or mechanizing force; it can fundamentally reshape the way business is done. In short, business should be viewed as more than a collection of individual or even functional tasks; instead it should be broken into processes that can be designed for maximum effectiveness, in both manufacturing and service environments.*" (p. 12)

Before the significant growth of ERP implementations in the late '90s, little academic research had addressed ERP systems in organizations (Kumar and Van Hillegersberg 2000; Esteves and Pastor 2001). With the increase of ERP implementations and increased focus on BPR, researchers turned their attention to the implications of implementing ERP systems in conjunction with BPR (e.g. Kirchmer 1999; Koch 2001; Gattiker and Goodhue 2002; Huq, Huq and Cutright 2006). Much of the literature on ERP systems thus suggests the management and integration of business processes as one of the key attributes of the systems (e.g. Davenport and Beers 1995; Davenport 1998; Soh et al. 2000; Nah, Lau and Kuang 2001). The growing popularity of ERP systems in the 1990s thus entailed an even more pronounced turn towards a process-oriented view in the design of the systems (Jacobs and Weston 2007), to the point where the Eleventh Edition of the APICS Dictionary (Blackstone Jr. and Cox 2005) defines ERP as a:

> ''*framework for organizing, defining, and standardizing the business processes necessary to effectively plan and control an organization so the organization can use its internal knowledge to seek external advantage*'' (p. 38).

The concept of business processes thus was (and still is) central in the design of ERP systems, and extensive efforts have been have been put into suggesting modeling techniques that capture business processes for the purpose of designing ERP systems, both in general (e.g. Becker, Rosemann and von Uthmann 2000; Dreiling, Rosemann, van der Aalst et al. 2008) and through suggestion of specific techniques, such as Business Process Modeling Notation (BPMN) (White 2004), ARIS (Scheer 2000), Unified Foundational Ontology (UFO) (Guizzardi and Wagner 2005), and Unified Modeling Language (UML) for enterprise architecture (Barros et al. 2000).

1.3.2 From process-oriented to role-oriented Enterprise Systems

Although BPR held the promise of substantial increase in productivity, the productivity gains envisioned by managers in organizations taking on BPR often failed to materialize (Legare 2002) or the BPR projects failed altogether (Sarker, Sarker and Sidorova 2006). Furthermore, the modeling of business processes in isolation is, by definition, done from an organizational perspective and not from the perspective of the people carrying out the tasks and activities necessary to complete the business processes. Consequently, in many cases, the intense focus on changing organizations through BPR, that swept in the wake of the process-oriented perspective, led to an over emphasis on lay-offs, cut-backs, and top-down organizational re-structuring (Davenport 1995). Subsequently, Davenport and Stoddard (1994) sought to "demythologize" BPR as the silver bullet for organizational productivity optimization, and Davenport (1995) even labeled the extensive application of BPR as "the fad that forgot people". Acknowledging the downsides of a purely process-oriented perspective, radical BPR was substituted with "softer" approaches to business process optimization, such as Total Quality Management (TQM) (Lawler, Mohrman and Ledford 1995).

Despite the increased focus on integration across business functions, ERP systems and ESs in general still lacked integration to other organizational business systems operating alongside the systems (Themistocleous et al. 2001). A mistrust in ERP's capability to handle the increased focus on e-business enabled by the widespread adoption of the Internet among enterprises and consumers, initiated a trend towards "bolts-on", or "add-ons" for existing ERP packages (Markus and Tanis 2000; Møller 2005). The increased number of disparate enterprise applications entailed a focus on Enterprise Application Integration (EAI) to "bind these applications into a single unified enterprise application" (Linthicum 2000, p. 1). In 2000 Gartner Group thus coined the term ERP II, defined as:

> *"a business strategy and a set of industry-domain-specific applications that build customer and shareholder value by enabling and optimizing enterprise and inter-enterprise, collaborative-operational and financial processes"* (Bond, Genovese, Miklovic et al. 2000).

Møller (2005, p. 488) summarizes ERP II as "componentized ERP, e-business, and collaboration in the supply chain". Adoption of internet technologies further enabled possibilities for delivery of ESs "on-demand". New delivery methods and pricing options, such as Software-as-a-Service (SaaS), Application Service Providers (ASP), and 'ERP rentals' and architectures, like Service-oriented architecture (SOA), were thus conceived during the 2000s (Harrell, Higgins and Ludwig 2001; Erl 2005). A new generation of ES vendors followed in the wake of the new Internet technologies, with the most noteworthy being Salesforce.com. The company was founded in 1999 and specialized in providing CRM systems to SMEs, based on SaaS (SalesforceProGrammers 2010). By 2008, Salesforce had more than 55.000 customers and revenue of over $1 billion (Schonfeld 2009).

The turn of the millennium also marked the beginning of a series of consolidations in the ES industry (Arnesen and Thompson 2003). Navision and Damgaard announced a merge between the two companies in November 2000 and the merger was acquired by Microsoft in July 2002 for $1.45 billion (Microsoft News Center 2002). Microsoft had previously acquired the ERP vendor Great Plains in April 2001 for $1.1 billion (Microsoft News Center 2001), which had previously acquired Solomon Software. In 2003 Microsoft launched its Microsoft Dynamics CRM and was thus increasingly becoming a significant player in the ES market, with 'Microsoft Dynamics' as label for the ES division. J.D Edwards and PeopleSoft merged in June 2003 and the merger was acquired by Oracle shortly after in a hostile takeover (Jacobs and Weston 2007). Oracle also acquired Siebel Systems in 2005 for $5.8 billion. The 2000s also saw the birth of Agilisys in 2002. The company acquired an extensive number of smaller enterprise software vendors in the years after its foundation, including an evolved version of the original IBM MAPICS system and the German ES vendor Infor Business Solutions (Morgan 2005). After the acquisition of Infor Business Solution, Agilisys changed its name to Infor Global Solutions.

By 2010, ERP vendors' global revenue has reached $21.2 billion, according to Gartner Group (Gartner 2011a). Gartner Group further expects the worldwide market for ESs in general to reach $357 billion by 2015, of which the European market accounts for $110 billion (Gartner 2011b). In 2010, SAP was by far the largest vendors holding an approx. 25% market share worldwide (Gartner 2011a; Panorama Consulting Group 2011). Oracle was a clear second with an estimated market share between 12% (Gartner 2011a) and 18% (Panorama Consulting Group 2011) depending on the source of the estimate. Gartner Group, reported Sage, Infor and Microsoft to have around 5% of the market each (Gartner 2011a), based on revenue, while Panorama Consulting Group (2011) estimated Microsoft's market share as high as 11%, based on the number of implementations among customer companies.

The widespread adoption of ESs and the increasing expansion in the scope of the systems entailed that:

> *"front-line workforces as diverse as sales, product development, finance, customer service, purchasing, and strategic or supply chain planning can draw on ES data and analytic capabilities to improve their job performance, increase their authority for decision making, and improve communications with customers"* (O'Leary 2000).

Additionally, the turn towards increased focus on e-commerce and the integration across organizations made possible by the Internet in the late 1990s and early 2000s, made it relevant for *external* actors to access (parts of) an organization's ES (Chaffey 2007). Or as put by Davenport, Harris, and Cantrell (2004):

> *"[Leading organizations] do not just give people access to data. They give access to the right data most applicable to the person and the problem at hand. In other words, they present the information in context, thereby empowering employees to better understand the implications of information and to act upon it."* (p. 23).

Consequently, a need for fitting information to meet the diverse needs of different user groups has entailed an increased focus on *syndicating* the presentation of tasks and information (White 2000).

In response, ES vendors have argued that syndicating tasks and information in user interfaces based on the organizational *roles* of the users provides: "role-tailored productivity [that] enables the people-ready business by combining the worlds of business process automation and personal productivity" (Microsoft Dynamics 2007). SAP thus argues that:

> *"The idea behind role-based interfaces is that a company doesn't have a single maintenance system, for example. It has a maintenance supervisor, a parts buyer,*

> *and a maintenance technician, each with a different view of that maintenance system depending on what they are trying to do. So, the first step is to organize by roles."* (Sleeper 2004)

The main arguments from the ES vendors is that role-oriented ESs focus on the organizational role(s) of the users and thus provide easier and faster access to information and tasks and requires less training than conventional ESs. Although scarce, academic literature has also suggested benefits of role-oriented ESs. Carlsson and Hedman (2004) thus argue that benefits of linking information and applications to roles are: easier administration of users; more convenient login procedures for users; and better control of who has access to information and applications. Focusing on roles as part of ES design and implementation has also been suggested as a means of ensuring proper mapping between business process and the roles carrying out the tasks in the business processes(Scheer 2000; Almeida et al. 2009).

1.3.3 Conclusion

Concluding on the evolution of ESs, early systems had a *function-oriented* perspective on supporting optimization of productivity within individual functional areas, such as inventory and forecasting in ICS in 50s, requirements calculations in MRP in the 60s, and manufacturing in MRP II in the 70s. The systems evolved to a *process-oriented* perspective with automation and integration of CIM and ERP and organizational focus on supporting redesign of business process across the organization in the 80s and 90s. Finally, the integration of componentized applications in ERP II in the 2000s, the widespread adoption of ESs and expansion in scope of the systems has entailed diversity of users operating the systems, and design of ESs is thus focused on syndicating information to accommodate this diversity. ES vendors and academic literature have suggested a *role-oriented* perspective as a means to accomplish this syndication, arguing that a role-oriented ES provides easier access to tasks and information and requires less training of users. During this evolution, the ES industry has grown into a multi-billion dollar industry with changing market leaders and several mergers and consolidations. Modern ESs thus hold multiple legacies and today they encompass ERP, ERP II, HRM, SCM, and CRM systems among others.

1.4 The Enterprise Systems life cycle and ecosystem

With the emergence of packaged software, or COTS, the phases in the software development life cycle (SDLC) of ISs have been divided between different actors (Morisio, Seaman, Parra et al. 2000). Development of the 'core' package is carried out by the software vendors, while implementation of the system is carried out in the organization that acquires the ES. As COTS ESs have become the predominant form of ESs, further references to ESs in the dissertation are implicitly the COTS type, unless specifically stated otherwise. Numerous life cycle models for ESs have been proposed (e.g., Esteves and Pastor 1999; Markus and Tanis 2000; Parr and Shanks 2000; Esteves and Pastor 2001; Rajagopal 2002; Somers and Nelson 2004). An example is the life cycle model proposed by Esteves and Pastor (1999). The model consists of the sequential phases of:

1. Adoption decision: The definition of system requirements, its goals and benefits, and an analysis of the impact of adoption at a business and organizational level.
2. Acquisition: Selection of the system package that best fits the requirements of the organization.
3. Implementation: Tailoring and adaptation of the system package acquired according to the needs of the organization.
4. Use and maintenance: The use of the system in a way that returns expected benefits and minimizes disruption.
5. Evolution: Integration of more capabilities into the system, providing new benefits, such as advanced planning and scheduling, supply-chain management, and customer relationship management.

6. Retirement: When the appearance of new technologies or the inadequacy of the system or approach to the business needs makes the organization decide on substituting the system with another IS approach more adequate to the organizational needs of the moment.

While each ES life cycle model has its own distinct characteristics, some overlap between the phases in the models can be found, and the life cycle model proposed by Esteves and Pastor (1999) is thus a reasonable generalization of these types of models.

However, a point of criticism of Esteves and Pastor's model is that it does not capture the iterative nature of ESs in which system and organization are continuously adapted to fit each other (Alter 2001; Rajagopal 2002). Another shortcoming of previous life cycle models is that the majority of the models depicts the life cycle from the view of the implementing organization in isolation and omits the SDLC of the vendor. An exception to this tendency is the model proposed by Hedman (2003). Hedman reviews a number of life cycle models and propose a synthesized life cycle model for ESs, inspired by other life cycle models and empirical research, which includes the iterative process of both the development of the core system at the vendor and implementation in the customer organization.

Hedman's (ibid.) model depicts the development of the ES package at the vendor beginning with the phase of 'Analysis' in which requirements are gathered based on requirements of the target customer segment, followed by 'Design' of the system, 'Realization' (coding), and finally the 'Offering' of the ES package to the customer(s), at which point the ES enters the life cycle at the customer organization. Iteration of the development cycle at the vendor continues, as new versions of the ES package are developed. In the client organization the life cycle begins with the 'Selection' phase, and proceeds through 'Configuration', 'Implementation', and 'Use and Operation', similar to the model proposed by Esteves and Pastor (1999).

However, companies are increasingly dependent on their *partners,* such as suppliers, distributers, and technology providers, for achieving success (Snow, Miles and Coleman 1992; Iansiti and Levien 2004a). This tendency has also diffused into the industry of ESs (Arndt, Kude and Dibbern 2008; Johansson and Newman 2010; Sarker, Sarker, Sahaym et al. 2012). ES vendors thus depend on consultant companies for implementing their systems (Robey, Ross and Boudreau 2002). Modern ES are also increasingly relying on bolt-ons, also referred to as *add-ons*. Add-ons, in the context of ESs, are extensions to the core ES package, which adds functionality to meet the needs of a particular customer segment (Brehm, Heinzl and Markus 2001). These add-ons are usually developed by third-party independent software vendors (ISV) under the license of the ES vendor and have become a common approach for ES vendors to augment and extend the value proposition of the core ES package (Brehm et al. 2001; Arndt et al. 2008).

As a result, the delivery model of ESs has expanded from a two-party configuration between the vendor and the customer organization to include a number of intermediary companies (Fox, Wareham and Cano 2009). This configuration of multiple actors may thus be said to resemble a network of actors, or what is often referred to as a *software ecosystem* (Iansiti and Levien 2004b; Messerschmitt and Szyperski 2005; Fox et al. 2009). With the tendency towards a delivery model that includes an ecosystem of actors, it becomes apparent that studying the ES artifact from at the vendors and customer organizations in isolation without regards to the intermediate actors, provides a limited perspective on the life cycle of ESs. Instead, extending the two-actor life cycle proposed by Hedman (2003) with the intermediate actors, as illustrated in Figure 1, provides a more contemporary frame for studying phenomena related to the life cycle of ESs.

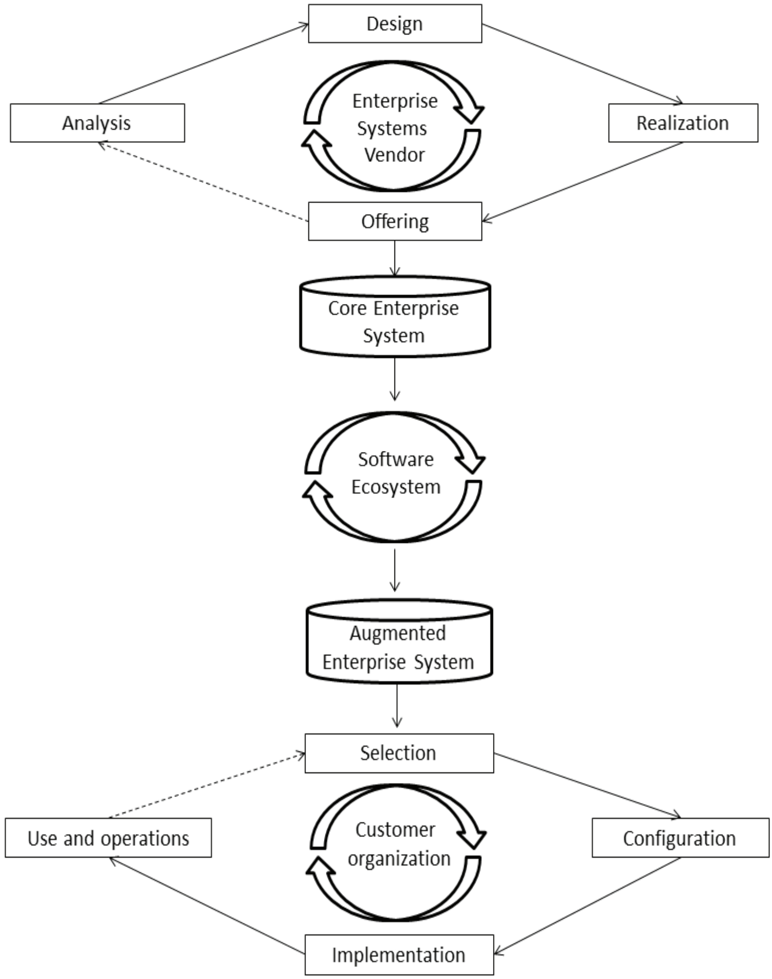

Figure 1. A three-actor life cycle of ESs (extended from Hedman, 2003)

ES vendors are thus increasingly dependent on their ecosystems for implementation and supply of additional services and products to complement the core ES and the other actors in the software ecosystem are correspondingly dependent on the vendor to supply them with the core ES package (Arndt et al. 2008). A quick look at the five largest ES vendors (SAP, Oracle, Microsoft, Sage, and Infor) confirms that they all have partners that, to various degrees, develop add-ons and handle implementations of ESs in customer organizations.

The final value proposition for the client organization is thus a combination of the value added by the various agents in the ecosystem (Fox et al. 2009; Jansen, Finkelstein and Brinkkemper 2009), also referred to as value cocreation (Sarker et al. 2012). While some characteristics of enterprise software ecosystems have been addressed in the literature, such as coupling and trust between actors (Kude and Dibbern 2009; Huber, Kude and Dibbern 2010) and value cocreation (Sarker et al. 2012), understanding of how these ecosystems transition to a new version of a core ES package, such as a role-oriented ES, is still limited.

1.4.1 The ecosystem of Enterprise Systems

The following sections describe the composition of ES ecosystems and the transition from one version to a new version of a core ES package. The description is based on empirical research conducted as pre-studies for the research project in this dissertation. The research is based on studies of the Microsoft ES ecosystem, and underlying research designs for the studies are described in detail in chapter 2.

The Microsoft software ecosystem in Denmark consists of more than 100 registered partner companies. The size of the partner companies spans from one-person companies to multinational enterprises with several thousand employees. Microsoft only sells licenses for the ESs through the partners in the ecosystem and is not directly involved with implementations at the customer organizations. No direct contact is thus made between Microsoft and the customer organizations during an implementation.

The ecosystem primarily consists of two types of partners: The ISVs and the value-added resellers (VARs). The ISVs develop reusable software add-ons which complement the "core package" of the ES. The business model of the ISVs thus relies on getting license fees from the add-ons they sell, and virtually all implementations of the NAV product line include one or several add-ons. The add-ons can broadly be divided into two categories: Cross-industry (horizontal) and industry-specific (vertical). The cross-industry add-ons extend the core package with features used by companies across different industries, such as payroll, online banking, or project management. The industry-specific add-ons complement the core package by adding support for specific industries, such as fashion, furniture, or education. The key complementary resource of an ISV to the ecosystem is thus the *horizontal and vertical add-ons*.

The VARs implement the ES together with the add-ons from the ISVs and make customer specific tailoring to the system to fit the requirements of the individual customer company. Many VARs have strong ties to their customers, and they continue to upgrade and tailor the system long after the initial implementation is finished. The key complementary resource of a VAR to the ecosystem is thus the *customer-specific customizations.* The business model of the VARs relies on a combination of getting a share of the license fee of the core ES package, a share of the license fee of the add-ons, and billing the customers for the hours spent on implementing and tailoring the system. Some partner companies have characteristics of being both an ISV and a VAR (ISV+VAR). These companies both develop reusable add-ons and implement the core system package together with their add-ons at the customer organizations. Figure 2 illustrates the value flow between Microsoft, ISVs, VARs and customers in the software ecosystem.

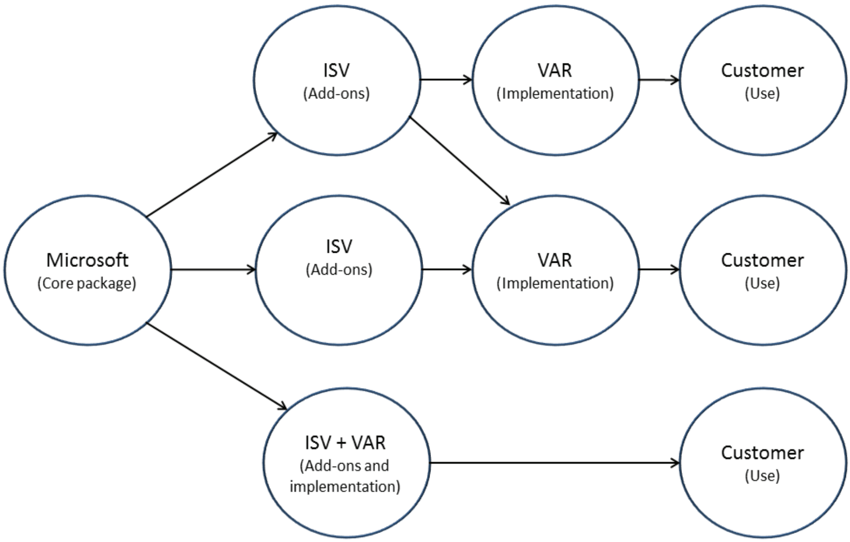

Figure 2. The value flow of the Microsoft software ecosystem (presented in paper I)

1.4.2 The transition to a new version of an Enterprise System

Understanding how an ecosystem transitions from one version of the core ES package to another provides a frame for understanding the process a new version undergoes from the point of release from the vendor to the implementation in the client organizations. The following analysis of the transition process first addresses the process for ISVs, then the VARs, and finally the ecosystem as a whole.

1.4.2.1 Transition process of the ISVs

When a new version of a core ES package is released by Microsoft, the ISVs in the ecosystem begin upgrading their add-ons to be compatible with the new version and to utilize the new features. In a transition process of 'Strategizing', 'Upgrading', and

‘Selling’ the ISVs gradually make the transition to upgrade their add-ons to complement the new version, as illustrated in Figure 3. In the ‘Strategizing’ stage the ISVs try to understand and compare the benefits and shortcoming of the new version and asses the demand for upgraded add-ons that are compatible with the new version. As a result of the ‘Strategizing’ stage, the ISVs decide which add-ons to upgrade and which to leave on the old version for the time being, and the transition process moves to the stage of ‘Upgrading’. In this stage the ISVs upgrade their add-ons to be compatible with the new version of the core ES package. The transition process of the ISVs then moves to the stage of ‘Selling’ the add-ons and, and depending on the demand for the upgraded and non-upgraded add-ons, the ISVs adjust the strategy in the next iteration of the transition process.

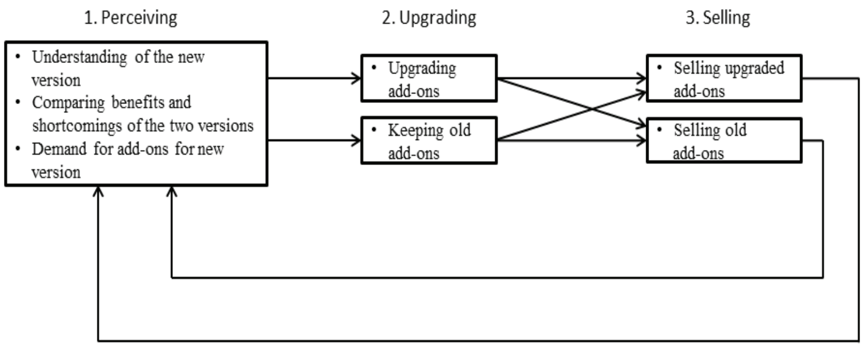

Figure 3. Transition process of the ISVs (adapted from earlier version of paper II)

1.4.2.2 The transition process of the VARs

When a new version is released, the VARs in the ecosystem also begin a process of transitioning to the new version through the stages of ‘Strategizing’, ‘Pushing’, and ‘Implementing’, as illustrated in Figure 4. The initial stage of ‘Strategizing’ is similar to that of the ISVs, as the VARs prepare a strategy of how to make the transition by trying to understand the new version and compare the benefits and shortcomings of the new version. As the VARs are dependent on upgraded add-ons from the ISVs when implementing the new version in client organizations, the strategy is influenced by the availability of upgraded add-ons. Furthermore, the strategies of the VARs are also dependent on the amount of experience with implementing the old and the new version. As a result of the 'Strategizing' phase the VARs move to the stage of 'Pushing', in which they try to persuade client organizations to purchase either the old or the new version. However, as the clients form their own perceptions about the new and the old version and create a 'pull' for one of the two versions, the resulting implementation may be different from that of the initial suggestion of the VARs, illustrated by the crossing paths in Figure 4. If the result ends in the VARs implementing the new version in the following 'Implementing' stage, new experience is gained which influences the strategy phase in the following iterations of the process of transitioning to the new version.

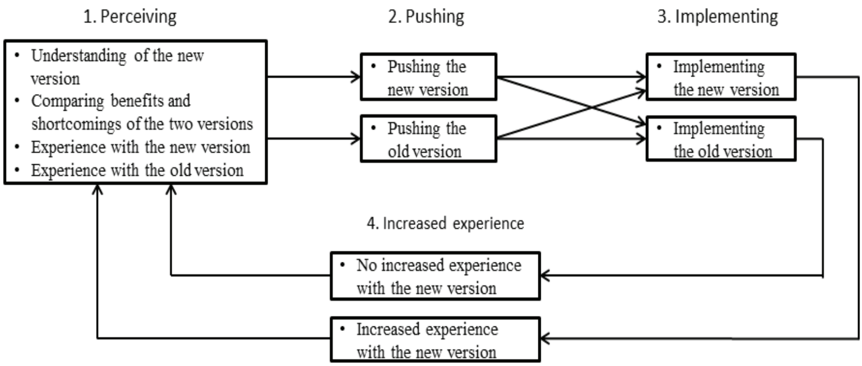

Figure 4. Transition process of the VARs (adapted from paper II)

1.4.2.3 The transition process of the ecosystem as a whole

Viewing the transition process from a perspective of the software ecosystem as a whole provides an opportunity for a holistic perspective of the transition process, as illustrated in Figure 5. When a new version of the core package of an ES is released by Microsoft, the vendor begins to exercise pressure on the ISVs to upgrade their add-ons and on the VARs to begin implementing the new version in the client organizations. As part of the 'Strategizing' stage at the ISVs and the VARs, the partner companies compare the benefits and shortcoming of the new version with the old version and communicate a response back towards the vendor for improvements of the core package. Concurrently, the partner companies begin the transition process cycles in which the VARs demand upgraded add-ons and the ISVs supply the upgraded add-ons back to the VARs. During the transition process, the VARs are pushing both the old and the new version to the clients, and the clients in turn create a pull for one of the two versions.

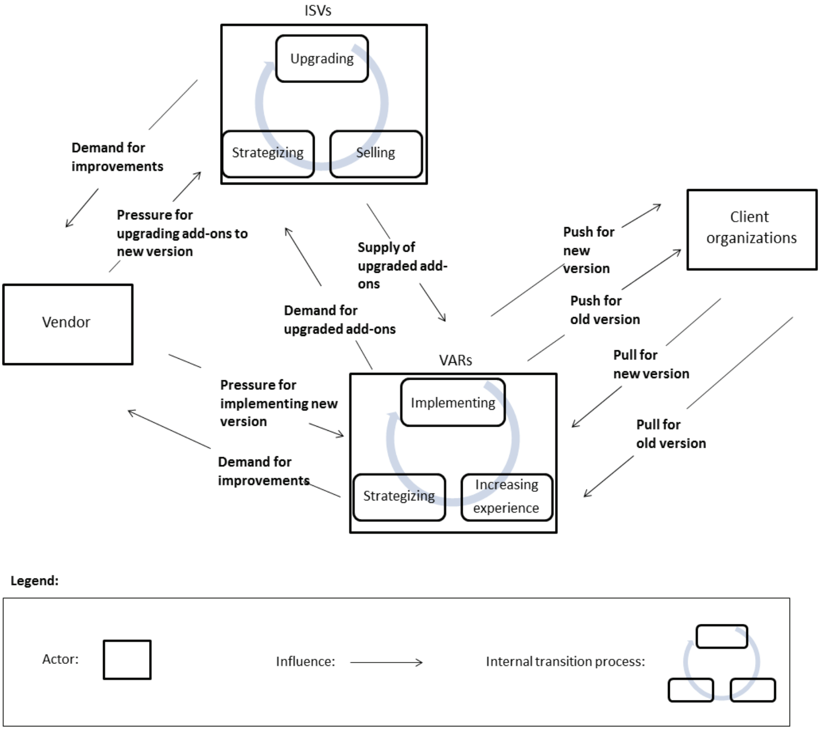

Figure 5. Transition process of the Microsoft software ecosystem (adapted from a previous version of paper II)

The interconnectedness of the actors in the ecosystem entails a potential inertia in the transition to, and diffusion of, a new version of the core ES package. First, the dependence on add-ons entails that if the ISVs have not upgraded the add-ons, the diffusion of the new version is slowed. Second, the push/pull configuration between the VARs and the client organizations entails that even if the VARs have decided to try to push the new version to the client organizations, the clients may still demand an implementation of the old version, thus slowing the transition process. However, the reverse scenario is also found in which the client organizations demand the implementation of the new version - even when the VARs are pushing for implementing the old version. The client organizations may thus also drive the transition to the new version of the ES.

1.4.3 Conclusion

Summarizing the research on the enterprise systems life cycle it can be concluded that a number of life cycle models have been proposed, of which the majority focuses on the life cycle in the client organization. The transition to COTS ESs, however, requires a "split" view between iterative development of the ES at the vendor and the subsequent configuration and implementation in the client organizations. Furthermore, the increase in strategic reliance on complementary resources of intermediary actors between vendors and client organizations suggests viewing the delivery model of ESs as an ecosystem of actors. Investigation into this ecosystem indicates a configuration of ISVs and VARs as key actors with vertical and horizontal add-ons and customer specific customizations as their respective key complementary resources in the ecosystem. Finally, the transition from one version to another of the core ES is important for understanding the process that a new version undergoes from the time of release to implementation in client organizations.

1.5 Enterprise Systems research in general

Research into ESs, and especially ERP systems, has been conducted in several fields, such as accounting, computer science, organization and management, and operation management (Cumbie, Jourdan, Peachey et al. 2005; Schlichter and Kræmmergaard 2010). Still, ES research, and research into organizational ISs in general, has constituted a substantial part of the IS field for the past two decades, and establishing the current state of knowledge on ESs and gaps in that knowledge, thus has a natural connection to the IS field. While the IS field was originally perceived as an applied discipline with a number of reference disciplines, such as Computer Science, Organizational Science, Management Science, and Sociology (Keen 1980; Markus and

Robey 1988; Orlikowski and Barley 2001), advances in theory and methodology has earned the IS field a place of its own within the scientific community (Culnan 1987; Baskerville and Myers 2002).

The change in the terms used to describe the systems that comprise the overarching term ‘Enterprise Systems’ (see section 1.3) somewhat complicates the task of surveying the existing literature. As the term ‘ERP system’ is often used to label any integrated organizational IS which spans multiple business functions (Cumbie et al. 2005), contemporary literature reviews tend to focus on reviewing publications using the ERP term. Esteves and Pastor (2001) survey 189 publications on ERP, published from 1997 to 2000 for the purpose of creating an annotated bibliography of ERP publications, and categorize them into two main categories: ‘phases in the ERP life cycle’ and ‘general directions’. The publications classified as relating to the ERP life cycle are then divided into phases along the life cycle (see section 1.4 for elaboration of life cycles). The survey shows a significant increase in ERP publications during the period with only 5 publications in 1997 and 76 in 2000.

Esteves and Bohorquez (2007) update and extend the bibliography by Esteves and Pastor (2001) with an additional 449 publications about ERP, published between 2001 and 2005. Table 1 shows a comparison between Esteves and Pastor (2001) and Esteves and Bohorquez (2007) and is constructed by extracting and calculating the absolute and relative number of publications related to each phase or general research area. Besides a significant general increase in the absolute number of publications related to the phases in the ERP life cycle (n=374), compared to Esteves and Pastor (2001), the ‘Adoption’, ‘Usage’, and ‘Evolution’ phases constitute a relatively larger part of the total number of publications, while publications related to ‘Acquisition’ constitutes a smaller part, and ‘Implementation’ remains by and large the same. The significant increase in the number of publications related to ‘Usage’ and ‘Evolution’ is to be expected as these phases occur late in the ES life cycle, and a period of time from the implementation "boom" in the late 90s thus had to pass before these phases could be studied in organizations.

Table 1. Comparison between Esteves and Pastor (2001) and Esteves and Bohorquez (2007)

Category	**Phase / area**	**Reference**			
		(Esteves and Pastor 2001)		(Esteves and Bohorquez 2007)	
		No.	~% of total	No.	~% of total
Life cycle	Adoption	7	4%	25	6%
	Acquisition	11	6%	15	3%
	Implementation	78	41%	207	47%
	Usage	17	9%	68	15%
	Evolution	12	6%	59	13%
	Retirement	0	0%	0	0%
General[3]	Research issues	11	6%	11	2%
	Organizational knowledge	9	5%	n/a[3]	n/a[3]
	Business modeling	4	2%	10	2%
	Product development	14	7%	15	3%
Education	Education	26	14%	35	(8%)
	Total	189	100%	445[4]	100%

Cumbie et al. (2005) review 49 ERP publications from 1999 to 2004 and categorize them according to: 'article accumulation' (by year and source), 'research method', and 'literature analysis and synthesis'. The literature analysis and synthesis divides the publications into 57% (n=27) 'implementation', 29% (n=14) 'operations', and 14% (n=7) 'benefits'. The paper concludes that the publications: 1) tend to use exploratory research over confirmatory ones; 2) became more frequent in 2002; 3) are found more

[3] This area is not included in Esteves and Bohorquez (2007)

[4] Esteves and Bohorquez (2007) state that they review 449 publications between 2001 and 2005 with 40 publications related to the 'General' category, but when counting the publications they only amount to 36. The total is thus only 445.

often in IS journals than operation management journals; and 4) prevalently focus on implementation. These conclusions thus generally support the findings presented in Esteves and Pastor (2001) and Esteves and Bohorquez (2007).

Botta-Genoulaz, Millet and Grabot (2005) examine 80 ERP related contributions published in 2003 and 2004 in order to identify trends in ERP research and classify the contributions into the categories of: ‘implementation’; ‘optimization’; ‘management through ERP’; ‘ERP tools’; ‘ERP and supply-chain management software’; and ‘case studies’. Little insight is offered in terms of quantitative analysis of the six categories. However, based on a qualitative review of the categorized contributions the authors suggest that the ERP research field has moved from a position of “observation” to a more “active behavior” and they call for more inter-disciplinary studies, by combining interest in ERP software engineering with human factors to overcome some of the implementation issues.

Schlichter and Kræmmergaard (2010) make a comprehensive review of 885 journal publications related to ERP from 2000 to 2009. Statistics are presented on: outlet; disciplines; authors; research method; and topic. Their findings show that more publications were published within the included operations management journals (31%) than in the included IS journals (24%) over the period (contrary to the findings by Cumbie et al. (2005)) and that ERP research has, so far, generally been interdisciplinary. Moreover, the review shows that case study is the dominant research method used in the publications (22%) while only 5% used combined methods. The authors conclude that the ERP field has matured but that the dramatic increase in ERP publications over the surveyed period was the result of a temporary widespread interest in an empirical phenomenon, rather than the beginning of a new research discipline.

Summarizing the general overview of previous research on ESs it is clear that a major increase in the number of publications appeared in 2002 and 2003. This is not surprising given the increase in implementations of ESs around the turn of the millennium due to the Y2K issue (see section 1.3.1). Following the increased interest in ESs, the topic has now matured into a sub-field of its own within IS and other disciplines with several conferences and conference tracks now dedicated to ES research, although ES research may still not be classified as a research discipline of its own. What is also clear from previous literature reviews is that from the establishment of "ERP" as the dominant term for describing enterprise wide systems, and throughout the past decade, there has been a strong focus on research related to implementation of these systems in organizations. While success and issues related to implementation are certainly an important topics, from both a theoretical and practical point of view, the literature surveys by Esteves and Pastor (2001) and Esteves and Bohorquez (2007) indicate that research on design (the category 'Product development') of ESs and related topics, such as modeling, are underrepresented in ES research in the past decade.

1.6 Purpose and research questions

Armed with a definition of ESs, an understanding of the ES life cycle, and an overview of ES research in general we may move on to address the purpose of this study and the research questions that guided it.

Benbasat and Zmud (1999) argue that much of existing IS research lacks *relevance* to practice due to, among other things, the overemphasis on rigor at the cost of researching relevant technologies. Many studies on new technologies are thus published years after the technology is considered "new" and already adopted (or rejected) by practice. As the inspiration of the research came from practice (see section 1.1) it seemed natural to return to practice when studying the phenomenon of role-oriented ESs, and the overarching purpose of this dissertation was thus to: Gain a more in-depth understanding of the emerging phenomenon of role-oriented ESs in the context of its life cycle and ES ecosystems.

Hevner et al. (2004) argue that two paradigms characterize much of the research in the IS field: behavioral science and design science. The behavioral science paradigm seeks to develop and verify theories that explain and predict human and organizational behavior, while the design science paradigm seeks to develop human and organizational capabilities by creating new and innovating artifacts. Taking a stance on the emphasis on these two paradigms, Orlikowski and Iacono (2001) argue that previous IS research tends to treat the technology in question as a "black box", and thus overemphasizes the universality of diverse technologies, while suppressing the distinct features of a given technological artifact. Gaining a deeper understanding of the emerging phenomenon of role-oriented ESs thus involves attention to both the construction of role-oriented ESs as an artifact and the human and organizational behavior that surrounds the subsequent implementation and use of the artifact.

From the overview of ES research in general (see section 1.5) it is evident that a substantial body of literature has addressed the implementation phase of the ES life cycle while fewer studies are concerned with the analysis and design of the systems. Organizational literature has addressed the concept of roles in the context of organizations (e.g. Katz and Kahn 1966; Pugh et al. 1968; Mintzberg 1979; Pareek 1994) and the IS literature has addressed some applications of roles in the analysis and design ISs (e.g. Ould 1995; Zhu and Zhou 2008). Previous research has also addressed organizational roles in the context of enterprise models for the purpose of designing and implementing ESs (Barros et al. 2000; Scheer 2000; Almeida et al. 2009). However, research on reflecting organization roles of users at the user interaction level of ESs is scarce, and the studies that do address this topic are mainly concerned with representing the roles from a security perspective through role-based access control (RBAC) (e.g. Ferraiolo et al. 1995; Sandhu, Coyne, Feinstein et al. 1996; She and Thuraisingham 2007). The few studies that address representation of roles at the user interaction level through other approaches, such as the user interfaces, are either based on theoretical proposition without empirical findings to support the propositions (e.g. Shneiderman and Plaisant 1994; Johansson 2009) or do not explain in-depth how the roles are represented at the user interaction level (e.g. Carlsson and Hedman 2004). Hence, while the concept of representing of roles at the user interaction level of ESs has been proposed, the topic is still poorly understood. This leaves both a theoretical and practical gap on how to move from role-oriented analysis and modeling to actually representing organizational roles at the user interaction level of ESs which, in turn, leads to the formulation of the first research question:

RQ1: *How can organizational roles be modeled and represented at the user interaction level when designing role-oriented Enterprise Systems?*

Looking at the ES life cycle of ESs it is clear that the traditional two-actor delivery model for implementing ESs has transitioned to a software ecosystem of vendors, ISVs, VARs and client organizations. This transition entails a need for considering the influence of the various agents in the ecosystems when the core ES system is being augmented and tailored to fit individual client organizations during implementation. Previous literature suggests that the implementation of ESs is a combination of organizational adaption to standard functionality of the system and adapting the system to align with the requirements of the organization (Boudreau and Robey 1999; Markus and Tanis 2000; Soffer, Golany and Dori 2005). Previous research has addressed various aspects of organizational and ES adaption, especially from a process-oriented perspective (e.g. Koch 2001; Huq et al. 2006; Sarker et al. 2006). However, as representation of organizational roles in ESs requires a number of predefined roles (Carlsson and Hedman 2004), we need to understand how these roles can be configured and tailored in the ES life cycle to fit the actual roles of various users in client organizations through a role-oriented perspective. Nevertheless, research on adaption of ESs during implementation from a role-oriented perspective is scarce (Worley et al. 2005). This leads to the formulation of the second research question:

RQ2: *How can predefined roles in role-oriented Enterprise Systems be mapped, configured, and tailored to fit actual roles of users in client organizations during implementation?*

Previous literature has studied various aspects of organizational benefits and success of ESs (e.g. Murphy and Simon 2002; Shang and Seddon 2002; Williams and Schubert 2010) and IS in general (e.g. DeLone and McLean 1992; Seddon, Staples, Patnayakuni et al. 1999). Key concepts for achieving ES success and benefits are the notions of use and user satisfaction. A number of issues relating to user satisfaction and usability of ESs have been identified (Gilbert 2003; Light 2005; Topi et al. 2005). Representation of organizational roles of users through multiple interfaces in role-oriented ESs has been proposed as a means of achieving better usability and higher user satisfaction (Calisir and Calisir 2004; Sleeper 2004; Johansson 2009). Still, no previous studies have empirically identified how organizations may obtain benefits of using role-oriented ESs. Additionally, previous research has identified a number of misfits between organizations and ESs in the context of use (e.g. Soh et al. 2000; Sia and Soh 2007; Wu et al. 2007) and role-related misfits have been suggested as a dimension of these misfits (Worley et al. 2005; Strong and Volkoff 2010). Still, no existing theories coherently address fits and misfits at the role level and an in-depth understanding of role-related misfits that may pertain to role-oriented ESs is thus needed. Combining the current gaps in our understanding of benefits of role-oriented ESs and role-related misfits in the context use leads to the third and final research question of:

RQ3: *How can client organizations benefit from the use of role-oriented Enterprise Systems and what are the potential role-related misfits of these systems?*

1.7 Outline and contribution of the papers

This section provides an overview of the papers included in the appendix of the dissertation and their contribution to answering the research questions. The applied research approaches of the papers are elaborated in chapter 2. The papers can be divided into two categories: one category addresses the ES ecosystem for the purpose of framing the research (paper I and II); and the other addresses the concept of role-oriented ESs (paper III, IV, V and VI).

1.7.1 Paper I: Ecosystem structure and resources

The first paper studies the Microsoft software ecosystem for the purpose of identifying key complementary resources by using the Resource-Based View (Barney 1991). The study is based on interviews with representatives from Microsoft and a series of case studies of partner companies in the software ecosystem. The paper outlines the structure of the Microsoft ecosystem and suggests four complementary resources that contribute to the competitive advantage of the ecosystem, namely: ERP core product; cross-industry (horizontal) add-ons; industry-specific (vertical) add-ons; and customer specific tailoring. The paper furthermore analyzes the potential impact of a newly introduced strategy by Microsoft of shifting from a horizontal to a vertical focus for the software ecosystem. The findings suggest that the strategy, if implemented successfully, preserves competitive advantage of the ecosystem through effectively combining resources and leveraging lock-in effects.

The paper contributes to framing the phenomenon of role-oriented ES by identifying the structure of ES ecosystems and illustrating the influence of the actors in the ecosystem in shaping role-oriented ESs as artifacts.

The paper is published in International Journal of Enterprise Information Systems (IJEIS), 2011, vol. 7, issue 2, pp. 18-33.

1.7.2 Paper II: Version transitioning

The second paper presents a grounded theory of the transition of the Microsoft software ecosystem from an old version to a new version of the NAV system. The grounded theory is based on interviews with respondents from Microsoft and the partner companies, document analysis, observations, and a demo version of NAV 2009 RTC. The grounded theory proposes the stages of 'Perceiving', 'Pushing', 'Implementing', and 'Increased experience' as phases in the transition process, and 'Technology impact', 'Supplier impact', 'Customer impact', 'Strategy impact', and 'Market impact', as contextual factors influencing the transition process. The findings suggest a number of enablers and barriers of the transition process. The grounded theory is integrated with existing theories of innovations to provide an initial step from a substantial to a formal theory.

The paper contributes to framing the phenomenon of role-oriented ESs by illustrating the transition that the actors in the ecosystem undergo when a new ES is released into the ES ecosystem.

The appended version is published in AIS Transactions on Enterprise Systems, 2012 (1): 4-17. A shorter version of the paper has been published in Proceedings of the 45th Hawaii International Conference on System Sciences (HICSS), 2012, pp. 4709-4718.

1.7.3 Paper III: Concepts for analyzing and representing roles in ESs

The third paper proposes some foundational concepts for analyzing, modeling and representing organizational roles in ESs based on synthesis of organizational role theory. The concepts are applied to a case study of how Microsoft represents role-related concepts in its enterprise model and how some of these concepts are represented in the NAV 2009 RTC system. The case study is based on interviews, document analysis, and a demo version of NAV 2009 RTC. The study finds that organizational roles are represented through the use of Personas in the enterprise model and through so-called 'role-centers' in the NAV 2009 RTC system. A number of role-related concepts, such as role aggregation and role specialization, are represented in the enterprise model. However, the case study finds that the relationship between roles and tasks/activities is implicit in the enterprise model, that this implicit relationship is partially inherited in the NAV 2009 RTC system, and that the system only allows association to a single predefined set of roles at a time. As a consequence, organizations with role sets that do not match the predefined role sets are dependent on tailoring to achieve optimal fit.

The paper contributes to understanding how organizational roles can be modeled and represented at the user interaction level when designing role-oriented ESs (RQ1)

The paper was accepted for the Conference on Enterprise Information Systems (CENTERIS 2011) in Algarve, Portugal and subsequently published as a book chapter in Communications in Computer and Information Science, 2011, Volume 219, Part 4, pp. 341-350, Springer, Heidelberg.

1.7.4 Paper IV: Comparative study of representation of roles in ESs

The fourth paper in the dissertation examines the phenomenon of role-oriented ESs by comparing the motivations for role-orienting ESs and the approaches to analyzing, modeling, and representing predefined roles in ESs. The study is based on inductive comparative case studies of Microsoft and SAP, based on interviews, documents, and examples of role-oriented ESs from the two vendors. The research indicates that the primary motivation of the vendors for including predefined roles is to complement a function-centric approach with a user-centric approach to the design of user interfaces in ESs. The research furthermore identifies strategies of an embedded and an independent approach to modeling the role concept and a unified and a componentized approach to reflecting role aggregation in user interfaces.

The paper contributes to understanding how organizational roles can be modeled and represented at the user interaction level when designing role-oriented ES (RQ1)

The paper is a working paper and has been published in the Department of IT-Management Communications Working Paper Series, 2011.

1.7.5 Paper V: Fit of predefined roles in ESs and strategies for tailoring

This paper studies the tailoring of the predefined organizational roles in the Microsoft NAV 2009 RTC system, by studying the perceived fit of the predefined roles and strategies for tailoring the roles among the partner companies in the Microsoft software ecosystem. The study applies the Grounded Theory Method and draws on interviews, observations, and documents for the analysis. The findings suggest that the predefined roles may provide the implementation consultants with an initial level of fit for the individual user. However, the study suggests misfits of the predefined roles related to role scope and industry-specific roles. Based on the findings on misfits, a classification of role misfits is proposed. The strategies applied by the partner companies for addressing the misfits consists of moving from a level of role fit to a level of personal fit, when addressing the scope misfits, and reliance on independent software vendors for developing industry-specific roles, when addressing the industry-specific role misfits. Based on the findings on tailoring, a classification of role tailoring is proposed.

The paper primarily contributes to understanding how predefined roles in role-oriented ESs can be mapped, configured and tailored to fit actual roles of users in client organizations during implementation (RQ2) and the potential role-related misfits of role-oriented ESs (RQ3).

The paper is unpublished.

1.7.6 Paper VI: Implementation and use of role-oriented ESs

The final paper included in this dissertation studies the use of the predefined roles in NAV 2009 RTC as implemented in five customer organizations, for the purpose of identifying potential benefits and challenges of reflecting organizational roles in ESs. The study is based on an extension of the foundation proposed in paper III for analyzing role-oriented ESs. The data for the study is based on interviews with representatives of the customer organizations and data about the implementation of NAV 2009 RTC in each organization. The findings suggest that while reflecting organizational roles in ESs may provide potential benefits related to role specialization among end-users, lacking support for role aggregation beyond the predefined level of aggregation and cumbersome switching between the predefined role user interfaces may entail disadvantages for users with multiple roles. The study furthermore indicates that further personalization of the predefined role user interfaces may be both beneficial and disadvantageous from a knowledge sharing perspective. Finally, the findings suggest the importance of continuous support for predefined back-office roles, such as the accountant role, while indicating further need for supporting front-office roles, such as roles related to sales.

The paper primarily contributes to understanding how predefined roles in role-oriented ESs can be mapped, configured and tailored to fit actual roles of users in client organizations during implementation (RQ2) and the potential benefits of the use of role-oriented ES and the role-related misfits of these systems (RQ3)

The paper has been published in the conference proceedings of the Fifth International Conference on Research and Practical Issues of Enterprise Information Systems (CONFENIS 2011), pp. 527-543, Aarhus, Denmark.

1.7.7 Summary

Table 2 provides a summary of the research approach and contribution of the appended papers.

Table 2. Summary and contribution of the appended papers.

Paper	Short title	Research approach	Contribution
I	Ecosystem structure and resources	Case studies and Resource-based view	Framing
II	Version transitioning	Grounded Theory	Framing
III	Concepts for analyzing and representing roles in ESs	Case study and Organizational role theory	RQ1
IV	Comparative study of representation of roles in ESs	Inductive case studies	RQ1
V	Fit of predefined roles in ESs and strategies for tailoring	Grounded Theory	RQ2 + RQ3
VI	Implementation and use of role-oriented ESs	Case studies and Organizational role theory (extended from paper III)	RQ2 + RQ3

2 The research design

Having described the frame for the research, established the purpose of the study, presented the research questions that guided the research, and provided an overview of the contribution of the appended papers, the following chapter describes and explains the research approach that contributed to answering the three research questions. The chapter explains the overall research approach as well as how research was conducted for the "pre-studies" and the answers to each of the three research questions, including: 1) the role of the 3gERP project; 2) overall research approach; 3) the chosen methodologies; the research design for the pre-studies and the three research questions; 4) data collection and analysis; 5) and the role of theory.

2.1 The 3gERP project

The research for this dissertation was conducted as part of the 3gERP research project. The 3gERP project was a collaborative research project between Center for Applied ICT (CAICT) at Copenhagen Business School (CBS), Department of Computer Science (DIKU) at Copenhagen University, and Microsoft Development Center Copenhagen (MDCC) with funding from the Danish National Advanced Technology Foundation (HTF) (3gERP 2011). The purpose of the 3gERP project was to develop a fundamentally new high-level software architecture with implementation tools and business models for a standardized, yet highly flexible and configurable global ERP-system for SMEs, which could be implemented and maintained at a fraction of the cost of current ERP systems (3gERP 2011). After grant application and initial hiring of researchers the 3gERP project began research in 2007. The project had an initial budget of 30 million DKK (Toft 2011) and more than 25 researchers and practitioners were directly involved in the 3gERP project until the project ended in 2010. I joined the 3gERP project in the fall of 2008 when research activities were already well underway. While joining the 3gERP project provided a frame for the research, no specific research design or methodologies were prescribed by the project.

2.2 The Danish market for Enterprise Systems

Figures for the actual value of the Danish market for ESs are usually only provided by commercial analytical companies, such as Gartner Group and IDC, and are often priced above the budget of academic research (Møller, Kræmmergaard and Rotbøl 2003). According to Computerworld (Krabbe 2008), referring to a survey made by IDC, the estimate for the value of the Danish market for 'ERP-services' was around $886 million in 2008. This figure fits Datamonitor's (2010) estimate of the combined market for software in 'general business productivity' and 'cross-industry and vertical applications' amounting to $880 million in 2009, as the enterprise software market generally declined between 2008 and 2009, according to Gartner Group (Gartner 2011a). According to Datamonitor, Denmark accounts for 2.6% of the European software market. Applying this share to the estimated market value provided by Gartner Group (Gartner 2011b) puts the Danish ES market at an expected value of $2.86 billion in 2015.

An analysis by Møller, Kræmmergaard, and Rotbøl (2003) showed that 73% of the top 500 largest companies in Denmark had adopted ERP systems in 2003. Of the Danish companies that had adopted ERP systems, over 1/3 had implemented Microsoft Dynamics NAV, the former Navision solution targeted at SMEs, while 20% of the companies had an SAP product. Adjusting for the number of employees in the customer companies reversed the picture with 61% of employees working with a SAP system and only 10% working with Microsoft Dynamics NAV. The difference in numbers, depending on the method of calculation, may explain the difference between Gartner Group (Gartner 2011a) and Panorama Consulting Group (Panorama Consulting Group 2011) when estimating the global market share of Microsoft (see section 1.3). The analysis by Møller et al. furthermore confirms previous surveys (e.g. Jacobson, Shephard, D'Aquila et al. 2007), indicating that SAP has a dominant position among large enterprises while losing market shares to local vendors in the SME market segment. Regardless of the method of calculation, the analysis shows that Microsoft has a relatively larger market share in Denmark than in other countries. This is not surprising given the Danish origins of the NAV and AX (former Axapta) product lines, but it illustrates the importance of the Danish market to Microsoft. The high adoption of ESs and strong position of Microsoft in the Danish market thus makes Denmark a relevant geographical frame for studying role-oriented ESs.

2.3 The overall research approach

While the three research questions provide some framing for the subsequent research approach, several paths could be pursued in answering the questions. The establishment of an overall research approach guiding the research is thus needed before constructing a research design for answering each of the research questions.

While all three research questions could potentially be answered by pursuing a purely theoretical research approach, the scarcity of existing literature addressing the design, implementation, and use of role-oriented ESs would complicate such an approach. Moreover, as practice appears to be ahead of the scholarly literature on the topic of role-oriented ESs and the original inspiration for the topic came from practice (see section 1.1), it seemed natural to turn to the study of practice when deciding on an overall research approach for the answering the research questions. Finally, it is the intimate connection with empirical reality that permits the development of a testable, relevant, and valid theory (Eisenhardt 1989). A decision was thus made to base the overall approach for answering the research questions on empirical collection of data through the study of practice.

Furthermore, the three-actor configuration of the ES lifecycle (see Figure 1) calls for a research approach which acknowledges the adaption of role-oriented ESs that occurs in the life cycle. From the outset of the research project it was thus an explicit goal to study the phenomenon of role-oriented ESs in the context of the ecosystem and apply research methodologies that would support inquiry at different stages in the life cycle.

Finally, reflection on the distinction between quantitative and qualitative methodologies had to be made at an early stage in the research process. Simply put, quantitative research methods are based on numbers while qualitative methods are based on words (Greene 2006). The main proposition of quantitative methods is that theoretical propositions about the general population can be reached through statistical generalization based on random sampling of the population (Simon 2004) while the aim of qualitative research is to produce *rich* description of a phenomenon (Strauss and Corbin 1990).

Miles and Huberman (1994, p. 1) state that: "Qualitative data are sexy. […] they help researchers to get beyond the initial conceptions and to generate and revise conceptual frameworks" (p. 1). Although this statement in itself would tempt many researchers to pursue a qualitative approach, the choice between the two approaches should depend on what one wants to know – i.e. the research questions (Silverman 2005). The research questions proposed in this dissertation favors a qualitative approach. The focus is thus on gaining rich and detailed insight into the phenomenon of role-oriented ESs from different perspectives – not on making standardized and systemic comparisons and account for variance. Moreover, qualitative research tends to focus on collecting data in the field at the location where participants experience the phenomenon under study (Creswell 2007). As the aim of this dissertation is to study the phenomenon of role-oriented ESs in the context of practice, qualitative methods align well with this aim.

Creswell (2007) distinguishes between five approaches to qualitative research: Narrative Research; Phenomenology; Ethnography; Grounded Theory; and Case Study. While several characteristics distinguish these qualitative approaches from each other, Creswell points to the difference in focus as an important differentiating element. *Narrative Research* is concerned with exploring the life of an individual, while *Phenomenology* focuses on understanding the essence of experience, and

Ethnography seeks to describe and interpret a culture-sharing group. *Grounded Theory* is focused on developing a theory grounded in data from the field and the *Case Study* approach is focused on developing an in-depth description and analysis of one or multiple cases. Comparing the focus of the five approaches, the Case Study and Grounded Theory approaches both fit the focus of the research questions and the decision to study role-oriented ESs in the context of practice. Further investigation into the two approaches was thus warranted. The following sections thus describe the two methodologies in general as well as how the methodologies were applied to answer each of the research questions.

2.3.1 Case Study research

A case study can abstractly be defined as "a phenomenon of some sort occurring in a bounded context" (Miles and Huberman 1994, p. 25) and is in itself a unit of analysis (Stake 2005). Case study research is thus focused on developing an in-depth description and analysis of one or multiple cases (Creswell 2007) and particularly applicable to "how" and "why" types of research questions (Yin 2008). Case study research is a particularly useful approach when: 1) research and theory are in their early formative stages, 2) the investigator has little control over the events, and 3) the focus is on a contemporary phenomenon within a real-life context (Benbasat, Goldstein and Mead 1987; Yin 2008). Comparing these three circumstances against: 1) the lack of research and theories describing the topic of role-oriented ESs; 2) the obvious lack of control in the research project over the adaption of role-oriented ESs in the life cycle; and 3) the contemporary and emerging nature of the role-oriented ESs and decision to study the topic in practice, made case study research a compelling methodology to include in the research design. Finally, the close connection between ISs and the organizations in which they are implemented makes case study research a suitable methodology for research in the IS field (Markus 1983; Benbasat et al. 1987; Lee 1989).

Unlike statistical research methods, case study research is not based on representing a relative sample size of the case population (Eisenhardt 1989). Yin (2008) describes five rationales for different types of case sampling: Critical; unique; typical; longitudinal; and revelatory. The *critical* case may be used for confirming or disproving a well formulated theory. The *unique*, or extreme, case is suitable for documenting extreme ends of theoretical dimensions. The *typical* case is used for describing commonplace situations. *Longitudinal* case studies investigate the same case at multiple points in time to specify how certain conditions change over time. The *revelatory* case is suitable when the investigator has the opportunity to observe and analyze a phenomenon previously difficult to study. Stake (2005) offers a different taxonomy distinguishing between: Intrinsic; instrumental; and collective case studies. *Intrinsic* case studies stems from interest in the case itself, without necessarily caring for the class of cases it belongs to. An *instrumental* case study denotes studying a case for the purpose of providing insight into an issue or to draw a generalization.

Collective case studies, also referred to as *multiple* case studies (Yin 2008), characterizes the studying of a number of cases to investigate a topic. As the research project was aimed at investigating a particular phenomenon, namely that of role-oriented ESs, an intrinsic case study was not applicable, and a choice between a single or multiple instrumental case study approach thus remained. Findings from collective case studies are generally considered more compelling (Tellis 1997; Yin 2008) and have the distinct advantage of facilitating *cross-case* analysis. If findings from one case study are compared with findings from other case studies it improves the generalizability of the findings (Eisenhardt 1989; Miles and Huberman 1994). On the other hand, a collective case study design requires more resources (Yin 2008), which may reduce the “depth” of each case study. The properties of the different types of case studies thus had to be considered when conducting the case study research.

2.3.2 Grounded Theory Method

Grounded Theory, also referred to as the Grounded Theory Method (GTM), is an *inductive* methodology for developing theories in close connection with empirical data (Urquhart 2007). GTM was originally proposed by Glaser and Strauss (1967). The methodology is particularly suited for grounding theory in the views of participants and studying process, action, or interaction involving multiple individuals (Creswell 2007; Strauss and Corbin 2008). Moreover, a distinct characteristic of GTM is the focus on *developing* theory rather than testing it (Glaser and Strauss 1967). Although Glaser and Strauss (ibid.) argue the application of GTM to any domain, regardless of its theoretical maturity, the GTM is arguably particularly useful for researching phenomena where no coherent theories exist. GTM has been used extensively in the IS field (Urquhart 2007) and combined with other methods, including case studies (e.g. Orlikowski 1993; Strong and Volkoff 2010).

Central notions in the Grounded Theory Method are those of 'concepts', 'categories', and 'properties' (Glaser and Strauss 1967; Strauss and Corbin 1990). 'Concepts' are labels placed on discrete (separate) happenings, events, or other instances of a phenomenon, while 'categories' are classifications of concepts at different levels of abstraction (Strauss and Corbin 1990). Categories serve a dual purpose in GTM, as they allow conceptualization of key analytical features, while also supporting communication of the phenomena in a meaningful picture (Dey 2007). 'Properties', in turn, describe the attributes and characteristics of categories (Strauss and Corbin 1990). The purpose of GTM is thus to create *a* grounded theory, although the terms Grounded Theory and Grounded Theory Method are used interchangeably in much of the literature (Bryant 2002).

2.3.2.1 Guidelines for Grounded Theory Method in IS research

Urquhart et al. (2010) propose five guidelines for conducting GTM in the IS field: 'Constant comparison'; 'Iterative conceptualization'; 'Theoretical sampling'; 'Scaling up'; and 'Theoretical integration'. Besides providing guidance and support for IS researchers embarking on doing Grounded Theory Method, the five guidelines also explicate the essence of the methodology.

Constant comparison is the process of constantly comparing instances of data to a particular concept, category, or other instances of data for the purpose of exposing theoretical properties of the concepts and categories. The process of constant comparison is one of the central notions for generating theory from data (Glaser and Strauss 1967). This guideline was followed by constantly comparing all the coded instances of data to other coded instances of data and merging and splitting concepts and categories.

Iterative conceptualization suggests that researchers should increase the level of abstraction and relate categories to each other to expose the different relationships between theoretical constructs. This should be done through the process of 'theoretical coding' (Glaser 2005), or 'axial coding' (Strauss and Corbin 1990) (see section 2.7.4 for detailed explanation of 'coding'). This guideline was followed by going through several iterations of the coding process, resulting in the same instance of data being "re-coded" several times in the iterative process of splitting and merging codes. Furthermore, theoretical memos were written as the analysis progressed and the memos were used for generating theoretical codes used for coding the data and for relating the codes to each other. In other words: "If data are the building blocks of developing theory, memos are the mortar" (Stern 2007).

Theoretical sampling stresses the importance of deciding on analytical grounds where to sample from as the research progresses (Eisenhardt 1989). Glaser and Strauss (1967) describes this as a "process of data collection for generating theory, whereby the analyst jointly collects, codes, and analyzes his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges." (p. 45). This approach helps *saturate* the categories of the emerging theory and ensures that the theory is actually grounded in the data (Stern 2007). This guideline had an impact on the research process in the sense that agreements with interviewees and partner companies could not be made prior to initiating the research study but had to be established as the data analysis played out.

The guideline of *Scaling up* proposes the grouping of higher level concepts into broader themes (categories) to help escape the descriptive level of analysis and help contributing to the generalizability of the emerging theory (Urquhart et al. 2010). This process was aided by extensive use of the theoretical memos and by iteratively visualizing the emerging theory through the use of diagrams in order to reach a *substantive theory* rather than mere description (Glaser and Strauss 1967). A substantive theory is developed from, and theorizes on, a particular empirical area of inquiry (Glaser and Strauss 1967), such as ESs.

Theoretical integration calls for integration of the developed *substantive theory* with other theories in the same or similar fields in order to create a *formal theory* (Glaser 2007b) that extends beyond the substantive area in which the theory originally emerged. In the research papers that applies GTM (paper II and V) the substantive theories, emerging from the substantive empirical field of ESs, were related to theories within and outside the IS field, by reviewing literature relating to the theoretical constructs of the substantive theory.

2.3.3 The two streams of Grounded Theory Method

The nature and use of GTM has been the subject of much disagreement among various scholars, to the point where the methodology has reached the status of an "essentially contested concept" (Bryant and Charmaz 2007b). While it is not within the scope of this dissertation to engage in all areas of the disagreements on GTM, the differences between the streams of GTM entails a necessary stance on some of the implications of using a contested methodology – especially the role of existing theory. Furthermore, a debate of the differences in conducting GTM provides a frame for discussing some of the philosophical underpinnings of the research presented in this dissertation.

GTM was originally formulated by Glaser and Strauss (1967) as a response to the increasing focus on verifying existing theories and testing hypotheses that followed in the wake of the turn towards positivism within the social sciences and science in general (Bryant and Charmaz 2007a). Glaser and Strauss (1967) proposed a new direction for social scientists for how to move away from this “logico-deductive” paradigm they perceived to be limiting the development of the social sciences. The move consisted of a shift from focusing on testing and verifying existing “grand” theories of the “theoretical capitalists” to generating new theories, and secondly a shift to “theorize from data rather than from the armchair” when developing new theories. The aim of GTM is thus to develop new theories rather than to test existing ones. Development of these new theories is based on an inductive approach of theory “emerging” from analysis in close connection to empirical data through “theoretical sensitivity” to enable conceptualization of data, as opposed to generating hypotheses from deduction. While the original work by Glaser and Strauss (1967) primarily described methodological strategies for *qualitative* research and emphasized the weaknesses of relying solely on *quantitative* statistical data, the authors stressed that both qualitative and quantitative data would lend themselves equally well to generation of grounded theory. Glaser (2007a; 2007b) has later re-emphasized that *all* kinds of data may serve equally as grounding for generating theory.

Glaser and Strauss came from different backgrounds with different views on underlying philosophical assumptions of doing research in the social science field (Kelle 2005; Bryant and Charmaz 2007a), which became evident with the publication of Strauss and Corbin’s (1990) “Basics of Qualitative Research” and Glaser’s “response” (1992) to Strauss and Corbin’s approach to doing GTM. Corbin and Strauss (1990) suggest the use of a “conditional matrix” as “an analytical aid” for researchers to analyze their data. Glaser (1992), on the other hand, emphasizes the importance of theory "emerging" from the data through "theoretical sensitivity", aided by "theoretical coding families" (Glaser 1978), and opposes the use of predefined "coding paradigms". Much of the disagreement among GTM researchers can thus be summarized into a debate of "emergence" vs. "forcing" of the empirical data from which the grounded theory originates (Kelle 2005). According to Kelle (2005) the issue has been inherent in the methodology since its beginning, due to the conflict between the concept of "emergence" on one hand and the concept of "theoretical sensitivity" on the other. The approach to doing GTM espoused in Strauss and Corbin's work (1990; 2008) is often referred to as the *Straussian* approach while Glaser's approach to GTM (1992) is often referred to as the *Glaserian* approach (Bryant and Charmaz 2007b).

2.3.3.1 Philosophical underpinnings of the Glaserian approach

The initial work of Glaser and Strauss (Glaser and Strauss 1967) resides in a positivist, objectivist tradition to doing social science (Clarke 2005; Kelle 2005; Bryant and Charmaz 2007a). This "early" GTM thus assumes a reality that can be discovered, explored, and understood and that this reality is unitary, knowable, and waiting to be discovered (Bryant and Charmaz 2007a). Bryant and Charmaz (2007a) point out that this view is restated in much of Glaser's later writings (1978; 1992) on Grounded Theory, and that Glaser does not acknowledge that researchers' own standpoints, historical locations, and relative privileges shape what they "can see". However, while Glaser (2007a) consistently emphasizes the somewhat positivistic stance that "all is data", he simultaneously states that "[t]he data is not "truth" it is not "reality". It is exactly what is happening" (p. 2). This problematizes simply labeling Glaser as a "naïve realist". Rather, Glaser (2007a) explains "That the data may not be reality or the truth should not disturb the [GTM] researcher. He should keep in mind, that after all, socially structured, vested fictions run the world, accurate descriptions run a poor second" (p. 2). This is not problematic to Glaser as he argues the importance following the “constant comparison” in GTM to reach “transcending abstraction”, instead of the “accurate description” sought by qualitative data analysis (Glaser 2007a).

2.3.3.2 Philosophical underpinnings of the Straussian approach

The Straussian approach to GTM draws heavily on Symbolic Interactionism (Blumer 1969) and Pragmatism (Dewey 1910; Mead and Morris 1934), and their underlying philosophical assumptions (Bryant and Charmaz 2007a; Strauss and Corbin 2008). The epistemological “focus” of Symbolic Interactionism may be summarized to the notion of meaning occurring, and handled through, the interpretative process of social interaction. Or as Blumer (1969, p. 2) puts it in his three premises on which Symbolic Interactionism rests:

1. Human beings act toward things on the basis of the *meanings* that the tings have for them.
2. Meaning of such things is derived from, or arises out of, the *social interaction* that one has with one’s fellows.
3. These meanings are handled in, and modified through, an *interpretative process* used by the person in dealing with the things he or she encounters.

While the emphasis of Symbolic Interaction is on the interaction between human beings, its ontological foundations extends to all “objects” in the world, such as technology, in that “the “worlds” that exist for human beings and for their groups are composed of “objects” and that these objects are the product of symbolic interactionism” (Blumer 1969, p. 10). In effect, objects exist in the form they are defined to us by others with whom we interact.

2.3.4 Summary

Summarizing the overall research approach, the research for this dissertation was conducted as part of the 3gERP project which offered an opportunity for studying role-oriented ESs in practice in the Danish market. The nature of the research supported the selection qualitative empirical research for the overall research approach. Comparing the focus of the research questions with the focus of five qualitative approaches, Case Study research and GTM were selected as appropriate methodologies. While Case Study research can encompass both an inductive and deductive approach, GTM is a purely inductive methodology. Furthermore, at least two streams of GTM can be traced back to the two founders of the methodology. While the Glaserian stream has positivistic underpinnings, the Straussian stream lends it philosophical foundation from Social Interactionism and Interpretivism. With this intermediate summary we may move on to look at how the research was designed to frame and answer the three research questions.

2.4 Research design for framing and answering the research questions

The following section describes how the research design was constructed to: 1) frame the research on role-oriented ESs and 2) answer each of the three research questions. The section ends with a summary of the research design.

2.4.1 Research design for framing the study

Before the study for answering the research questions on role-oriented ESs was undertaken, research was conducted into the ecosystems of ESs (see section 1.4.1 and 1.4.2). The purpose of this research was to provide an understanding of the context in which ESs are delivered from the vendor to the client organizations. This research contributed to framing and understanding the adaption of role-oriented ESs that occurs in the ecosystem and how the different actors in the ecosystem influence the adaption of ESs from vendors to client organizations. This "framing" research (or pre-study) consisted of two studies: one addressing the structure of an ecosystem and its competitiveness through complementary resources (paper I) and the other investigating the transition from one version of en ES to a new version (paper II). The collaboration with Microsoft through the 3gERP project provided an opportunity for using the Microsoft ES ecosystem as an overarching case for studying an ES ecosystem.

2.4.1.1 Studying structure and complementary resources in ES ecosystems

As one of the purposes of the pre-study research was to uncover the structure and complementary resources in ES ecosystems, using Case Study as methodology with Microsoft ES as the overarching case and a number of partner companies as *embedded* case studies (Yin 2008) provided a design that would allow analysis at both the company level and the ecosystem level. While the inquiry into structure was possible through a purely inductive approach, the investigation of complementary resources suggested the use of a theoretical frame. After reviewing management literature on competitiveness and resources, the choice eventually fell on the Resource-Based View (RBV) as theoretical framework. The explanation and application of this framework is described in detail in paper I and in the sections on the role of theory and data analysis (see section 2.7.2.1).

2.4.1.2 Studying version transitioning in ES ecosystems

The second purpose of the pre-studies was to uncover how an ES ecosystem transitions from one version of a core ES package to another and thereby contributing to understanding how the ecosystem transitions into augmenting, adapting, and implementing role-oriented ESs. Once again, the Microsoft ES ecosystem provided an overarching case. GTM was chosen as methodological frame for this research for two reasons. First, the study was focused in the *process* and *interaction* that occurred between the players in the Microsoft ES ecosystem when a new version was launched and GTM is particularly suited for studying process and interaction (see section 2.3.2). Second, while previous research has theorized diffusion of innovations, both in general and in the IS field (e.g., Abrahamson 1991; Lyytinen and Damsgaard 2001; Rogers 2003), these theories seemed inadequate for explaining the complex processes and interactions that occurs in an ecosystem when a new version of a core ES package is released from a vendor. GTM, on the other hand, is well suited from generating new theories. The details of applying GTM to the study of version transitioning is explained in paper II and in the section analyzing data (see section 2.7.4).

2.4.2 Research design for research question 1

The decision to pursue an empirical study of role-oriented ESs in practice, the opportunity provided by the 3gERP project, and knowing that Microsoft had just released what they claimed to be a role-oriented ES (see section 1.1), made the study of NAV 2009 RTC an obvious case for a *revelatory* case study (see section 2.3.1) for studying the first research question on:

How can organizational roles be modeled and represented at the user interaction level when designing role-oriented Enterprise Systems?

Having a second case would, however, provide the opportunity for cross-case analysis of how different vendors approached the topic of organizational roles in ESs. Investigation of both Oracle and SAP was conducted to initially establish if these vendors had products that would make suitable comparison with the Microsoft's NAV 2009 RTC.

At the time, Oracle was close to launching their Fusion Applications product line, in which Oracle suggested that: "the Applications UX team has observed more than 170 user roles as they completed their jobs using Oracle products. These firsthand experiences have built the foundation for Fusion products and will ensure that Oracle products meet users' needs" (Oracle 2010a). The Oracle Fusion Application thus appeared to be a fitting match for comparison. However, despite several attempts at establishing contact with representatives from the vendor, no success was achieved. Furthermore, the Fusion Application was not launched until September 2010 in the US (Dignan 2010) and so finding someone with any application experience in Denmark, or even finding an operational implementation, was thus unlikely, and so Oracle Fusion Applications was dropped as a second case study.

From the study on roles in EPs by Carlsson and Hedman (2004) we know that SAP has incorporated roles in their ESs for several years. Looking into a product line from SAP that would make a suitable comparison to NAV 2009 RTC, the SAP All-in-One version 8.81 seemed a reasonable match. With the addition of the NetWeaver Business Client (NWBC) as front-end client for the All-in-One, SAP promises a "clear *role based* focus on the tasks relevant to end users" [italics added](Janson 2011). Fortunately, representatives from SAP were willing to participate in research project and provide the necessary information for making a cross-case comparison of how the two vendors approached the topic of reflecting roles in ESs. The study for answering the first research question thus became a comparative (multiple) case study of how two large ES vendors represent organizational roles at the user interaction level of their role-oriented ESs. The study was conducted by comparing the representation of organizational roles at the interaction level of Microsoft NAV 2009 RTC and SAP All-in-One version 8.81 w/ NWBC respectively and comparing the underlying models with this representation.

The use of GTM was not applicable for the study of the first research question as the question was aimed at inquiry into the interaction level of role-oriented ESs as an artifact result - not the design of the systems as a process.

2.4.3 Research design for research question 2 and 3

The choice of Microsoft and SAP as cases for studying the modeling and representation of roles at the interaction level of role-oriented ESs made a comparative study of the two vendors' ES ecosystems an appealing choice for addressing the second research question on:

How can predefined roles in role-oriented Enterprise Systems be mapped, configured, and tailored to fit actual roles of users in client organizations during implementation?

And the third research question on:

How can client organizations benefit from the use of role-oriented Enterprise Systems and what are the potential role-related misfits of these systems?

Both vendors have hundreds of partners and thousands of customers world-wide and a comparative case study at the ecosystem level would certainly make an appealing research design. However, the resources needed to take on such a comparative study seemed to limit the chances of completing the entire research project within the three year time frame of the project. A choice between one of the two ecosystems thus had to be made. Participation in the 3gERP project made partner companies in the Microsoft software ecosystem more accessible and the Microsoft partner channel was thus selected. This also entailed that the NAV 2009 RTC system would be the primary representation of the role-oriented ES artifact in this part of the research.

While the second and third research questions are concerned with distinct foci of the phenomenon of role-oriented ES, namely implementation and use respectively, the empirical focus for answering the two questions is partially overlapping. While inquiry into the process of mapping, configuring and tailoring predefined roles (RQ2) could be studied with the partner companies as the unit of analysis in isolation, studying the actual implementations of role-oriented ESs in the organizations and the instruments provided by the ES vendors provides a more holistic view of the process and recognizes the interconnectedness of the ES ecosystem. Although the research design for answering the second research questions was primarily based on studying the strategies applied by the partner companies for mapping, configuring, and tailoring the predefined roles, it was thus decided to include data from Microsoft and implementations of NAV 2009 RTC as well.

Organizations acquire ESs for different reasons (Davenport 1998; Shang and Seddon 2002), with different degrees of success (Sumner 1999; Al-Mashari, Al-Mudimigh and Zairi 2003; Law and Ngai 2007), and put the systems to use in different ways (Botta-Genoulaz and Millet 2005). A single case study thus ran the risk of unintentionally getting an "odd" case when conducting research on the implementations of NAV 2009 RTC in organizations. Multiple comparative case studies of organizations that had implemented the system were thus preferable.

Since the nature of the second research question is concerned with the *process* of adapting role-oriented ESs to achieve fit at the role level and very limited research has addressed this topic, the use of GTM was applicable. However, GTM requires a certain number of individuals (participants) to reach 'saturation' of the theory (Creswell 2007; Strauss and Corbin 2008). Although the exact number of individuals cannot be known a priori to conducting GTM, due to the emerging nature of GTM, up around 20 interviews are often needed before initial saturation is reached (Stern 2007). While GTM has, successfully, been applied as methodology *within* case studies of organizations (e.g. Orlikowski 1993), pursuing such an approach requires sufficient participants in the case organization alone to reach saturation.

Although some of the Microsoft partner companies have a total number of employees that would permit the use of GTM within a case, only few of these employees were familiar with the NAV 2009 RTC by the time the research was conducted, and even fewer had actually carried out implementations of the system in client organizations. Applying GTM within case studies was thus not possible. Instead, applying GTM *across* the Microsoft partner companies would increase the chances of reaching a sufficient number of participants for the methodology and allow the development of theory at the ecosystem level as well as the *type* level of partner companies (ISVs and VARs).

As benefits and issues of use of ESs often develop over time (Davenport 2000; Markus and Tanis 2000; Shang and Seddon 2002; Schubert and Williams 2009), conducting longitudinal case studies on the *use* of NAV 2009 RTC in client organizations would allow the study of evolution in use of the system when answering the third research question on benefits and role-related misfits. However, due to the negative economic climate at the time of the launch of NAV 2009 RTC in late 2008, only few customers acquired the system between the launch and the beginning of 2010. It was thus decided not to do longitudinal case studies. Finally, combining GTM with the case studies would have supported further theorizing on the use of role-oriented ESs in client organizations. However, the low number of client organizations that had implemented the system at the time the research was undertaken entailed that reaching sufficient saturation of the categories for a grounded theory would not be possible. The study of use of role-oriented ESs for answering the third research question was thus primarily based on Case Study research of client organizations that had implemented and were using the NAV 2009 RTC system combined with data from Microsoft and the partner companies.

2.4.4 Summary

The research design for the pre-studies for framing the research and the research for answering the three research questions was based GTM and Case Study research with empirical data from the three types of actors in the ES ecosystem: Vendors; partner companies (ISVs and VARs), and customers. Table 3 illustrates how the methodologies were applied to the different studies and the actors in the ES ecosystem.

Table 3. Research design.

		Studies				
		PS 1	**PS 2**	**RQ 1**	**RQ 2**	**RQ 3**
Ecosystem actors	**Vendors**	Case Study	GTM	Case Study	Case Study	
	Partners			-	GTM	
	Customers	-	-	-	Case Study	

2.5 Sampling companies

This section explains sampling from the partner companies in the Microsoft ES ecosystem and the client organizations using the NAV 2009 RTC.

2.5.1 Partner companies

Combining sampling for Case Study research and sampling for GTM required some consideration. The application of GTM requires a need for *theoretical* sampling of the cases (see section 2.3.2), and the case studies could thus not be selected *a priori*, but had to be selected as the research progressed. On the other hand two archetypes of partner companies (ISVs and VARs) existed in the ecosystem, as well as a mixed type (ISV+VAR) (see section 1.4.1). The Case Study research thus required *representational* sampling of the two archetypes and the mixed type of partner companies provide a comprehensive view, when studying the structure and complementary resources of the ecosystem.

Furthermore, the size of the partner companies in the Microsoft ES ecosystem varied significantly. In some partner companies the owner of the company was the only employee while other companies had more than 250 employees in their Danish division and tens of thousands employees world-wide. While the study of the Microsoft ecosystem was not specifically aimed at theorizing about the influence of company size, it was important to do representational case studies of both small and large partner companies to ensure that findings represented companies of different size.

Furthermore, many of the partner companies had been in the ecosystem since long before Microsoft acquired the Navision/Damgaard merger (see section 1.3) and some of these companies had not adopted a cross-product strategy and thus only sold and implemented either the NAV (the former Navision) or the AX (the former Axapta from Damgaard) system. In order to be able to compare adaption of NAV 2009 RTC across companies, it was decided to only select partner companies in the ecosystem that delivered solutions and services for the NAV system.

Combining the sampling of partner companies for the Case Study research with the sampling for the GTM research thus became a balance between selecting companies that would be representational of the actors in the ecosystem and selecting companies that would allow theoretical saturation of the emerging grounded theories. Ultimately, a total of 22 companies were contacted throughout the research and 10 partner companies were eventually included in the case studies and GTM studies. Table 4 provides an overview of the partner companies included in the research.

Table 4. Selected partner companies in the Microsoft ES ecosystem

Company alias	Company type	No. of employees
Partner 1	ISV + VAR	28
Partner 2	VAR	250 local / 1100 global
Partner 3	VAR	50
Partner 4	VAR	14
Partner 5	VAR	1
Partner 6	ISV + VAR	250 local / 39000 global
Partner 7	VAR	50
Partner 8	ISV + VAR	180
Partner 9	VAR	80 local / 1800 global
Partner 10	ISV	23

2.5.2 Client organizations

Sampling client organizations for the research on use of NAV 2009 RTC proved to be challenging. Due to the financial climate in 2008 and 2009, organizations generally pursued a cautious approach to new investments – including acquisition and upgrade of ESs. Additionally, as Microsoft only sold and distributed their ESs through the partner network, finding the customers that had actually acquired and used the system was reliant on close collaboration with the partner companies that participated in the study. Selecting client organization for case studies was thus based on accessibility rather than a formal predefined sampling strategy. This approach to case sampling had the potential disadvantage that the partner companies could "screen" some of the implementations that they were not interested in having researched. However, the scarcity of customer companies that had adopted NAV 2009 RTC left little choice in this regard. Additionally, since the third research question addressed the use of the NAV 2009 RTC and not the relationship between the client organizations and the partner companies, the risk of getting biased cases was deemed acceptable.

A total of five customer organizations that had adopted the NAV 2009 RTC agreed to participate as cases in the research. Fortunately, two of the customer companies had migrated from a different ES solution, while three had upgraded from a previous version of the NAV product line. This combination gave the possibility of comparing differences across cases to assess whether findings differed between companies that had migrated and companies that had upgraded. The main characteristics of the five customer cases are shown in Table 5.

Table 5. Selected client companies.

Client organization alias	No. of employees	Industry	ES prior to implementing NAV 2009 RTC
Customer 1	800	Aviation (airport)	Other ES
Customer 2	50 (150 worldwide)	Fashion design	Previous version of NAV
Customer 3	75	Furniture manufacturing	Previous version of NAV
Customer 4	90	Geographical services	Previous version of NAV
Customer 5	10	Packaging	Other ES

2.6 Data collection

As the overall research approach was framed within qualitative methodologies, data for the research was primarily collected and analyzed using qualitative data collection methods. The following sections describe the types of data collected and the role they played in the research.

2.6.1 Interviews

Interviews were conducted as the primary technique for providing the data for both the case study research and the GTM. Selection of respondents for the interviews was based on their knowledge of, or involvement in, the topic of role-oriented ESs. The simultaneous collection of data for both the case study research and the GTM entailed that while a single interview was often enough to provide data for the case study research of the partner companies in the ecosystem, the opportunity for more interviews in the same company could help saturate the emerging concepts of the GTM. More than one interview was thus carried out in some of the partner companies.

All interviews were semi-structured (Kvale and Brinkmann 2008, p. 130) and an interview guide with a list of topics and suggested questions was prepared prior to the interviews and offered to the respondents before the interview was conducted. While some questions were static to allow cross-case comparison, other questions and topics evolved as the research progressed, to allow evolution of the grounded theories and to explore topics that seemed relevant. A total of 24 interviews were carried out as part of the research project divided between: 6 interviews with representatives from Microsoft and SAP, lasting between 51 and 108 minutes with an average of approx. 60 minutes; 15 interviews with representatives from the partner companies in the Microsoft ecosystem, lasting between 19 and 108 minutes with an average of approx. 60 minutes; and 5 interviews with the respondents in the client organizations, lasting between 21 and 102 minutes with an average of approx. 45 minutes. All the 23 interviews were audio recorded and fully transcribed resulting in over 280 pages of transcription to support a detailed data analysis.

Two interviews with representatives from one of the partner companies were omitted from the data analysis. Both representatives were unfamiliar with implementation of the NAV 2009 RTC system and one of the respondents was furthermore clearly nervous about being interviewed. A third interview with a manager from the company was arranged instead, resulting in a useful interview. Additionally, one of the representatives from Microsoft had left the vendor shortly before the interview was conducted. However, the respondent had extensive insight into the reflection of roles in the user interface of NAV 2009 RTC and, with an approval from Microsoft; it was thus decided to include the interview in the data collection for the case study of Microsoft.

2.6.2 Documents

Documents may be used to provide "background and context, additional questions to be asked, supplementary data, means of tracking and development, and verification of findings from other data sources" (Bowen 2009, p. 30). The documents collected for the research project filled each of those purposes at different times in the research project. The documents were primarily collected from publicly available sources and from access to Microsoft's intranet. A variation of the document type data consisted of getting access to an interactive software version of the 'Microsoft Customer Model', which was used by Microsoft for communicating the concept of role-oriented ESs to the partner companies in the ecosystem. While the Customer Model was not intended as a "full-fledged" enterprise model, it still provided valuable insight into the how the role concept was viewed by the vendor. A detailed description of the model is provided in paper III and IV. The role of the collected documents thus ranged from purely contextual background information to being central to the analysis.

2.6.3 Observations

Observations were not initially an explicit part of the research design. However, as part of the participation in different events organized by Microsoft and their partner companies, notes were taken of incidents that seemed relevant to understanding various aspects of role-oriented ESs and thus formed a type of participatory observations (Angrosino 2005). Unstructured observations from a total of two conferences, two vendor presentations, and three meetings/workshops were collected. The role of the observation data was thus primarily as source of inspiration.

2.6.4 Demo system

Early in the research project a demo version of NAV 2009 RTC was acquired with full feature capabilities and capable of running on a regular PC. The observation of the demo version served multiple purposes. First, it became a foundation for establishing basic knowledge about the artifact of the research project, sharpening the other data collection methods (e.g. the precision of the questions in the interview guides). Second, it provided the foundation for analyzing how Microsoft reflected organizational roles in their ESs. Finally, the running demo system provided a source for triangulating the other data types, e.g. information in the documentation for the NAV 2009 RTC and statements from the interview respondents. A demo version of SAP All-in-One was not obtained.

2.6.5 Data from NAV 2009 RTC implementations

A final type of data consisted of collecting data about the implementations of the NAV 2009 RTC in the client companies. The administration module of the system contained data on the number of user logins and which of the predefined user interfaces of NAV 2009 RTC these user logins were associated with. Second, the data in the administration module allowed identification of which user interfaces that had been adapted compared to standard, when combined with confirmation from the respondents in client organizations.

2.6.6 Summary

The data collection for the research was based on interviews, documents, observations, a demo system of NAV 2009 RTC, and data from the administration module of NAV 2009 RTC in each of the implementations. Table 6 provides an overview of the data collected at the different agents in the ES ecosystem.

Table 6. Overview of data collection.

Ecosystem actors	**Data**
Vendors	• 2 case studies • 6 interviews • Documents • Observations • Demo system (NAV 2009 RTC)
Partners	• 10 case studies • 16 interviews • Documents • Observations
Customers	• 5 case studies • 5 interviews • Documents • Observations • Implementation data of NAV 2009 RTC

2.7 Data analysis and the role of existing theory

The following sections explain the analysis of data in the research project and the role of theory in the analysis of the data.

2.7.1 The role of theory in analysis of representation of roles at the interaction level

Wand and Weber (1990; 1995) propose three characteristics of ISs for the purpose of evaluating the "goodness" of ISs: Surface structures; deep structures; and physical structures. *Surface structures* manifest the nature of the interface between the IS and the users, e.g. the user interface. *Deep structures* manifest the meaning of the real world system that the IS is intended to model, such as roles in an organization. *Physical structures* manifest the technology used to implement the system, such as physical hardware. The foundation for the structures are based on the philosophical ontological theory of Bunge (1977) and is thus often referred to as the Bunge-Wand-Weber (BWW) model or theory (Soffer, Golany, Dori et al. 2001; Rosemann and Green 2002). The BWW theory has been applied extensively in IS and ES research for various purposes including: meta models (Rosemann and Green 2002); process models (Green and Rosemann 2000); IS modeling (Soffer et al. 2001); and ES misfits (Sia and Soh 2007; Strong and Volkoff 2010). The BWW theory comes with an extensive set of ontological constructs for the purpose of evaluating ISs. However, for the purpose of framing the modeling and representation of roles in role-oriented ESs, their general notions of structures may be sufficient. The modeling of organizational roles and the methods used to reflect them in the ES may thus be perceived as deep structures of roles while the subsequent representation of the roles at the interaction level may be viewed as the surface structures of roles.

While the BWW theory was not applied in the appended research papers, it is applied in this cover paper to provide a theoretical lens through which to view the representation of organizational roles at the user interaction level (RQ1).

2.7.2 The role of existing theory in analysis of the case studies

While Case Study research supports a deductive approach where existing theoretical constructs are applied to the case analysis (Eisenhardt 1989), inductive inquiry without commitment to a particular existing theory is equally valid (Flyvbjerg 2006). When conducting case study research to answer the three research questions, two categories of existing theory were applied as "lenses" for analyzing the data: 1) organizational role theory and theory on user models and 2) the Resource-Based View.

The application of organizational role theory and user models was primarily based on the role-related concepts and structures uncovered during the review of previous literature (see section 3.1). Although the work of Katz and Kahn (1966) played a significant role in laying the foundation for the derived concepts and structures of roles in an organizational context, the theoretical concepts and structures, such as role aggregation, role transition, and role specialization, applied to the analysis of the case studies is based on a synthesis of existing organizational role theory. Existing theories on user models (see section 3.1.4) were likewise applied in the analysis of the case studies. For a detailed description of the applied theoretical concepts see papers III, IV and VI.

2.7.2.1 The Resource-Based View

The study on competitive advantage of the Microsoft partner ecosystem (paper I) applied the Resource-Based View (RBV) of organizations as theoretical framework. The RBV theory was originally proposed as a response to the emphasis on environmental conditions as determinants of the competitiveness of firms in different industries, such as Porters (1985) five forces model, (Barney 1991; Grant 1991). RBV proposes that idiosyncratic attributes of the individual firm may impact its competitiveness (Barney 1991). More specifically RBV suggests *resources*, in the form of assets and capabilities, as determinants of a firm's competitive advantage (Barney 1991). The two key assumptions of the theory are that: 1) firms operating in the same industry may be heterogeneous in respect to the strategic resources they control and 2) these resources are not perfectly mobile between firms. Barney (1991) suggested: value, rareness, imperfect imitability, and substitutability as attributes for describing strategic resources. These attributes have, however, been extended in several studies and Wade and Hulland (2004) review and synthesize these extensions and suggest the attributes of: valuable; rare; appropriable; inimitable; imperfectly mobile; and non-substitutable as attributes of resources that lead to competitive advantage.

A resource is considered *valuable* when it enables the firm to implement strategies that improve its efficiency and effectiveness (Barney 1991). *Rarity* refers to the condition where the resource is not simultaneously available to other firms (Wade and Hulland 2004). A resource is considered *appropriable* when it has the potential of generating rent relative to the appropriation of the particular resource, which is difficult to access (O'Leary 2000). *Inimitability* prevents competitors from copying the resource (Wade and Hulland 2004). *Imperfect mobility* is the ability to prevent the transfer or acquisition of a resource between firms (Wade and Hulland 2004). Finally, a resource is considered *non-substitutable* when there are no strategically equivalent substitutes (Barney 1991). Depending on the degree to which a firm's resources meet the criteria for the attributes, the firm can obtain different degrees of competitiveness (Barney 1991). The degree of competitive advantage can thus be categorized into: competitive disadvantage, competitive parity, temporary competitive advantage, and sustained competitive advantage, depending on the attributes of a firm's resources.

The main reason for applying RBV theory in the study of the Microsoft ecosystem was its ability to explain and describe complementarity of resources of the actors in the ecosystem. The RBV thus helped to explain why the ecosystem has been, and according to our analysis continues to be, at a competitive advantage within the ES industry in Denmark. By combining the RBV with theories of network effects and lock-in (Shapiro and Varian 1999) it was also possible to assess Microsoft's strategy of strengthening the relationship with their ecosystem partners.

2.7.3 The role of existing theory in analysis in the GTM studies

The debate on emergence vs. forcing (see section 2.3.3) has noticeable implications on the role of existing theory, or what Strauss and Corbin (Strauss and Corbin 1990) refer to as "technical literature", when conducting GTM. Strauss and Corbin (1990) suggest two purposes for existing literature. First, previous research should help identify gaps in current understanding of a given phenomenon. This is not inherently problematic from a GTM perspective. Second, however, Strauss and Corbin suggest that existing literature and previous research "helps the researcher to delineate important variables for study and suggests relationships among them" (1990, p. 49). This is a significant departure from the "original" stance on existing literature, proposed in Glaser and

Strauss (1967), which suggests "literally to ignore the literature of theory and fact on the area under study, in order to assure that the emergence of categories will not be contaminated by concepts more suited to different areas" (Glaser and Strauss 1967, p. 37). Glaser (1992; 2007a), on the other hand, preserves the original stance on existing literature for theoretical integration and development of formal theory, only *after* the emerging substantive grounded theory has emerged, or as part of the data collection, in which existing theory ranks equally to any other data source.

The two papers in this dissertation that apply the Grounded Theory Method to analysis of data differ slightly in their use of existing theories. In the study of the transition between two versions in the Microsoft ecosystem (paper II), a general understanding of existing theories was present before doing the analysis, but existing literature was not studied in-depth until after the theory of 'version transitioning' had emerged. This gives the paper a slight Glaserian flavor, in regard to the role of existing theory. On the other hand, the analysis in the study of the tailoring of predefined roles in NAV 2009 RTC by the Microsoft partner companies (paper V) was carried out with an existing in-depth knowledge of the theoretical constructs of organizational roles from organizational role theory. While the existing theoretical constructs were not "forced" onto the data, the closer interplay with existing theory in the analysis resembles the Straussian approach, in regard to the use of existing literature.

2.7.4 Analyzing the data for Grounded Theory

Analyzing data in GTM consists of the process of *coding* data. Again, the disagreements between the two founding fathers of GTM (section 2.3.3) have given rise to some disagreements between researchers on how the process of coding should be conducted. Hence, two approaches to coding data in GTM have been proposed. One approach, proposed by Strauss and Corbin (1990) consists of open, axial, and selective coding. The other consists of open, selective, and theoretical coding (Glaser 1992).

In the GTM approach prescribed by Corbin and Strauss (1990), *open* coding is the process of breaking down, examining, comparing, conceptualizing, and categorizing data. *Axial* coding consists of a set of procedures whereby data are put back together in new ways after open coding, by making connections between categories. Strauss and Corbin (1990) propose the use of a *conditional matrix* as an "analytical aid" in the process of doing axial coding. It is the use of this conditional matrix that has been the center of much debate among GTM researchers, and Strauss and Corbin (2008) have later emphasized that using the matrix is an optional part of their approach coding. The conditional matrix was thus not used in the axial coding phase of GTM. *Selective* coding is the process of selecting a core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development. In Glaser's (2005) additional coding stage of *theoretical* coding, only the theoretical categories of the emerging theory is linked to each other. Although Strauss and Corbin's (2008) selective coding and Glaser's (2005) theoretical coding differ conceptually, the selective coding seems to be able to achieve the purpose of theoretical coding and was thus applied.

The concepts and categories of the two GTM studies are described in detail in the two papers that describe the studies (paper II and V), but the following paragraphs offer elaboration on the *process* of coding the data in the studies.

2.7.4.1 Coding in the study on version transitioning

In the analysis for the study on how the partner companies transition from one version of the NAV system to another (paper II), the process of coding data was aided by the use of the Atlas.ti software, which is designed for the exploratory process of theory building (Muhr 1991). The interview transcripts were thus imported to ATLAS.ti for detailed analysis. In the phase of *open* coding, the transcripts were initially coded word-by-word. It quickly became apparent that consistent coding at this level was too detailed to yield a useful level of conceptualization. Instead, a combination of coding word-by-word and line-by-line was applied. As the analysis progressed and concepts became more saturated, multiple lines of interview transcripts were coded at a time. Coded instances of data were constantly compared to ensure consistent labeling of data. The following phase of *axial* coding did not apply the conditional matrix proposed by Strauss and Corbin (1990), as mentioned previously. Instead, concepts from the open coding phase were linked together and grouped into categories. This phase involved repeatedly changing concepts and re-coding data. In the phase of *selective* coding, a single category, 'version transitioning', was selected as the focal category for the emerging grounded theory and all other categories and their concepts were related to this category. Again, this phase included repeatedly re-conceptualizing and re-coding data to achieve the best possible "fit" of the categories of the emerging theory. The analysis was thus an iterative process which constantly sought to saturate the emerging concepts and categories of the grounded theory, by collecting and analyzing more data.

2.7.4.2 Coding in the study on adaption of the predefined roles

The analysis of data for the study on how the partner companies adapted the predefined roles of NAV 2009 RTC (paper V) generally applied the same approach as the study on version transitioning (paper II). However, the purpose of the study was not to develop a "full" grounded theory, and hence the phase of selective coding was omitted from the analysis cycle. The analysis cycled between the phases of open and axial coding, and no single core category was selected from which to evolve a grounded theory around. Analysis ended with a set of related categories of the introduction of predefined roles, misfits of the predefined roles of NAV 2009 RTC, and strategies for addressing the misfits during implementation of the system.

2.8 Summary of the chapter

This chapter has described and explained the overall research approach for how the research was conducted using the qualitative methodologies of Case Study and GTM for the pre-studies and the study of role-oriented ESs in the context of practice. A discussion of the underlying philosophical assumptions of GTM was discussed, which explicated some of the philosophical underpinnings of the dissertation. The research design for the pre-studies and answering each of the three research questions was presented, along with an explanation of the qualitative data collected in the research project. Finally, a discussion of the role of existing theory in analyzing the data was presented. Having presented the research design, we move on to answer the three research questions.

3 Role-oriented Enterprise Systems

The following chapter of the dissertation answers the three research question by combining the primary findings from the research studies and existing literature. The findings themselves are presented in the appended papers and are not described in detail. I thus recommend familiarizing oneself with the appended papers before proceeding with the following chapter.

3.1 Organizational roles and user models

Before embarking on the account of the different aspects of role-oriented ESs, we must first understand the conceptual and theoretical underpinnings of the term 'role'. The term is frequently used in daily conversation about a variety of topics, both in academia and everyday life. The theatrical notion of "playing a role" seems intuitive to most of us, but using the term in the context of ESs requires a more precise definition of the term. However, a few clarifications and assumptions are needed before embarking on a detailed account of the concept of roles. First, no single commonly agreed upon definition of 'a role' exists within the general field of role theory (Biddle 1986) or the IS field (Zhu and Zhou 2008). Furthermore, not all authors addressing the concept of roles in the literature state which definition of the term they adhere to. Consequently, an understanding of what constitutes a role must implicitly be derived from some of the written texts, which inherently leaves room for some degree of interpretation. This leads to a second clarification about how the role concept is applied in this dissertation.

Much of the IS literature includes *non-human* occupants of roles, such as, general business entities (Barros et al. 2000), software components (Selçuk and Erdoğan 2011), or ISs themselves (Askenäs and Westelius 2003; Johansson 2009). While the inclusion of non-human occupants extends the application and context to which the role concept can be applied, it is of little relevance to the topic of reflecting organizational roles in ESs for the purpose of supporting the roles of end-users, as end-users are ultimately human beings. This is not to say, that theoretical propositions proposed with the assumption that roles can be occupied by non-human roles are irrelevant *per se*, but it requires attention to the implications of applying the theories in the context of human actors as exclusive occupants of roles.

Finally, much previous research on roles has been dedicated to describing and theorizing about the roles of participants and stakeholders carrying out the development and implementation of ISs. While most of this research assumes human actors as occupants of roles, these roles bear little resemblance to the roles of *end-users* of ISs. Again, this is not to suggest, that theories addressing these aspects of IS development have no relevance for this study, but their explanatory power is limited when investigating the specific topic of organizational roles of end-users. Hence, the following account aims at describing previous literature relevant to the role concept in the context of the roles of the human beings interacting with ISs in the context of use.

3.1.1 Role definition and structure

In a review of contemporary role theory, Biddle (1986) summarizes five perspectives on roles: Functional; Symbolic Interactionist; Structural; Organizational; and Cognitive. While all five perspectives may contribute to our understanding of the role concept, the perspective on *organizational* role theory, which may be viewed as a sub-perspective of *functional* role theory, seems closely tied with ES and organizational IS in general.

Much of our theoretical understanding of the role concept in an organizational perspective can be traced back to the seminal work of Katz and Kahn (1966) on the social psychology of organizations (Biddle 1986). In this work the very essence of an organization is “the patterned activities of a number of individuals” (Katz and Kahn, p. 17). Although not stating an exact definition of the role term, Katz and Kahn offer an indication of the condensed essence of a role when stating that: “In their organizational forms, roles are *standardized patterns of behavior* required of all persons playing part in a given *functional relationship*, regardless of personal wishes or interpersonal obligations irrelevant to the functional relationship" [italics added](1966, p. 37). Closely tied to the concept of role in organizational theory is a number of other concepts, elaborating our understanding of what constitutes a role.

The notions of *office* and *position* are often used interchangeably with the role term (e.g., Ferraiolo, Barkley and Kuhn 1999). The concepts differ in that the "notion of *office* is a *relational* concept defining each *position* in relation to the others and to the system as a whole" [italics added] (Katz and Kahn 1966, p. 173). Pareek (1994) elaborates on the difference between role and position by stating that a position is concerned with *hierarchical relations* and *privileges*, while a role is concerned with the *obligations* (responsibilities) of that position. Worley et al. (2005) introduces the term "*actor*" as synonymous with the individual and describes the relationship between actors, positions, and roles as "the actor occupies a position (job description) characterized by one or several roles" (p. 624). Positions are thus conceptually different from roles (Handy 1993).

Another concept closely associated with the notion of roles is the concept of a *task*. A task, in organizational context, may be broadly defined as a self-contained unit of work carried out by individuals in turning inputs into outputs (Goodhue and Thompson 1995; Barros et al. 2000). "Roles describe specific forms of *behavior* associated with given *tasks*; they develop originally from task requirements" [no italics added] (Katz and Kahn 1966, p. 37). The various tasks associated with the particular role may in turn constitute part of the *activities* of an *office*: "Associated with each office is a set of *activities* or expected behaviors. These activities constitute the *role* to be performed, at least approximately, by any person who occupies that office" (Katz and Kahn 1966, p. 173). While the concepts of 'activities' and 'tasks' thus differ conceptually, as a task may consist of several activities, the two terms are used interchangeable in much of the literature, and the distinction serves a limited purpose when describing the relationship between organizational roles and the work they are responsible for carrying out in the organization. The two terms are thus used interchangeably in this dissertation and emphasis is put on using the term ‘task’, unless quoting directly from sources in the literature.

The distribution of tasks between different roles is often referred to as ‘job specialization’ (Mintzberg 1979) or ‘role specialization’ (Pugh, Hickson, Hinings et al. 1963; Pugh et al. 1968). Role specialization “refers to the specificity and narrowing down of the tasks assigned to any particular roles” (Pugh et al. 1963, p. 302). Furthermore, individuals may occupy multiple roles (Katz and Kahn 1966; Curtis, Kellner and Over 1992; Scheer and Nüttgens 2000), also referred to as ‘role aggregation’ (Almeida et al. 2009). The concepts of ‘role aggregation’ and ‘role specialization’ conceptually differ in that role *aggregation* describes the relationship of multiple roles occupied by a single individual while role *specialization* is concerned with distribution of tasks between each of the roles, as illustrated in Figure 6. Large organizations are often more specialized than SMEs (Mintzberg 1979). This entails that individuals in large organizations will likely occupy fewer and more specialized roles than individuals in SMEs. While distinction between the concepts of ‘role aggregation’ and ‘role specialization’ is relevant from a conceptual perspective, the individual user will likely experience the concepts as synonymous and simply focus on which tasks they as individuals are assigned to carry out in the organization. Nevertheless, the two concepts are used distinctively in this dissertation for the purpose of theoretical precision.

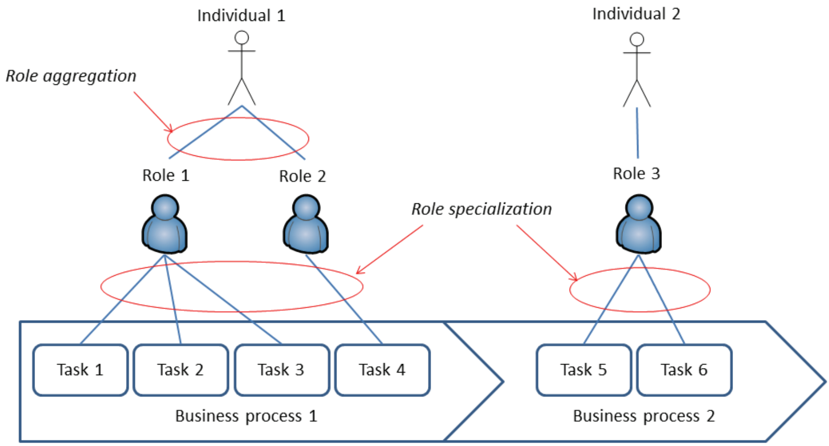

Figure 6. A meta model of relationships between role-related concepts (adapted from illustrations in paper IV and V)

Katz and Kahn (1966, p. 180) offer three concise statements in furthering the understanding of the structure of tasks, individuals, roles, and offices:

- Multiple tasks may be defined into a single role.
- Multiple roles may be defined into a single office.
- Multiple offices may be held by a single person.

Additionally, through their associated tasks, organizational roles are related to the notion of *business processes*. In the quest for a common definition of the term 'business process' Lindsay et al. (2003) conclude that no common definition of the term is found throughout the literature. Despite the lack of a common definition, parts of the literature still provide some useful definitions for gaining an understanding of the conceptual implications of the term. Davenport and Beers (1995) define a business processes as: "structured sets of work activities that lead to specific business outcomes for customers” (p. 57). Hammer and Champy (1993) have a similar definition, stating that: “A business process is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. A business process has a goal and is affected by events occurring in the external world or in other processes” (p. 9). A business process may thus be perceived as a series of tasks that, when combined, will produce a desirable output in some form.

Summarizing the relationship between individuals, roles, tasks (or activities), and business processes we may perceive the relationship between the concepts as depicted in Figure 6, when trying to capture the essence of Katz and Kahn’s (1966) proposition that: “A role consists of one or more recurrent [tasks] out of a total pattern of interdependent activities which in combination produce the organizational output.” (p. 179). To aid the understanding of the role related concepts and Figure 6 consider the following example: Susan (individual) is an Assistant Professor (position) at Capital University (organization). Susan may occupy the roles of teacher, researcher, and conference organizer (role aggregation). The teacher role may include typing the curriculum for the course (task) and putting the curriculum for a course on the university’s website (task). Alternatively, the task of putting the curriculum on the website may be carried out by Jim (individual), who is hired as IT-administrator (position) and is responsible for IT-related tasks (role), to reduce the administrative tasks carried out by academic personnel at Capital University, which entails a higher degree of role specialization for the teacher role.

3.1.2 Role taking

While the definition and structure of organizational roles contributes to understanding and framing the concept of role-oriented ESs, we must also understand the very process of *forming* organizational roles. Katz and Kahn (1966) propose a conceptual model of the process of *role taking* in which the role is formed and changed over time. The role taking process revolves around ‘role senders’ and a ‘focal person’, as illustrated in Figure 7. The *role senders* are the individuals that have expectations towards the role behavior of the focal person. Based on their expectations and evaluation they send a role through information and influence to the focal person. This constitutes the ‘sent role’. The *focal person’s* perception of the role sending and perception of the role constitutes the ‘received role’. The focal person exhibits ‘role behavior’, also referred to as *role signs* (Handy 1993) in the form of compliance, resistance, and “side effects”. The role senders evaluate the role behavior of the focal person and the role taking process thus iterates. Katz and Kahn (ibid.) suggest that three factors indirectly influence the role senders in the role taking process: Attributes of the focal person, such as personality or skills; interpersonal factors, such as relationships with the role senders; and organizational factors, such as industry or organization type.

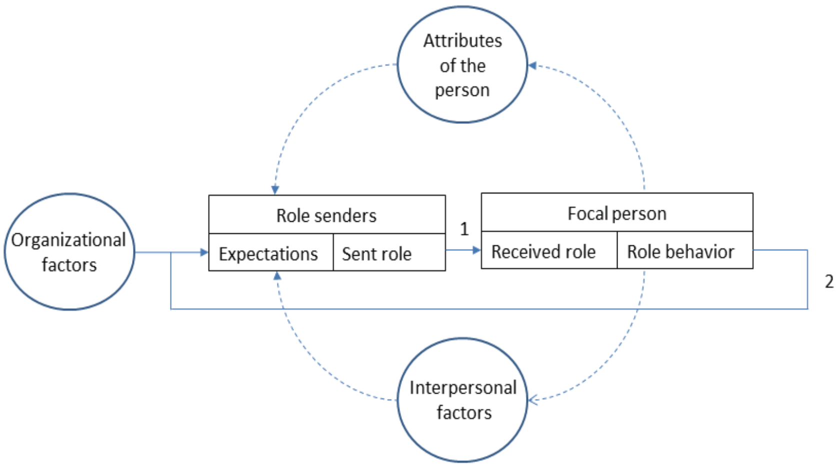

Figure 7. Organizational role taking (Katz and Kahn, 1966, p. 187).

A change in the roles of a focal person in an organization may occur from a switch to another position or from gradual or sudden change in the organizational structure (Nicholson 1984). The gradual organizational change in roles is also referred to as *role transition* (Nicholson 1984; Handy 1993; Pareek 1994). Role transitions are a natural part of the dynamic evolution of structure of organizations, and occur both in radical and incremental changes in organizational structure (Mintzberg 1979).

3.1.3 Role strain

Organizational role theory has addressed numerous issues related to dysfunctional roles, also referred to as *role strain* (Handy 1993). The notion of *role ambiguity* refers to the condition in which expectations are incomplete or insufficient to guide the behavior of role occupants (Biddle 1986). When role ambiguity occurs, the focal person or the role senders thus become uncertain about the responsibilities of a role (Handy 1993). Role ambiguity may cause stress, lower job satisfaction, and decrease performance of the role occupants (Rizzo, House and Lirtzman 1970; Baroudi 1985). The notion of *role overload* refers to the situation in which too many responsibilities are included in a role for the focal person to handle (Handy 1993). While a moderate degree of role overload can increase the focal person's performance (role pressure), a high degree of role overload may cause stress and reduced productivity (Handy 1993).

Role conflict describes the situation in which a focal person occupies roles with incompatible expectations for the behaviour or responsibilities of the roles (Katz and Kahn 1966). While some authors (e.g. Handy 1993) distinguish between role conflict and *role incompatibility* for the purpose of differentiating between incompatible expectations of *multiple* roles for the same focal person and incompatible expectations for a *single* role, we may stick to the notion of role conflict, for reasons of simplicity, when describing the situation in which expectations for one or several roles are incompatible. Role conflict has been associated with various indices of personal "malintegration" in the work place, such as poor job performance, lower job satisfaction, lower commitment to the organization, and higher rates of accidents and resignations (Baroudi 1985; Biddle 1986).

We may thus conclude that various types of role strain may lead to reduced individual and organizational performance.

3.1.4 User models in HCI and CSCW

While the review of organizational literature related to the concept of organizational roles provides one frame for conceptualizing end-users, the application of *user models* in the fields of Human-Computer Interaction (HCI) and Computer-Supported Collaborative Work (CSCW) may provide an alternative approach for conceptualizing end-users.

The field of HCI studies the interaction and relationships between humans and computer (Fischer 2001) while the field of CSCW is concerned with how collaborative activities and their coordination can be supported by means of computer systems (Carstensen and Schmidt 2006). These fields have thus been continuously focused on improving the design of computer artifacts for the purpose of easier use (Fischer 2001). One approach to achieving this has been the suggestion of various methods and techniques for user abstraction, such as User Archetypes (Mikkelson and Lee 2000), User Models (McGraw and Harbison 1997), and Personas (Cooper 1999). Although many of these user abstraction were originally conceived for the purpose of ensuring a focus on human factors in IS design in general (Chin 2001) and are consequently aimed at capturing user abstractions across different domains (Razmerita, Angehrn and Maedche 2003), some of them may be applicable alternatives for conceptualizing end-users in an organizational context.

The Persona technique was originally developed by Cooper (1999) for the purpose of communicating user needs to the design team, and was further positioned by Grudin and Pruitt (2002; 2003) and Nielsen (2004), and its main objective is to describe fictitious potential users of a given system . The description of a Persona may be captured in a 'Foundation Document' (Grudin and Pruitt 2002, p. 148). Aside from information such as 'Technology Attitude' and 'Demographic Attributes', the Foundation Document also contains information about 'Work Activities', including '*role* at work'. Pursuing this approach one might think of the Persona as a "container" for the relationship between the individual and the various roles the individual occupies in the organization. However, Grudin and Pruitt (ibid.), and the literature on Personas in general, pay little attention to describing these roles or how they relate to other concepts. An exception to this is Holtzblatt (2002) who suggest integrating Personas with 'rich' data in order to integrate them with roles and responsibilities from flow models and tasks from sequence models. While the Personas technique is often applied to more consumer-oriented IS development (e.g. Cooper 1999; Lindgren, Chen, Amdahl et al. 2007; Mulder and Yaar 2007), Grudin and Pruitt (2002) developed their Personas in the context of business software development at Microsoft. Personas can thus be applied as an alternative to organizational roles for the conceptualization or abstraction of roles of end-users in ESs. See paper III for an example of a Persona.

3.1.5 Conclusion

Studying the existing literature on organizational roles gives us a definition of the role term along with their relationships to the related organizational concepts of positions, tasks, and processes, and the structures between them. Additionally, organizational role theory has explained how organizational roles are formed as part of the role taking process in organizations, and described types of role dysfunction that lead to reduced individual and organizational performance. Previous research in HCI and CSCW provides some suggestions for alternative conceptualization of end-users, of which the Personas technique appears to be a suitable candidate in the context of ESs.

3.2 Design

The following section reviews previous research related to the analysis and design phases in the life cycle model (see section 1.4) and integrates it with the findings in paper III and IV for the purpose of answering the first research question of how organizational roles can be modeled and represented at the user interaction level when designing role-oriented ESs.

3.2.1 Modeling roles as deep structures

In an extensive review of the use of roles in the IS field, Zhu and Zhou (2008) argue that application of the role concept is emerging in various areas of IS analysis, design and implementation. They classify different applications of roles and propose a definition of a role-*based* IS as a system that is: "analyzed with role-based models, designed by role structures, and constructed with roles as first-order components" (p. 392). The notion of role-*based* systems suggests a strong focus on roles as the foundation for analysis and design of systems and should thus clearly satisfy the vaguer concept of role-*oriented* systems.

However, Zhu and Zhou (ibid.) do not specify clearly what qualifies as "constructed with roles as first order components", but state that in order to build a role-based system, "roles should be used as underlying mechanisms, defined, specified, constructed, and applied" (p. 392). Drawing on the terminology of the BWW theory (see section 2.7.1), this statement seems to suggest that an ES should include roles as deep structures in order to qualify as role-oriented. Before real-world concepts, such as roles, can be sufficiently represented in the deep structures of systems; a model that includes the concept in the ontology should be created (Wand and Weber 1995). Different approaches have been applied in the IS field for the purpose of modeling roles in deep structures. In keeping with the decision to limit the focus of the study to representation of human roles we may concentrate on previous research which seeks to model human roles[5]. The majority of models and theories that seek to include the concept of roles in an organizational context are framed within business process modeling. Almeida et al. (2009) suggest that one of the advantages of modeling roles in the context of business processes is that it allows the model to remain stable in the presence of dynamic changes of role allocation. Changes to the workforce occupying the roles do thus not change the model of the organization. Barros et al. (2000) similarly argue that modeling roles in the context of enterprise models entails a more flexible integration of business concepts and that: "role modeling represents an alternative and/or complementary way of modeling the enterprise." (p. 64).

Role activity diagrams (RAD) (Ould 1995) represents one approach to modeling roles and seek to capture the activities of business processes and associate them with roles for the purpose of software modeling. RADs differ from most other process diagrammatic notations in that they adopt the role, as opposed to the activity, as their primary unit of analysis in process models (Giaglis 2001). Roles in the context RADs are thus defined as *responsibilities* through collections of *activities* (Murdoch and McDermid 2000). The RAD descriptions include the set of roles in focus, their component activities, and their interactions, together with external events and the logic that determines what activities are carried out when (Abeysinghe 2000). RAD thus contains extensive notations on states, actions, interactions, choices, conditions, and units of work to model roles in the context of business processes.

Enterprise models, such as ARIS (Scheer 2000), the UFO-C modeling language (Guizzardi and Wagner 2005), and Unified Modeling Language (UML) (Object Management Group 2011) that focus primarily on modeling business processes also contain concepts for modeling roles. In the case of ARIS, roles describe a certain type

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[5] Models, theories, and techniques that apply a broader perspective on roles to encompass *both* human and non-human roles are included in the study.

of employee with clearly defined *qualifications* and *skills*. Employee candidates are then matched to roles based on *profiles* of the required qualifications and skills. ARIS also associates roles and positions in a many-to-many relationship (a position may be related to multiple roles and vice versa). However, in an extensive review of role modeling notations, Almeida et al. (2009) find that distinguishing between roles, positions, employees in the ARIS framework is difficult and ambiguous. The main focus in most enterprise models is thus on the sequence of activities that constitute a process, rather than on the human actors using the system (Worley et al. 2005). Relations between the human actors and the systems are thus specified purely on a functional level by assigning the tasks necessary to complete business processes to roles of human actors. These process models do thus not capture the "true" interaction between users and systems (Worley et al. 2005).

3.2.1.1 Roles as independent concept in deep structures

The research in the appended papers (paper III and IV) illustrates how the combination of ARIS (Scheer 2000) and Contextual Design (1998), as applied by SAP, can be applied to modeled roles as part of the deep structures of role-oriented ESs, or as "first-order constructs", when drawing on the terminology of Zhu and Zhou (2008). In this approach roles are *independent* concepts that are *explicitly* defined and described in regards to their *external structure* to other business entities, such as business processes (Scheer and Nüttgens 2000), tasks and activities (Fox, Barbuceanu and Gruninger 1996; van der Aalst, ter Hofstede, Kiepuszewski et al. 2003), or to job positions (Katz and Kahn 1966; Pareek 1994). Modeling roles as an *independent* concept thus allows roles to be defined independently, such as a set of qualifications and competencies (Scheer and Nüttgens 2000; Worley et al. 2005), a set of responsibilities (Katz and Kahn 1966; Pareek 1994), a number of goals (Ammenwerth et al. 2002), a placeholder for behavior (Barros et al. 2000), or as substitute for an individual person (Becker et al. 2000). The essence of modeling roles as an independent concept may thus be captured by Steimann's (2000a) statement that: "a role comes with its own properties and behavior" (p. 86).

The explicit description of organizational roles in the SAP enterprise model also extends to the *internal structure* of the roles. The industry specific variation of roles is thus one type of internal structure. An example is the 'Sales Representative' role which also exists in a specialized version for the insurance industry - the 'Insurance Sales Representative' role. A second type of internal structure for reflecting *role aggregation* at SAP, which was not mentioned in paper IV, is the *single* and *composite* roles. Drawing on previous research for describing role aggregation through composite roles, Johansson (2009) uses the notion of composite roles to describe the structure of a role that is constituted by other roles and suggests that "[an] extension of the role analysis is to look into what roles and composite roles that exist in different organizations as well as the kind of combinations of roles that exists" (p. 552). A single role thus represents the lowest level of decomposition for a role, while a composite role consists of aggregation of multiple single roles. This internal structure thus represents one approach to addressing the topic of role aggregation in deep structures.

3.2.1.2 Roles as embedded concept in deep structures

The use of Personas, as applied by Microsoft, illustrates that this technique can indeed be applied to enterprise modeling, as suggested explicitly by e.g., Johansson (2009) and implicitly by Grudin and Pruitt (2002; 2003) themselves. The Microsoft Customer Model thus illustrates how Personas may be reflected as part of an enterprise model. However, the Persona approach to modeling organizational roles entails that the roles are *embedded* in the Personas. The use of Personas as the top level of abstraction of user types thus reflects a view on organizational roles as a "second-order construct", rather than a "first-order construct" (cf. Zhu and Zhou 2008). The organizational roles are thus not described in themselves, and *external structure* with other organizational entities is described *implicitly* through the Personas of which they are part.

The role as embedded concept in the Microsoft Personas entails that *internal relationships* between the roles are not explicitly defined or described either. However, as some Personas contain ‘persona variables’, describing the different configurations of the roles occupied by a particular Persona, depending on the organizational configuration in which the Persona is placed, some internal structure between the modeled roles is suggested. An example of this variation is the ‘CEO’ Persona, which comes in two versions; one for small enterprises and one for large enterprises. While this is not an explicit internal role structure, it indicates some degree of *role specialization* embedded in the Personas. Additionally, all the roles embedded in the Personas can be characterized as cross-industry roles in the sense that they are generalized to fit the roles of users across different industries.

3.2.2 Representing roles in surface structures

While enterprise modeling provides specific suggestions for how to analyze and describe the structure of organizational roles for the purpose of reflecting them as part of the deep structures in the design, it is not concerned with how roles are represented in the design of surface structures in role-oriented ESs.

3.2.2.1 Role-based access control

A common method for representing roles in ISs is through the design of access control (Zhu and Zhou 2008). The central notion of role-based access control (RBAC) is that access permissions are administratively associated with roles, and users are made member of appropriate roles (Ferraiolo et al. 1995). RBAC has been used extensively in databases, system management, and operating systems for simplifying management of permissions (Sandhu et al. 1996; Ferraiolo et al. 1999; Zhu and Zhou 2008), and security in most contemporary ESs is also based on RBAC security models (Carlsson and Hedman 2004; She and Thuraisingham 2007). The ESs are thus designed to support configuration of role-based access to fit the authorization requirements of the organization.

However, while the literature on RBAC provides suggestions for bridging organizational roles and ESs, the technique is primarily concerned with authorization rights and less with user experience. RBAC roles are thus “binary” in nature in the sense that either the user has the required privileges to access functions or not. The RBAC role approach does not capture the *frequency* with which a role needs access to a given function or information nor *how* the role accesses functions and information. Knowing that the accounts receivable role has read access rights to accounts in the general ledger does not provide much guidance on how the information should be accessed or displayed. The RBAC technique does thus only partially capture the design of role-oriented user interfaces in terms of displaying information to fit organizational roles at the user interaction level, and Zhu and Zhou (2008) argue that RBAC-roles are generally difficult to apply in human collaboration. This argument is in line with the findings in paper IV, where it is evident that application of RBAC roles does not capture the conceptual distinction between ‘positions’ and ‘roles’, and thus favors the hierarchical depiction of an organization, as opposed to the “actual” work carried out by individuals (cf. Suchman 1983).

3.2.2.2 Role-oriented user interfaces

A few attempts in existing IS literature have been made to explicitly suggest how to reflect roles in surface structures through user interfaces. Shneiderman and Plaisant (1994) propose a ‘role-centered’ design to user interfaces with the conceptual idea of a ‘Personal Role Manager’ (PRM) as a way of structuring and improving the user interface in ISs in order to “improve performance and reduce distraction while working in a role, and facilitate shifting of attention from one role to another” (p. 6). The idea of the PRM is thus that users with multiple roles can *switch* between user interfaces depending on the role they perform at a given point in time. The suggestion of a role manager is an interesting proposition from, at least, two perspectives. First, the role manager provides a perspective on how to reflect the organizational roles on the presentational level of the ES. Second, the very notion of a role manger implicitly implies the occupation of multiple organizational roles (role aggregation) as something the user *consciously* switches between – as opposed to unconsciously and seamlessly transitioning from one role to another. Johansson (2009) thus points out, that if users need to consciously switch between the roles they occupy, the system at least needs to support a very easy switch between them.

The topic of representing roles in user interfaces for ESs has only been vaguely addressed, primarily through the application of Enterprise Portals (EP). Puschmann (2004) defines EPs as a single point access to inter- and intra-organizational ISs with the purpose of integrating information and present users with a role-oriented and personalized view of the information. In the context of portals, roles can be defined as: "an activity set that a portal user, internal or external person or application, undertakes in order to achieve a desired business objective" (Carlsson and Hedman 2004, p. 271).

Carlsson and Hedman (2004) also provide some insight into how roles are represented in user interfaces of SAP's EPs when stating that roles are:

> *"... 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."*(p. 271)

While this statement provides some insight into how roles can be represented at the interaction level, no detailed account is provided of how roles are represented in the user interfaces or how the design accounts for role related structures, such as role aggregation. Additionally, Carlson and Hedman (ibid.) only address the representation of roles in EPs - not ESs in general. They thus explicitly call for additional research on the application of the role concept in the context of ESs using organizational role theory to understand additional aspects roles in ESs.

A significant contribution of the two papers related to design and representation of organizational roles in role-oriented ESs (paper III and IV) is thus the investigation of how organizational roles can be reflected in *user interfaces*. The direct representation of roles in the user interfaces of ESs is a key finding in relation to answering how roles can be represented at the interaction level of ESs. The reflection of Personas in the 21 "role-centers" of NAV 2009 RTC and the representation of roles through "Work Centers" in All-in-One 8.81 w/ NWBC thus offer concrete suggestions for how to reflect organizational roles in the user interfaces of role-oriented ESs. Screenshots of the role-oriented user interfaces in the two systems can be found in the appendix of paper IV.

The *unified* approach to representing roles in the role-centers of Microsoft's NAV 2009 RTC is directly traceable to the *embedded* approach to modeling roles in the Microsoft Customer Model (see section 3.2.1.2). However, the fixed level of role aggregation entailed by this approach combined with the need for associating a user login with a different user interface, if users want to *switch* to another role or role set, entails a high dependence of fit of the predefined user interfaces, unless the interfaces are adapted to the users in individual client organizations. Likewise, the representation of roles through 'Work Centers' in SAP's All-in-one 8.81 w/ NWBC and delivery of role content through 'WorkSets' in packages is traceable to the approach of modeling roles as *independent* concept in the SAP enterprise model. This *componentized* approach to representing roles in user interfaces of ESs entails a more flexible degree of role aggregation, as content from other roles can be included in a user interface without much effort.

The design of multiple user interfaces in role-oriented ESs to accommodate different organizational roles is a significant departure from the single user interfaces in conventional ESs. The findings thus provide a link between Shneiderman and Plaisant's (1994) theoretical proposition of a Personal Role Manager and a practical application of this concept. Furthermore, the direct link between the enterprise models and the user interfaces in the vendors' ESs provides insight into which roles that are supported by the systems, although the embedded approach to modeling and representing roles in the Microsoft case only makes establishment of this link possible from a theoretical perspective.

3.2.3 Conclusion

Drawing on the definition of a role-based IS by Zhu and Zhou (2008), previous literature on representing roles in ISs and ESs and the research presented in paper III and IV allows a definition of a role-oriented ES as an ES that:

- Is analyzed and designed with a *model* of organizational roles;
- Supports internal and external role *structures* in the deep structures;
- *Represents* organizational roles in the surface structures at the user interaction level.

Furthermore, previous research and the research in the appended papers makes it is possible to provide an answer to the first research question of:

How can organizational roles be modeled and represented at the interaction level of role-oriented enterprise systems?

Applying the BWW theory to the study of representation of roles in deep and surface structures of role-oriented ESs, organizational roles can be modeled as part of the deep structures explicitly or implicitly through an *independent* or *embedded* approach respectively. The independent approach to modeling roles entails a more *flexible* approach to role aggregation, whereas the embedded approach entails a *fixed* level of role aggregation. The role models can reflect different degrees of *specialization* of the modeled roles, such as industry specificity. Roles can be represented in the surface structures at the interaction level of role-oriented ESs through RBAC and through multiple user interfaces. The research indicates that while RBAC is suitable for reflecting formal structure of hierarchy and job positions, representation of roles through multiple user interfaces is more suitable for reflecting the actual interaction with the ES at the role level. These role-oriented user interfaces can be directly linked to the independent and embedded approach to roles in the underlying deep structures, entailing a *componentized* and a *unified* approach to representing the roles in the user interfaces.

Table 7 provides a summary of the dimensions of modeling organizational roles as part of the deep structures and representing roles in the surface structures as found in the case studies of the two vendors.

Table 7. Modeling and representation of roles at the interaction level.

Dimensions	**Microsoft**	**SAP**
Modeling roles in deep structures		
Overall approach to modeling	Personas + Customer Model	Contextual Design + ARIS
Modeling of roles	Embedded	Independent
Role aggregation	Fixed	Flexible
Role specialization (Industry specificity)	Low	Medium
Representation of roles in surface structures		
Overall approach to representing roles	RBAC + Multiple UIs	RBAC + Multiple UIs
Role representation in the UIs	Unified	Componentized
Role aggregation	Fixed	Flexible
Role specialization (Industry specificity)	Low	Medium

3.3 Configuration and implementation

Having defined a role-oriented ES, and addressed how organizational roles can be modeled and represented in analysis and design of role-oriented ESs, the following section addresses the second research question on:

How can predefined roles in role-oriented Enterprise Systems be mapped, configured and tailored to actual roles of users in client organizations during implementation?

The answer to the second research question is thus concerned with activities in the 'configuration' and 'implementation' phases in the life cycle model (see section 1.4). However, before we dive into this part of the literature it is worth noting, that while distinguishing the phases of 'configuration' and 'implementation' from the subsequent phase of 'use and operation' in the life cycle models is rather straightforward in theory, existing literature (especially longitudinal studies) tends to overlap between these phases. Configuration, implementation, and use of ESs is thus an iterative cycle of adapting systems and organization (Alter 2001; Hedman 2003). Much of the literature that reports on IS and ES implementation thus *also* refers to subsequent use and operation of the systems when evaluating the impacts and results of the implementation (e.g. Orlikowski 1993; Soh, Kien Sia, Fong Boh et al. 2003; Strong and Volkoff 2010). For the purpose of cohesion, topics relating to fit, impact and benefits of role-oriented ESs in use and operation are addressed in the section addressing the third research question (see section 3.4).

The step from analyzing and designing ISs to implementing the systems in specific organizations is often associated with substantial difficulties. Implementation of ISs in an organizational context has thus been a core topic in the IS field for several decades (e.g. Bjørn-Andersen et al. 1979; Kwon and Zmud 1987; Markus and Robey 1988; Orlikowski 1993). Implementation of ESs has been known to be particularly arduous and implementation costs are often five to ten times the cost of the software licenses (Davenport 2000; Scheer and Habermann 2000). Moreover, the list of ES implementation projects that have failed to meet the expectations of the client organization is long (Markus and Tanis 2000) and studies have shown that, depending on the measure of implementation failure, the rate of failure has been over 50% (Escalle, Cotteleer and Austin 1999). A number of authors have thus proposed critical success and failure factors (Bingi et al. 1999; Sumner 1999; Nah et al. 2001; Yeo 2002; Umble, Haft and Umble 2003; Ngai, Law and Wat 2008) and models for ES implementation success (e.g. Holland and Light 1999; Parr and Shanks 2000; Al-Mashari et al. 2003). These models propose a number of activities and contextual factors that influence the success, or failure, of ES implementation.

3.3.1 Implementation approaches and methods

An important objective in ES implementation is to establish the needs of the client organization and to compare them with the universal functions of the ES to establish how the ES is to be adapted to meet the needs (Rolland and Prakash 2000; Soffer et al. 2005), also referred to as requirements analysis. Various approaches and methods for establishing organizational requirements and configuring ESs to meet them have been proposed. One overall approach is founded in an *organization-to-system* approach to requirements analysis and modeling. Rolland and Prakash (2000) argue that organizations think in terms of goals and objectives and that goal-driven alignment should be the level of focusing the requirements analysis. Ng, Ip and Lee (1998) propose a hierarchical design pyramid in which: general business rules and logic are described at level one of the pyramid; input, output, control and processes are described at level two; and the object model, data schema, and entity-relationships are described at the third level. Both of these approaches represent a top-down approach to analyzing organizational requirements for the purpose of ES adaption. The underlying assumption is thus that low-level requirements of tasks and functions can be derived from high level goals or business logic. Correspondingly, a bottom-up approach can be applied in which lower level objectives are identified and synthesized to form more general and high-level objectives and goals (Wei, Chien and Wang 2005).

Another source of requirements analysis approaches come from the ES vendors themselves. Both SAP and Microsoft offer proprietary implementation methodologies for their ESs. SAP uses the ASAP implementation methodology (Dolmetsch, Huber, Fleisch et al. 1998; Daneva 2004) and Microsoft uses the Sure Step methodology (Dynamics 2012). Both of these implementation methodologies, and ES vendor implementation methodologies in general (Scheer 1994; Rosemann 2000; Soffer et al. 2001), include reference models depicting the standard processes and functionality of the system, to different extents. The underlying assumption of this approach is thus a natural extension of the very idea of COTS software, namely that universal processes and functionality of the system can fit the individual organization. Establishing requirements and modeling the client organization using these reference models can be categorized as a *system-to-organization* approach where the system lays the *basis* for identifying organizational requirements. The following section addresses the organization-to-system and system-to-organization approaches in the context of role-oriented ESs.

3.3.2 Mapping between predefined roles and actual roles

As role-oriented ESs are explicitly aimed at supporting the roles of users in a client organization, a central activity in implementing these systems is the identification of *actual* roles in the organization and subsequent mapping to the *predefined* system roles in the ES. This activity is conceptually similar to the identification and mapping of business processes in process-oriented ESs. Worley et al. (2005) introduce the notions of *competencies* and *knowledge* as concepts for integrating roles and business process in the implementation of ESs. Simply put, the general proposition is that once the business processes of an organization are defined (as-is or to-be), the business processes consist of a given set of activities which in turn consist of a set of tasks that requires competencies to be carried out. (Human) actors in the organization in turn possess a number of competencies, which are partly based on knowledge, which can be mapped to the competencies needed to carry out the tasks. The collection of tasks carried out by the actor thus constitutes the role of the actor (similar to the illustration in Figure 6). Ammenwerth et al. (2002) suggest mapping high-level activities and the time spent on each activity. They, moreover, propose mapping the content, frequency and media of communication between roles to identify requirements of organizational roles. Both the approach suggested by Worley et al. (2005) and Ammenwerth et al. (2002) represent the *organization-to-system* approach to mapping roles in the role-oriented paradigm.

Drawing on the findings from the research project, another approach to identifying the roles in the organization is using the model of the predefined roles in the role-oriented ES. The availability of the Microsoft Customer Model to the partner companies, as part of the Sure Step methodology, thus made it possible for implementation consultants to use the model for mapping roles by matching the Personas in the model with the users in the client organizations. However, only few of the implementation consultants were actually aware of the existence of the Microsoft Customer Model and none of them had actively used it for identifying and mapping roles of the users in organizations. Furthermore, the conceptual idea of orienting ESs to the organizational roles of users was present in the Microsoft partner companies prior to the release of the role-oriented NAV 2009 RTC. Some of the implementation consultants in the VAR companies had thus already tried to adapt previous versions of the NAV system to fit organizational roles by adapting menus, links, and shortcuts to different user groups. Instead of applying the Microsoft Customer Model, the consultants applied a variation of the system-to-organization approach to mapping roles in which they, based on their experience, would "bypass" the reference model and evaluate the role centers in NAV 2009 RTC and assign them to users in the client organization. Still, both the formal use of roles in reference models and the observed "ad-hoc" approach among the implementation consultants suggest a *system-to-organization* approach to mapping roles.

3.3.3 From processes to roles and vice versa

In the process-oriented approach to ES implementation, the main unit of analysis is, not surprisingly, the business *processes* of the client organization. Most of the process-oriented implementation literature that include the notion of roles, such as ARIS, proposes the mapping of roles to the tasks in the business processes *after* the business processes have been identified and modeled. The argument for this approach is that organizations cannot easily establish the set of roles unless the organization has been able to establish a basic description of their processes (Curtis et al. 1992). This approach to identifying roles may be categorized as a *process-to-roles* approach in which the processes are the main concept of the analysis. On the other hand, the implementation consultants in the research project perceived the focus on organizational roles as helpful for gathering requirements and understanding the operation of the customer organizations *before* identifying the business process (see paper V). The partners explained that users in customer organizations often found it easier to describe their organizational roles, rather than explaining the business processes of the organization in their entirety. The role-oriented approach was thus perceived as a useful complementary approach to a process-oriented perspective of organizations. For conceptualization purposes we may label this approach as the *role-to-process* approach, as it partially relies on the roles for identifying processes.

3.3.4 Configuration

Besides general configuration of parameters similar to conventional ESs, role-oriented ESs need configuration of the predefined roles to match the mapping identified in the requirements analysis. The configuration phase at the client organizations of the ES life-cycle mimics the design and realization phases of the vendors to some extent

(Hedman 2003). The significant difference is that the majority of the system design is already in place once the ES has been selected (this is the very purpose of acquiring COTS ES as opposed to developing bespoke ESs from scratch). ESs thus entail a certain generic approach to meeting requirements (Davenport 1998; Seddon, Shanks and Willcocks 2003; Strong and Volkoff 2010). According to Markus (2000), "[it] has been estimated that in the best case, [COTS] ESs only address about 70% of the needs of the average organization." (p. 20). Although, the majority of the design of the system is already given, ESs are, at least in theory, designed to be configured to fit the particular client organization in which they are implemented (Brehm et al. 2001). Some configuration is thus always required for getting the system "up and running" (Brehm et al. 2001).

In the case of NAV 2009 RTC users can only be assigned to a single role-center at a time. Hence, configuration of roles at *user interface* level is fairly straight forward. However, the user interface roles that determine how the user perceives the role at the interaction level are not explicitly related to the RBAC roles in the system (MSDN 2012). A change in the association between RBAC roles and a user does thus not change the layout of the user interface for that user. Configuration of user interface roles and RBAC roles are thus separate tasks, although they need to be aligned to ensure that functionality in the user interface roles are actually accessible.

3.3.5 Tailoring

When functionality of the selected ES does not meet the requirements of the client organization, and the requirements cannot be met through configuration, two fundamentally different strategies for addressing this gap may be applied. Either the organization has to adapt to the standard functionality of the ES or the system has to be adapted to meet the requirements of the organization (Rolland and Prakash 2000; Luo and Strong 2004). When the gap between the system and the organization is too large or the predefined functions or processes in the system diverge from the requirements of the organization in areas critical to the business, various degrees of *tailoring* may be carried out, with modifications to the source code of whole modules in the system as the most extensive type of tailoring (Brehm et al. 2001). While 'tailorable technologies' in general may often be modified by end-users (Germonprez, Hovorka and Collopy 2007), tailoring, in the form of customization and implementation of add-ons of ESs requires significant knowledge of the inner workings of the systems. This usually necessitates the involvement of consultant companies for carrying out the tailoring (Luo and Strong 2004). The importance of a good relationship between the client organization and the consultant company has thus repeatedly been pointed to as criteria for ES implementation success (Robey et al. 2002; Wang and Chen 2006).

However, extensive tailoring has been associated with significant additional costs, risk of delay, difficulties with upgrading to newer versions of the system, and even outright failure of implementation (Bingi et al. 1999; Sumner 1999; Luo and Strong 2004; Quiescenti, Bruccoleri, La Commare et al. 2006). Tailoring, in the form of modifications to the source code, is thus often discouraged in much of the existing literature on ESs (e.g. Bingi et al. 1999; Sumner 1999; Nah et al. 2001). However, some requirements may be so important that tailoring is necessary to ensure execution of core business functions (Light 2005). Additionally, the standardization inherent in ESs potentially deteriorating competitive advantage obtained through differentiation (Davenport 1998), may also be a reason for tailoring the systems (Davis 2005).

Tailoring may be applied to role-oriented ESs for the same reasons as tailoring of conventional ESs. Moreover, as role-oriented ESs are aimed at supporting organizational roles, tailoring may be applied to address misfits between the predefined roles and the actual roles which has been identified during mapping between the two (further elaboration of these misfits are presented in section 3.4.5). Paper VI shows a significant difference between implementations in client companies in the approach to tailoring the predefined role user interfaces. Whereas one company (Customer 1) used only unmodified role user interfaces, another company (Customer 2) had tailored 6 out of 8 role user interfaces, while the remaining three companies had chosen a “middle-of-the-road” approach of tailored a single role user interface each. Furthermore, 9 out of the 21 predefined role user interfaces in NAV 2009 RTC had been implemented in the case companies without any tailoring.

Different strategies for tailoring role-oriented ESs can be identified by comparing the findings in paper V and VI. First, a strategy of *tailoring for role specialization* can be derived. This strategy was observed in the implementation of Customer 2 and among the implementation consultants. The role specialization strategy was aimed at specialization of the system roles beyond the predefined level to match specific requirements of the roles in the specific client organization. Customer 2 had thus decided to tailor the predefined roles of NAV 2009 RTC, and even create new roles from scratch, to fit the roles in their industry (fashion design) and in different departments (design, logistics, customer service etc.). As implementation consultants gained experience in tailoring specialized roles they began to build up a “catalogue” of specialized roles for reuse in other client organizations with similar roles.

A second derived strategy was *tailoring for role enlargement*. This strategy was observed in part in the implementations at Customer 3, 4, and 5 and among the implementation consultants. The strategy was aimed at enlarging the predefined roles of NAV 2009 RTC to accommodate a number of users with slightly different roles. Customer 3 had thus enlarged the ‘sales order processor’ role to include a number of bookkeeping and accounting tasks. To support this strategy some implementation consultants had created a “super role” user interface in which the majority of functionality was available. During implementation, functionality could gradually be removed from the role to fit roles in the client organization.

3.3.6 Conclusion

From previous literature and the findings in the papers we may arrive at a conclusion to the second research question on:

How can predefined roles in role-oriented Enterprise Systems be mapped, configured and tailored to actual roles of users in client organizations during implementation?

Predefined roles in role-oriented ESs can be mapped to actual roles in client organizations using an *organization-to-system* approach of identifying roles in the organization by means of knowledge, competencies, responsibilities or high-level mapping of activities. Correspondingly, a *system-to-organization* approach can be applied in which the analysis of roles is founded in the predefined roles of the system by utilizing the vendor's reference model or evaluating the predefined roles directly from the system. Moreover, exiting literature suggests that identification of processes may be used as the concept in focus of analysis before mapping the tasks in the business processes to the roles in the organization. This strategy may be labeled as a *processes-to-roles* approach. However, the presented research suggests that a focus on roles in the requirements analysis may, reciprocally, serve as a central concept for identifying the business processes, suggesting a *roles-to-processes* approach is available. These strategies are discussed in further detail in section 4.3.

Additionally, role-oriented ESs may require tailoring in order to obtain fit between the predefined roles and the actual roles. Strategies for tailoring the predefined roles include tailoring for *specialization* in which the predefined roles are tailored to fit roles in particular industries or organizational units. Finally, a strategy of tailoring for *enlargement* may be applied in which the predefined roles are enlarged with more content to fit a broader set of roles.

3.4 Use and Operation

Having addressed selected aspects of implementation of role-oriented ESs we may move on to address the third and final research question on:

How can client organizations benefit from the use of role-oriented Enterprise Systems and what are the potential role-related misfits of these systems?

The following section of this dissertation thus covers the phase of use and operation in the life cycle model (see section 1.4) from the perspective of role-oriented ESs.

The primary reason for implementing an IS or ES is to obtain benefits from the system once it has been implemented and is used in daily operation. A substantial amount of research has thus addressed the very concept of *IS success* (e.g. Raymond 1990; DeLone and McLean 1992; Goodhue 1995; Saarinen 1996; Seddon et al. 1999). DeLone and McLean (1992) synthesize previous research on IS success and propose a combined process and variance model of IS success with the constructs of 'System Quality', 'Information Quality', 'Use', 'User Satisfaction', 'Individual Impact' and 'Organizational Impact'. In a ten-year update of the model, DeLone and McLean (2003) review literature that test and evaluate the model and conclude, that although the model has been critiqued from some perspectives, the relationship between most of the constructs have been validated. They make minor changes to the model to accommodate the notion of 'Service Quality', divide 'Use' into 'Use' and 'Intention to use', and include 'Individual Impacts' and 'Organizational Impacts' into a broader construct of 'Net Benefits', as depicted in Figure 8. While the inclusion of 'Organizational Impact' into 'Net Benefits' may cover the broader aspects of IS success in general, the notion of 'Organizational Impact', or 'Organizational Benefits', are still the focal point of ESs (Davenport 1998; Shang and Seddon 2002).

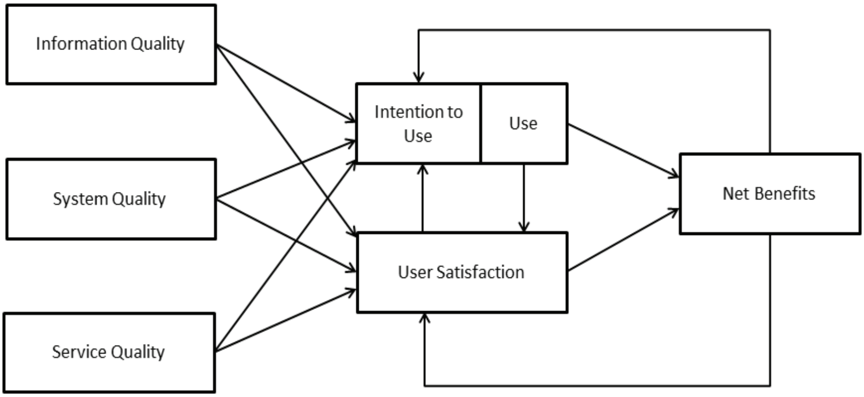


Figure 8. The updated DeLone and McLean IS success model (DeLone and McLean 2003)

3.4.1 Organizational benefits of Enterprise Systems

The list of proposed organizational benefits of ESs from an organizational perspective is rather extensive. As with much other ES research, ERP system research has caught the primary attention of researchers. Poston and Grabski (2001) studied the financial impact of ERP over a three year period. While they found no significant improvement associated with residual income or the ratio of selling, their findings suggest significant improvement in firm performance resulting from a decrease in the ratio of cost of goods sold to revenues. Further, there was a significant reduction in the ratio of employees to revenues for each of the 3 years examined following the ERP implementation. Similarly, Hunton, Lippincott, and Reck (2003) examined the longitudinal impact of ERP adoption on firm performance by matching 63 firms with peer firms that had not adopted ERP systems. Their results indicated that return on assets (ROA), return on investment (ROI), and asset turnover (ATO) were significantly better over a 3-year period for adopters, as compared to non-adopters. However, Wieder et al. (2006) found no organization performance increase from ERP adoption when comparing between adopters and non-adopter but that longer experience with ERP led to higher overall performance and process performance improvements – but only when the ERP system was extended with SCM capabilities. They also found support for improved process performance leading to improved overall organizational performance.

Matolcsy, Booth, and Wieder (2005) compared ERP adopters and non-adopters and found sustained operational benefits and improved overall liquidity. In addition they also found some support for increased profitability two years after adoption. Finally, Nicolaou, Dehning, and Stratopoulos (2003) reported that firms adopting ESs exhibited a significantly higher overall differential performance from the second year after adoption than a matched control group. Their decomposition of overall performance into profitability and efficiency financial indicators showed that significant differences attained by the ERP adopting firms were due to higher profitability but not efficiency. The research reports on ES benefits are thus somewhat ambiguous and indicative of the general "IS productivity paradox" that has been haunting IS research for decades.

Several authors have sought to develop taxonomies and classifications of the benefits (e.g. Legare 2002; Murphy and Simon 2002; Shang and Seddon 2002; Williams and Schubert 2010). Shang and Seddon (2002) describe the perceived net benefit flows (PNBF) of ESs from the perspective of middle level managers, based on 233 case stories from ES vendors and propose 'operational', 'managerial', 'strategic', 'IT infrastructure', and 'organizational' dimensions for measuring the benefits. Williams and Schubert (2010) propose a taxonomy of ES benefit levels based on the 'Exp-Ben framework' (Schubert and Bhaskaran 2007) by comparing expected and realized benefits from a sample of 32 out of 120 in-depth case studies of ES implementations and propose the levels of 'business design', 'management', 'functional areas', and 'IT and infrastructure' for classifying the benefits. Extending the classifications by Shang and Seddon (2002) with the taxonomy of Williams and Schubert (2010) provides a comprehensive view of the benefits generally associated with ESs.

Operational benefits are related to the day to day operations of the organization and include cost reduction, cycle time reduction, productivity improvement, quality improvement, and improved customer service. *Managerial* benefits are linked to better control of the organization's resources, monitoring of operations, and support of business logic. This dimension is similar to the 'management' level by Williams and Schubert (2010). Managerial benefits include better resource management, improved decision making, and improved performance in different divisions of the organization. *Strategic* benefits relate to competitive advantage gained by IT-investments, such as ESs. Benefits in this dimension are related to inter-organizational alliances, increased innovativeness, and differentiation.

Benefits in the *IT infrastructure* dimension relate to the foundation for present and future business applications and include IT cost reduction and increased IT infrastructure capabilities. This dimension corresponds to Williams and Schubert's (2010) 'IT and infrastructure' level. Finally, *organizational* benefits arise when organizations gain focus, cohesion, learning, and execution of its chosen strategy strategies due to implementation of an ES. The benefits in the organizational dimension include changing work patterns, facilitating organization learning, user empowerment, and support for a common vision. Williams and Schubert's (Williams and Schubert) 'business design' level is somewhat similar to this dimension but includes all benefits related to improvements of processes and workflows.

Williams and Schubert's (2010) 'functional areas' level is not readily comparable to the dimensions of Shang and Seddon (2002) as this level distinguishes between benefits achieved in business functions related to different departments, such as marketing, procurement, and sales, which is not explicated in the dimensions by Shang and Seddon.

ES benefits often develop over time (Davenport 2000; Markus and Tanis 2000; Poston and Grabski 2001; Shang and Seddon 2002; Schubert and Williams 2009). In an extension of the PNBF framework, Staehr, Shanks, and Seddon (2003) thus propose that the benefits of ESs do not come from the system alone but from *how well* the software is used by business manager and users in the post implementation period. Esteves (2009) uses Deloitte's (1999) 'usage stages' to measure the realization of benefits, according to Shang and Seddon's (2002) classification, after the ES "goes live". The Deloitte usage stages consist of stabilize (3-9 months after go-live), synthesize (6-18 months after go-live), and synergize (12-24 months after go-live). Estevez (2009) finds that 'operational', 'managerial', and 'IT infrastructure' benefits are primarily realized in the first two usage stages, 'organizational' benefits are mostly realized in the second and third stage, and 'strategic' benefits are primarily realized in the third stage. Poston and Grabski (2001) even found that realization of benefits associated with cost reduction of ERPs can take more than two years.

Finally, many benefits of ESs are often intangible and non-quantitative in respect to direct cost reduction or increased revenue (Murphy and Simon 2002; Shang and Seddon 2002; Gable, Sedera and Chan 2003). The financial value of increased user satisfaction or easier access to information is thus not easily assessed, while improved user productivity or improved management performance are easier to trace in terms of cost saving or increased revenue (Murphy and Simon 2002).

3.4.2 Use and user satisfaction of Enterprise System

Following the model of DeLone and McLean (2003) (see Figure 8) the constructs of 'Use' and 'User Satisfaction' are important for achieving the organizational benefits described in the previous section. While the 'User Satisfaction' construct as measure of success of ISs has been the center of some debate in the IS literature (e.g. Melone 1990; Wixom and Todd 2005), it is difficult to consider an IS as successful if users are dissatisfied with the system (Zrivan, Pliskin and Levin 2005). Similarly, *user adoption* has also been proposed as a measure of success in much of the IS literature (Davis 1989; Venkatesh, Morris, Davis et al. 2003). However, as adoption of ESs is often mandatory for users in organization, the 'Use' and 'User satisfaction' construct may be more appropriate measures in the context of ESs (Al-Jabri and Al-Hadab 2008).

'Ease of use' and 'Learnability' (ease of learning) are generally recognized as some of the important antecedents for achieving user satisfaction of ESs (Seddon 1997; Gable, Sedera and Chan 2008), and user satisfaction of ESs has in turn been shown to positively influence ES success (Wu and Wang 2007) and organizational performance (Law and Ngai 2007). In a study of usability characteristics of ESs, Calisir and Calisir (2004) also confirm that 'ease of use' and 'learnability' are important antecedents of user satisfaction in the context of ESs. However, a number of issues related to the usability and user satisfaction of ESs have been reported . Referring to a usability study of ESs by Forrester Research, Gilbert (2003) states that several of the systems required "inordinate patience and expertise" and that many fall short in "general usability".

In a study of the usability of an ES, Topi et al. (2005) identified a number usability issues in the system, including 'difficulties of identifying and accessing' functionality due to difficulties of finding the needed functions. Similarly, Wu et al. (2002) found low satisfaction of end-users in general 'system understanding'. In a study of an ES implementation, Light (2005) found that screens were so 'cluttered and complex' that the organization had the user interface for shop floor control modified to display a minimum of data. Indirectly related to user satisfaction, Huang et al. (2004) found that 'failure of getting user support' was rated as one of the top ten risks in ES implementations in a Delphi study with ES experts. Moreover, in a study of the issues related to implementation and use of ESs, as perceived by ES providers and consultants, Helo et al. (2008) report that 27% of the respondents perceived the 'lack of a user-centric' approach as a disadvantage of ESs. Consequently, end-user adoption of ESs may be low in organizations where ESs adoption is not mandatory or enforced

(Worley et al. 2005). Finally, ESs traditionally require extensive training of the users for them to operate the often complex interfaces of the systems (Umble et al. 2003; Sleeper 2004) inducing additional costs of implementation.

3.4.3 Benefits of role-oriented Enterprise Systems in use

Academic literature on the benefits of role-oriented ESs is scarce. Carlsson and Hedman (2004) point to three possible benefits of linking information in EPs to roles: Easier administration of users, better control of who has access to information and applications, and more convenient log-in procedure for users. Although the authors provide no empirical evidence or reference for these proposed benefits, the benefits seem plausible. However, summarizing the research from paper IV, V, and VI we may arrive at some more substantial potential benefits of using role-oriented ESs.

3.4.3.1 Improved ease of use

Drawing on the findings in the papers, the primary benefit of using role-oriented ESs is related to *ease of use*. The separation of tasks and information into multiple user interfaces oriented towards the different organizational roles provides users with a better overview of the tasks and information they need to access frequently while hiding or even omitting functions that are not needed by a particular role. Representatives from vendors, partner companies, and client organizations thus suggested this as the primary benefit of role-oriented ESs. The immediate benefit of easier access to tasks and information is improved performance for the users, but fewer user-caused errors are also associated with ease of use (Rogers, Sharp and Preece 2007).

3.4.3.2 Improved learnability and reduced requirements of training

Studying the findings from the research project it is also evident that representation of organizational roles at the interaction level makes it easier for *novice* users of ESs to learn how to use the systems. When the user interface is oriented towards the specific role(s) of the novice user and fewer options are available, the user can concentrate on learning the functions that applies to her role in daily use. Some of the client organizations had thus, with success, used the transition from a conventional ES to a role-oriented ES to introduce the system to users that had never used an ES before. Poor understanding of ESs among novice users is often remedied by increased training of users (Staehr et al. 2003; Botta-Genoulaz and Millet 2005) and easier understanding of the system among novice users may thus entail a reduced need for training. As inadequate training has been found to be a contributing factor to ES implementation failure (Gupta 2000) the improved learnability of the role-oriented approach is a clear benefit.

3.4.3.3 Reduced role ambiguity

An inherent impact of role-oriented ESs is a clearer demarcation of role boundaries between individuals in an organization, as put by a sales manager in Company 5: "*I think [the role-oriented UIs] is a good way to make the different responsibilities clear to the employees.*" Role-oriented ESs may thus contribute to transparency of role boundaries, lessening the risk of *role ambiguity* and its negative consequences (see section 3.1.3). While this demarcation of responsibilities may be perceived as a benefit of the role-oriented approach, consequences of this demarcation may also have negative impacts, which is address in the section on role-related misfits (see section 3.4.5).

3.4.3.4 Improved user satisfaction

Although the research did not directly measure the impact on user satisfaction associated role-oriented ES, it seems reasonable to assume that the previous studies identifying ease of use, learnability as antecedents of increased user satisfaction (DeLone and McLean 1992; Seddon 1997; Calisir and Calisir 2004) are applicable to the domain of role-oriented ESs as well. Adding the indirect effects of reduced risks of role ambiguity through improved demarcation we may with reasonable theoretical warranty assume that these attributes lead to *improved user satisfaction*. This theoretical proposition resonates well with the empirical findings from the study of the client organizations where all the companies were generally pleased with their decision to implement a role-oriented ES. Moreover, as user satisfaction, when combined with actual use, is the main antecedent for achieving organizational benefits of ISs in general (DeLone and McLean 2003), the role-oriented approach is likely to contribute to achieving various other general benefits of implementing ESs at the organizational level (see section 3.4.1). Especially benefits related to productivity improvement at the 'operational' level are likely to increase as a result of increased user satisfaction.

3.4.4 Fit and misfit of Enterprise Systems

A key concept of ES implementation success is the notion of *fit*. One approach to conceptualizing the notion of fit in the context of IS success is the Task-Technology Fit (TTF) theory. The TTF theory holds that IT is more likely to have a positive impact on individual performance if the capabilities of the IT match the tasks that the user must perform (Goodhue 1995). While Goodhue and Thompson (1995) also suggest that TTF also influences the actual *use* of IS, their findings do not demonstrate as strong support for this causality as the proposition that TTF impacts individuals performance. Although the TTF theory was originally concerned with performance at the individual level, Zigurs and Buckland (1998) have extended TTF to the group level. Still, TTF neither conceptualizes fit at the role level nor the organizational level (Strong and Volkoff 2010). As ESs are mainly adopted for their organizational benefits (see section 3.4.1), fit in the context of ESs has thus primarily been addressed at the organizational level.

When the embedded functions of the ES are in opposition to the practices and needs of the customer organization, *misfits,* also referred to as *misalignments*, appear. Soh et al (2000) classify ERP misfits according to functional, data, and output misfits. *Data* misfits are incompatibilities between the ERP package and the organizational requirements in terms of data format, or the relationships among entities as represented in the underlying data model. *Functional* misfits relate to incompatibilities in terms of processing procedures required and *output* misfits arise from incompatibilities in the presentation format and the information content of the output. The authors note that the output misfit is by far the most prevalent form of misfit found in ESs and that misfits may generally be worse in Asian countries (as opposed to Western) countries due to differences in organizational culture. Extending Soh et al's (ibid.) classification, Wu, Shin, and Heng (2007) and Rolland and Prakash (Rolland and Prakash 2000) propose *goals* as s misfit category at the top level of analysis.

Strong and Volkoff (2010) propose the concepts of 'coverage' and 'enablement' as measures of fit between ESs and organizations and correspondingly propose the associated concepts of 'deficiencies' and 'impositions' as overall types of ES misfits. Simply put, *coverage* fit measures the degree to which the ES meets the requirements of the organization and *deficiency* misfits are thus caused by inadequate coverage of the organizational requirements in the specific ES being implemented. *Enablement* fit, on the other hand, describes the ESs ability to enable the organization to operate more effectively and efficiently than was the case without an ES and the associated *imposition* misfits are thus caused by the very nature of introducing ESs in organizations (p. 746-747).

As ESs are often selected for their ability to support and improve business processes, fit between the system and the organizational business processes it supports is critical to ES success (Davenport 1998; Holland and Light 1999; Markus and Tanis 2000; Robey et al. 2002; Luo and Strong 2004). A key premise for achieving the organizational benefits of ES implementation (see section 3.4.1) is thus the fit to business processes.

3.4.5 Role-related misfits

Soh et al. (2003) study the use of an ERP package in a hospital and identify 'opposing forces' between the ERP package and the organization as sources for misalignments.

Among others, the authors identify the embedded process-oriented structure of the ERP package as being in opposition to the function-oriented structure of the organization, which creates ‘job scope’ misalignment between the system and the users in the organization. The traditional functional structure of the hospital with clear demarcation between administrative and medical staff was thus in opposition to the process-oriented structure of the system where the handling of transactions was not limited by functional boundaries. An example of a resulting misalignment in their case study is that “nurses’ job scope would be expanded to include capturing information about patient location, attending physician, and treatment department because they were the “person on the spot” at certain important points of the transaction process (in this case, patient movement).” (p. 92). The increased job scope of the nurses may thus be interpreted as entailing lower *role specialization*, as a result of the introduction of the ERP system. This change is categorized as a misalignment by Soh et al. (2003), due to the extra effort in checking and correcting data that occurred from medical staff being unfamiliar with administrative tasks, although the change also resulted in the more current and detailed information on patients and more efficient workflows.

Volkoff and Strong (2010) report similar role related misfits. Using Grounded Theory (Strauss and Corbin 1990) as the methodological frame, they conduct a longitudinal case study of a manufacturing company during the implementation of SAP for the purpose of identifying ES misfits. Strong and Volkoff propose that “role misfits occur when the roles in the ES are inconsistent with the skills available, create imbalances in the workload leading to bottlenecks and idle time, or generate mismatches between responsibility and authority” (p. 742). Similarly to the findings by Soh et al. (2003), Strong and Volkoff report that each role needed more understanding and knowledge of the network of tasks to be performed and had to spend more time performing coordination activities between functional areas. The case study thus reports an example where the ‘material planner’ role was *enlarged* to include acquisition of the required material and the organization thus had to create a new 'buyer material planner' role to accommodate the embedded processes of the system. The authors report that the users perceived the system as the foundation for this new role and that the responsibilities concurrently changed from a tactical to strategic level that some users could evolve into while others could not. On the other hand, Strong and Volkoff point out that the fixed role authorizations in the SAP system increased the number of people involved in any action and made it difficult to overlap the tasks carried out by each role, entailing a role *narrowing*. In turn, this caused limited managerial flexibility for dynamically reassigning workforce as needed. Finally, (Strong and Volkoff 2010) reports the location of tasks related to the 'shipping role' being spread across many of the predefined roles in the system.

Another example from the literature of potential role misfit between ESs and organizations is Carlsson and Hedman's (2004) evaluation of 329 EP "role templates" in SAP's mySAP Portals. Using Quinn and Rohrbaugh's (1983) Competing Values Model as theory for the evaluation, they point out that the predefined roles primarily supported operative and middle management roles but lacked support for top manager roles.

In order to arrive at a more theoretical level of abstraction, as opposed to a descriptive level, we may introduce Strong and Volkoff's (2010) misfit types of *deficiencies* and *impositions* (see section 3.4.4) to the domain of role-oriented ESs. We may thus apply the deficiency label to misfits that are either attributable to the *particular* role-oriented ES and the imposition label to misfits that are inherent to the role-oriented approach in *general*. By using these two types of misfits as overall categories we are able to distinguish between the misfits that can be addressed through adaption of the ES at the design or implementation and misfits that are inherent to representing organizational roles in ESs.

3.4.5.1 Role aggregation

The research in paper V and VI illustrates misfits related to *role aggregation* of user in organizations. This misfit occurs when a user occupies multiple roles and these roles are represented in different user interfaces. Although predefined system roles may exist in the role-oriented ES that maps perfectly with the respective roles of the user, the tasks and information are located in different user interfaces and the user thus has to switch between the interfaces when switching roles, as illustrated in Figure 9. The partner companies reported that since the NAV 2009 RTC was primarily targeted at SMEs, many users in the customer organizations had multiple roles. The level of role aggregation of the users did thus not always fit with the roles aggregated in the predefined user interfaces. The role aggregation misfit was also found in the study of client organizations (Customer 4) where the interviewed user had multiple roles that required switching between the predefined user interfaces.

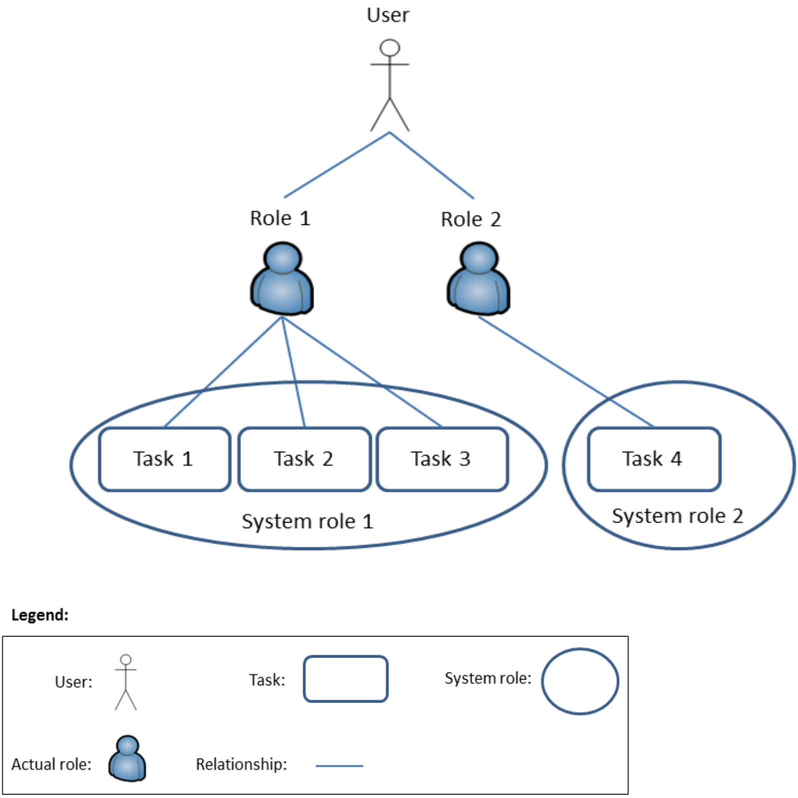


Figure 9. Role aggregation misfit.

Depending on the difficulty of switching between the role user interfaces, an amount of time is spent switching between the interfaces, decreasing the performance of the user, and undermining the ease of use associated with the role-oriented approach (see section 3.4.3.1). In the case of NAV 2009 RTC, users can only be associated with one role-oriented user interface at a time, and significant time consumption and inconvenience is thus associated with switching between two interfaces. Consequently, some partner companies reported, that when users experienced the role aggregation misfit, they were prone to abandoning the role-centers in NAV 2009 RTC altogether and use the old front-end client with the conventional user interface instead. As the appearance of the role aggregation misfit depends on the role aggregation of the predefined system roles, the misfit may be categorized as a *deficiency* misfit, as flexible role aggregation or a match between the predefined role aggregation and the actual roles may remedy the misfit.

3.4.5.2 Role scope

Role scope differs conceptually from role aggregation in that role scope is concerned with the relationship between a role and its tasks while role aggregation is concerned with the relationship between a user and her roles (see section 3.1.1). By combining the findings in paper V and VI, we may argue for two different types of role scope misfits. First, a user may occupy a role that entails carrying out a number of tasks, but the predefined role assigned to the user includes *more* tasks than required, as illustrated in Figure 10. We may term this type of misfit as the *role overload* misfit, similarly to the term used in organizational role theory to describe the situation in which a role has too many tasks (see section 3.1.3). The user does thus not gain full benefits of the role-oriented approach, as tasks and information that are superfluous to the role of the user do not serve any purpose and limits the ease of use gained from the role-oriented approach.

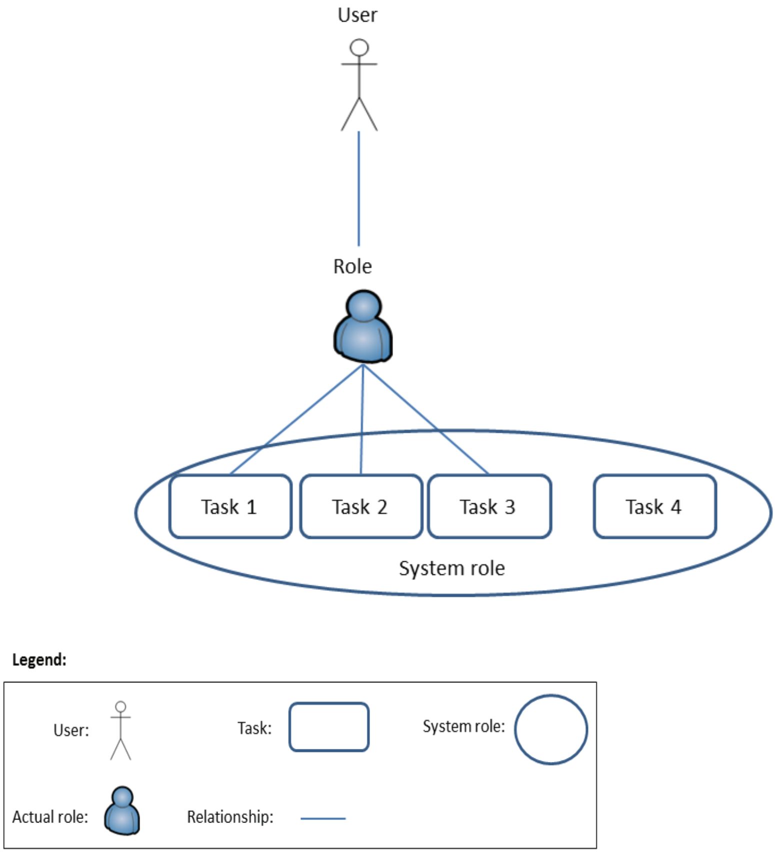


Figure 10. Role overload misfit.

Second, a user may occupy a role that entails carrying out a number of tasks, but the tasks are located in *different* predefined role user interfaces, as illustrated in Figure 11. We may term this type of misfit as the *role segregation* misfit. The user thus needs to switch between the user interfaces while working in the same role to gain access to the required tasks. The consequences of this misfit are thus similar to those of the *role aggregation* misfit. Both types of role scope misfit (role overload and role segregation) may be categorized as *deficiency* misfits, as they not inherent to the role-oriented approach itself, but to the fit between particular system roles and actual roles.

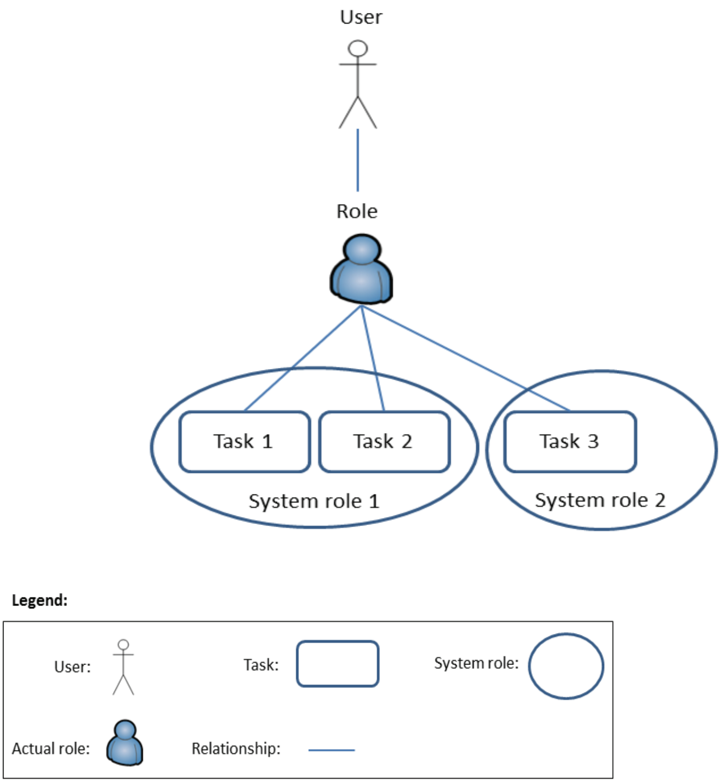


Figure 11. Role segregation misfit.

Additionally, a user may occupy a role that entails carrying out a task that is not supported by the system and hence not present in *any* of the predefined role user interfaces. However, this situation simply represents a situation where the system does not support a required task and should not be mistaken as a misfit that is attributable to role-oriented ESs, as the issue applies to ESs in general – not just role-oriented ones.

3.4.5.3 Role specialization

The client companies in the research used a different number of the role-centers in NAV 2009 RTC, ranging from two to eight (see paper VI). While this difference may be partially explained by differences in organizational coverage of the ES, it points to differences in *role specialization* of organizations as a potential misfit for role-oriented ESs. An example of the role specialization misfit is the *industry-specific* role misfit discussed in paper V. In the case of industry-specific role misfits, the desired tasks or information may be available in a "generic" variation but not in the specialized industry-specific variation required by the role. In the case of NAV 2009 RTC, the ISVs that had upgraded their add-ons (both industry-specific and cross-industry) to be compatible with NAV 2009 RTC had made the functionality of the add-ons available in *all* the predefined role-oriented user interfaces. Although certain industry specific functions may be relevant to all roles in a company, most companies have generic cross industry roles that are not specialized for a certain industry (Pugh et al. 1968). Making all the industry-specific functions available to all predefined roles thus undermines the role-oriented approach and limits the role specialization. As it is possible to address this misfit by only including the industry-specific functions in the predefined roles where they are needed, the role specialization misfit may be categorized as a *deficiency* misfit.

The concept of *cross-industry* misfit is also addressed in paper V. However in the case of cross-industry misfit, no user in any industry is able to access the desired task or information, as it is simply not available. While the absence of cross-industry functions thus constitutes a misfit for organizations needing the functions, it is thus not a misfit that is attributable to the role-oriented approach per se but rather a case of missing functionality all together.

3.4.5.4 Role narrowing

Previous studies have identified examples of both role narrowing and role enlargement in implementations of conventional ESs (see section 3.4.5). A central condition for achieving the benefits of role-oriented ESs (see section 3.4.3) is to syndicate tasks and information into different user interfaces. Role-oriented ESs thus inherently cause additional *role narrowing,* compared to conventional ESs with a single unified user interface where all tasks and information are available to every user. For the same reason, it is unlikely that role-oriented ESs will entail *role enlargement* when compared to conventional ESs. Strong and Volkoff (2010) classify role narrowing as an *imposition* misfit and identifies limited flexibility for dynamically reassigning workforce as a consequence caused by role narrowing. Although client organizations may even perceive the role narrowing and demarcation of responsibilities as a distinct advantage of role-oriented ESs (see section 3.4.3.3) this pivotal attribute of role-oriented ESs is also the cause of role-related imposition misfits.

3.4.5.5 Role transition

Role-oriented ESs may entail a potential misfit related to *transition* (see section 3.1.3 for elaboration of role transition). Although radical changes in organizational structure and the role set of an organization may cause misfits at the role level in conventional ESs as well, role-oriented ESs are more susceptible to such changes as they are adapted to a specific role set at the individual and the organizational level. Changes to the role set at either the individual or organizational level may thus cause role transition misfits. This type of misfit is arguably magnified by the role-oriented approach regardless of the approach to representing the roles at the interaction level and may thus be perceived as an *imposition* misfit of role-oriented ESs when compared to conventional ESs.

However, the misfits related to role transition may be increased depending on representation of roles at the interaction level of role-oriented ESs. In the *unified* approach to representing roles at the interaction level, the predefined system roles are tighter coupled (see section 3.2.1.2), and changing the role(s) of a user thus requires more adaption than in the *componentized* approach, where mappings to predefined roles are more readily addible or removable. This circumstance suggests a *deficiency* dimension to the role change misfit of role-oriented ESs, as the degree of the misfit can be lowered depending on the approach to representing the roles in the system.

3.4.6 Conclusion

Drawing on previous research on ES benefits and misfits and the research from the appended papers we may answer the third and final research question on:

How can client organizations benefit from the use of role-oriented Enterprise Systems and what are the potential issues of the role-oriented approach?

Studying the previous literature on use and operation of ESs in general it is clear that the ESs hold the promise of a number of benefits at different organizational level. However, previous research points to several issues with use and usability in ESs. Role-oriented ESs may contribute to improving *ease of use* and *learnability* attributable to the role-oriented syndication of tasks and information at the interaction level. The IS success literature suggests that these two factors may contribute to improved *user satisfaction* which in turn contributes to achieving general organizational benefits of implementing ESs. The improved learnability attributable to the role-oriented approach also entailed *reduced need for training* of novice ES users. Additionally, the reduced *role ambiguity* entailed by the clear demarcation of role boundaries inherent in the role-oriented approach reinforces the division of labor between the users in organizations. Combining the benefits found in the research with previous studies we may synthesize the causality of the benefits of using role-oriented ES as illustrated in Figure 12.

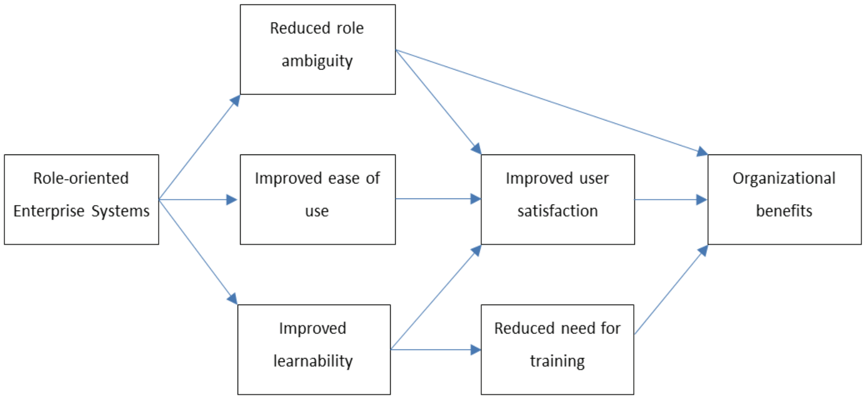


Figure 12. Causality of benefits of role-oriented ESs

While benefits may thus be obtained from implementing role-oriented ESs, previous research also points to several misfits of ESs, some of which are related to organizational roles. By applying the categorization of deficiencies and imposition misfits to role-related misfits of role-oriented ESs derived from previous literature and the appended research papers, we may arrive at a categorization of role-related misfits of role-oriented ESs and their consequences, as presented in Table 8.

Table 8. Role-related misfits of role-oriented ESs.

Role related misfit	**Description**	**Misfit type**	**Consequence**
Role aggregation	• The predefined level of role aggregation does not fit with actual role aggregation of the user	Deficiency	• The user has to switch between predefined roles
Role scope	• Role overload: Too many tasks in the predefined system role compared to the tasks of the actual role of the user • Role segregation: Tasks are located across different predefined system roles compared to the actual role of the user	Deficiency	• Role overload: Limits the benefits of the role-oriented approach • Role segregation: The user has to switch between predefined roles
Role specialization	• Specialization of the system role is different from the specialization of the actual role	Deficiency	• Limits the benefits of the role-oriented approach
Role narrowing	• The predefined system role limits the option for carrying out tasks of other roles	Imposition	• Limits the flexibility for reassigning workforce
Role transition	• The fixed predefined system role makes changing to another role cumbersome	Deficiency + imposition	• Impairs the process of organizational change

3.5 Summary of the chapter

This chapter has provided a review of organization role theory and answered the three research questions related to design, implementation and use of role-oriented ES. Through the study of previous research and the findings in the appended papers the chapter has thus provided us with: 1) approaches to modeling and reflecting roles deep and surface structures for the purpose of representing organizational roles at the user interaction level; 2) approaches to mapping predefined roles in role-oriented ESs to actual roles during implementation and subsequent strategies for tailoring them; and 3) possible benefits and categories of role-related misfits of role-oriented ESs in use and operation. Having answered the three research questions we may move on to discuss selected aspects of role-oriented ESs to advance our understanding.

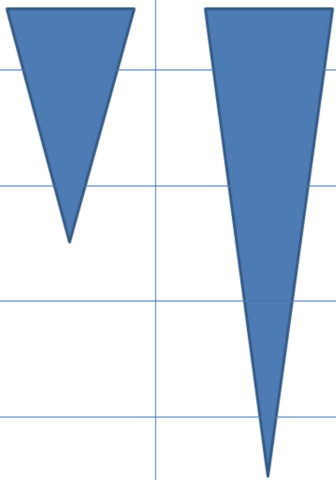
4 Discussion

The following chapter discusses some of the findings in order to reach a higher and more theoretical level of understanding of role-oriented ESs to contribute to the literature on ESs and ISs in general. The discussion is framed by returning to: design of deep and surface structures of role-oriented ESs in an ecosystem context; role-oriented design, implementation, and use; and organizational role theory.

4.1 Design in an ecosystem context

To arrive at a more holistic understanding of how the design of role-oriented ES evolves across the different actors in an ES ecosystem, we may attempt to integrate the findings from the study with the increased understanding of ES ecosystems from the pre-studies. Once again we may draw on the BWW theory (see section 2.7.1) for the purpose of gaining an understanding of how the design of predefined system roles in role-oriented ES evolves in the deep and surface structures across the ES ecosystem, as illustrated in Table 9.

Table 9. Design of deep and surface structures of system roles in an ecosystem context.

Ecosystem actors	Deep structures	Surface structures	Design focus and influence
Vendors			• Foundation for representing roles in deep and surface structures • Industry specific roles • Country specific roles
ISVs			• Industry specific roles • Roles for specific departments
VARs			• Roles for specific organizations • Roles for specific departments • Re-usable custom roles
Customers			• Roles for the specific organization • Roles for specific departments
Individual users			• Personalized roles

From the research findings it is clear that the ES vendors control whether an ES qualifies as role-oriented in the first place. The vendors design the representation of roles (and other concepts) in deep structures of role-oriented ESs and lay the foundation for how roles are reflected in the surface structures through the user interface. During the realization of the role-oriented ES, the vendors decide how internal and external structures of the role are modeled and embedded in the deep structures in the role-oriented ES. The vendors also decide the scope of the predefined roles, including which *countries* and partially also which *industries* the predefined roles are aimed at.

When the ISVs "receive" the core version of the role-oriented ES, the deep and surface structures of the roles are in already place (see section 3.2.1). The ISVs thus have a significantly lower control of the deep and surface structure than the vendors. Still, the ISVs may develop *industry* specific variations of the system roles to augment the roles to fit specific customer segments and even add functionality to support roles in *organizational functions* (departments) not covered by the core version of the system. Some degree of vendor control over the system roles is thus lost, although the vendors exercise a certain influence and control over their partners (paper I) (Huber et al. 2010).

When the VARs implement the role-oriented ESs in client organizations, the system roles are mapped to the actual roles of the client organization and may be configured and tailored to meet the specific requirements of the *individual organization* (see section 3.3.2). The VARs have little control over the representation of roles in the deep structures of the role-oriented and primarily influence the representation of roles in surface structures through configuration and tailoring (see sections 3.3.4 and 3.3.5.). The focus of the system roles configured by the VARs is thus the individual client organizations, although the VARs may reuse tailored roles across different organizations (see section 3.3.4) and specific departments. The focus of fit in the client organizations is on the role set in their particular organization. The system roles may be specialized and assigned to users based on functional departments (as in Company 2) or enlarged to fit a broader set of tasks (as in Company 3,4, and 5).

4.1.1 Personalization – beyond fit at the role level

The research presented in this dissertation has so far been focused on the concept of *role*-oriented ESs. However, the findings from the research also provide the opportunity for peeking into fit of ESs beyond the role level. Representatives from vendors, partner companies, and client organizations argued that role-oriented ESs is just the first step towards *personalized* interaction with ESs. The options for users to configure the user interface to their personal preferences in the two case systems (see paper III and IV) was thus perceived as an important step towards personalized user interaction. This type of personalization differs from much of the conventional literature on personalization of ISs (e.g. Mobasher, Cooley and Srivastava 2000; Mulvenna, Anand and Büchner 2000; Zimmermann, Specht and Lorenz 2005), in that personalization is often perceived as achieved through ‘recommender systems’ based on user models and stored data about the behavior of users (typically in the process of buying products online). The personalization options offered in the two role-oriented ESs is a more user-driven type of personalization, offering a set of “manual” personalization functions.

Some partner companies had engaged in extensive training of the users to enable them to personalize the user interfaces, and some users in all of the case companies had utilized the option of personalizing their user interface and perceived the option as beneficial for fitting the system to their personal preferences (see paper V). These findings indicate that the option for personalization could be viewed as complementary to role-oriented fit, supporting previous suggestions of personalization as a way to accommodate the individual preferences to achieve fit at the individual level (e.g. Greenberg 1991). Although the users have no control over the deep structures in the design and fit of the system, they may thus still influence the surface structures of the system to achieve fit at the individual level, as illustrated in Table 9.

The proposition that design of the ES artifacts can be viewed as an evolution throughout an ecosystem is arguably already implicit or emergent in much of the literature on ES life-cycles (see section 1.4). However, the integration with theory of deep and surface structures and the amendment of design at the individual level advances our understanding of how the design of ESs as a tailorable technology (Germonprez et al. 2007) is modified across the different actors in the ES ecosystem throughout its life-cycle. The illustration of design as evolutional in the ecosystem thus helps us to identify the level of actor at which a specific type of misfit may be addressed. Viewing the design of ESs in this perspective, there is thus little point in, for example, attempting to remedy deficiency misfits caused by the deep structures at the level of the individual user, as this level of ecosystem actors have no influence of these structures, whereas misfits attributable to the surface structures of the systems may still, to some degree, be addressed at this level.

4.2 Addressing role aggregation in deep and surface structures

Armed with an overview of how the actors in the ES ecosystem influences the design of deep and surface structures of system roles in role-oriented ESs we may return to the issue of the *role aggregation* misfit found in the study (see section 3.4.5) and contribute with a prescriptive discussion on how to remedy this issue when vendors design role-oriented ESs.

The use of Personas at Microsoft as a “container” for the modeling of organizational roles poses an interesting proposition for modeling the organizational roles of users as *deep structure*s in ES design. However, the Persona technique was originally intended for communicating requirements of users and better engaging designers of ISs in the needs of the users (Nielsen 2004), and thus seeks abstraction at the user level (Pruitt and Grudin 2003) rather than the role level. The role concept is only partial in describing the properties of the fictitious user, and a role is thus a “second order” concept in the original Persona technique (see section 3.1.4). The inherent result of roles as *embedded* in Personas may thus entail difficulties with establishing explicit relationships between the embedded roles in the Persona and other entities – especially when identifying the distinct tasks of each embedded role. As illustrated by the research, the “legacy” of the Personas in the representation of roles in NAV 2009 RTC makes unambiguous mapping of tasks to the role level in the system difficult, if not impossible.

On the other hand, Personas may capture aspects of user abstraction that the role concept does not, and the use of Personas does not exclude *independent* modeling of organizational roles of users. Shifting the relationship to other business entities, such as tasks, from the Persona level to the role level would thus be one approach to maintaining roles as independent concepts without diminishing the benefits of Personas. The Personas would still be used for abstraction at the user level while maintaining an explicit and unambiguous relationship between roles and tasks, as illustrated in Figure 13.

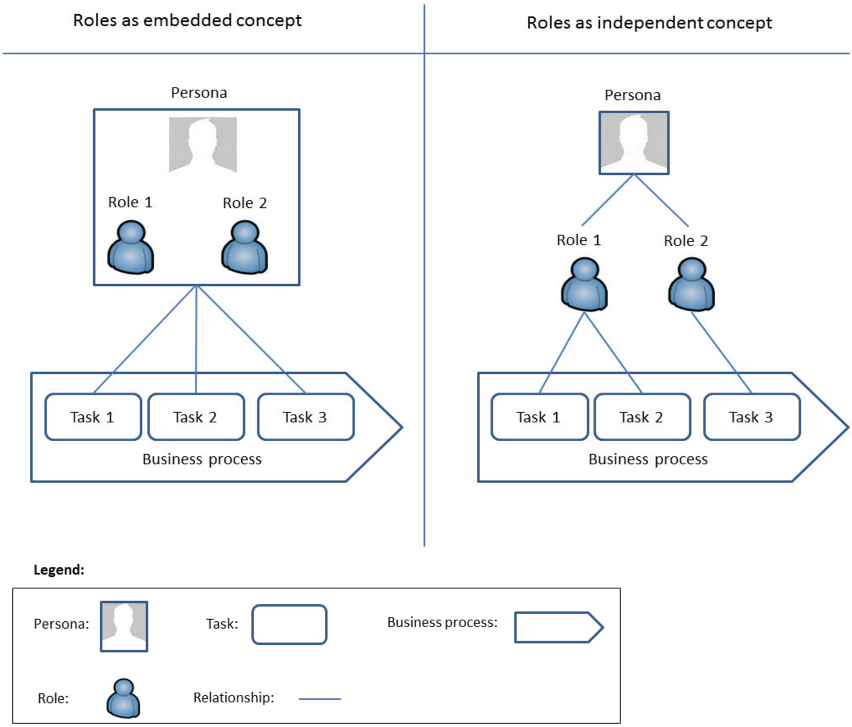


Figure 13. Roles as embedded and independent concept with the use of Personas

Moreover, the independent modeling of roles would have to be reflected in the *surface structures* of the role-oriented ES. In the case of NAV 2009 RTC, RBAC roles (security roles) are already part of the surface structures of the system. These RBAC roles exist as independent concepts, and users can be associated with multiple roles, allowing flexible role aggregation at the security level. However, as RBAC roles are not explicitly linked to the user interface roles (see section 3.3.4), a change in the RBAC roles does reflect directly on the user interfaces roles.

The immediate solution to this problem would be to explicitly link the security roles to the user interface roles. However, as discussed previously in this dissertation (see section 3.2.2.1), RBAC roles cannot readily be extended to user interface roles, since the information about which roles have access to which tasks and information does not translate directly into *how* these tasks and information should be presented to the user in the user interface. The fact that user interface roles are not readily aggregated thus constitutes a central challenge for representing roles at the user interaction level of role-oriented ESs. SAP addresses this issue through the componentized approach to representing roles in the user interface where each role gets a “tab” in the user interface (see appendix in paper IV). While this approach solves the role aggregation issue it still entails that users have to switch between interfaces when switching roles, although the switch is much more seamless (a single click) than switching between role-centers in NAV 2009 RTC.

In the end, the choice between representing roles at the surface structures of role-oriented ESs through the unified or componentized approach arguably comes down to the magnitude of the role aggregation misfit in client organizations. In the research, three out of the five client organizations had users with role aggregation, but only in a single organization was the role aggregation inconsistent with the predefined role aggregation in NAV 2009 RTC (paper VI). Although, the five client organizations were not selected using representational sampling (see section 2.5.2), the findings still indicate the existence of some fit of the predefined role aggregation in the unified approach. This indicates that while fixed role aggregation in role-oriented ESs makes it difficult to adapt the system to organizations with different configurations of role aggregation, a "best-practice" approach to predefined role aggregation is still possible.

4.3 Aligning organizations, systems, processes, and roles

As shown in the sections answering the second and third research question, previous research has addressed the requirements analysis of ESs and the subsequent notions of alignment, fit, and misfit in the context of use (see section 3.3 and 3.4). While some of the literature addresses requirements analysis and fit from the perspective of organizational roles, no integrated model exists for achieving alignment between organizations, systems, processes, and roles, which partially impairs the implementation of role-oriented ESs. Proposal of an integrated model will help to demonstrate how basis (organization or system) and concepts (processes or roles) of the requirements analysis for ES implementation can be aligned.

The study of implementation of role-oriented ESs and the use of roles for analyzing requirements presents an opportunity for extending current approaches to requirements analysis and alignment. Analyzing requirements and aligning the systems with the requirements is often a complicated, time consuming, and semi-structured process (Bernroider and Koch 2001; Alves and Finkelstein 2002; Wu et al. 2007). While adding a complementary approach of applying roles for requirements analysis of ESs may not reduce complexity, it may be needed to ensure alignment and fit between systems and organizations to overcome role-related misfits. Returning to the approaches for identifying organizational requirements for ESs (see section 3.3) we may thus extend the approaches of organization-to-system, system-to-organization, processes-to-roles, and roles-to-processes to arrive at higher level of theoretical abstraction, beyond role-oriented ESs, for ES requirements analysis.

The proposition of organization and system as *basis* for ES requirement analysis and processes and roles as *concepts* of the analysis, as depicted in Figure 14, provides a frame of reference for categorizing ES requirements analysis approaches. The proposition of the frame is that requirement analysis approaches for establishing alignment between organization, system, processes, and roles can be based in either the organization or the system and the concepts of analysis can be focused on either processes or roles. By establishing a combination of basis and concepts in the analysis (one of the four quadrants of Figure 14) it is possible to either shift the basis of the analysis or the concept in focus of the analysis to achieve alignment in other combinations. The approaches for starting at one combination of basis and concept and arriving at other combinations may progress as follows.

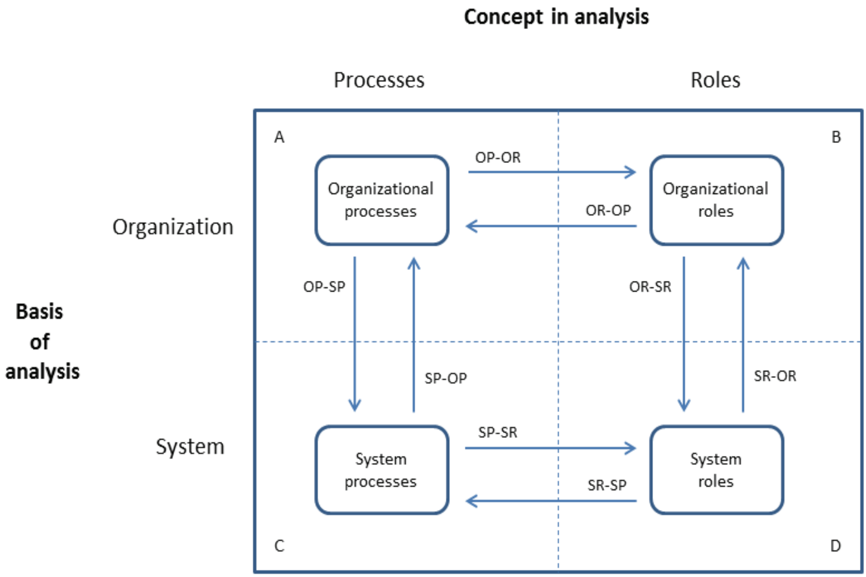


Figure 14. Alignment of organization, system, processes, and roles.

A client organization and its implementation consultants may decide to base their analysis of requirements on organizational processes by using the organization as basis for the analysis and processes as the concept in focus of the analysis (quadrant A). Once the organizational processes have been established the *basis* of the analysis may be shifted to the system to establish how the system must be configured to align with the organizational processes (quadrant C). This would be an ‘organizational processes to system processes’ (OP-SP) approach. Correspondingly, the *concept* in focus of the analysis may be shifted to organizational roles (quadrant B) by mapping the tasks of the identified business processes to roles. This would be an ‘organizational processes to organizational roles’ (OP-OR) approach. A second example may be to use the organizational roles as origin of the analysis (quadrant B). Once the organizational roles are identified the concept in focus may be shifted to the organizational processes by mapping the identified tasks of the roles to sequences of tasks constituting business processes. This would be an ‘organizational roles to organizational processes’ (OR-OP) approach. Likewise, the basis for the analysis may be shifted to the system to establish how the system roles should be configured to meet the requirements of the organizational roles. This would be an ‘organizational roles to system roles’ (OR-SR) approach. Other starting points (quadrants) may be chosen as origin for the analysis and when the analysis for that combination of basis and concept has been analyzed it may be used as foundation for moving to the “neighboring” combinations, until all four combinations are aligned.

The choice of where to begin the analysis may be based on level of maturity. Organizations with a high level of business process maturity (Fisher 2004; De Bruin and Rosemann 2005) may feel confident in founding the analysis in their own organizational processes and extend the analysis from there, while organizations with a lower business process maturity level may decide to use the system processes as a starting point to benefit from the best practice “blue print” of the system. Using the

ESs as blueprint for designing organizational processes is a well-established practice when choosing ESs (Soffer et al. 2001). However, as found in this study, organizations and their users may be more comfortable with describing their organizational roles and tasks and use these roles as foundation for modeling business processes. Finally, the emergence of role-oriented ESs with predefined system roles provides an opportunity for using the system roles as blue prints for designing organizational roles.

4.4 The influence of role-oriented technology on fit and performance

Turning the attention to role-oriented ESs in use, we may integrate the findings from the study with previous IS and ES literature on use, to arrive at a more theoretical level of understanding on how role-oriented ESs impact the performance of organizations, as illustrated in Figure 15. The illustration depicts the process, role, and individual levels of fit and their influence on organizational performance.

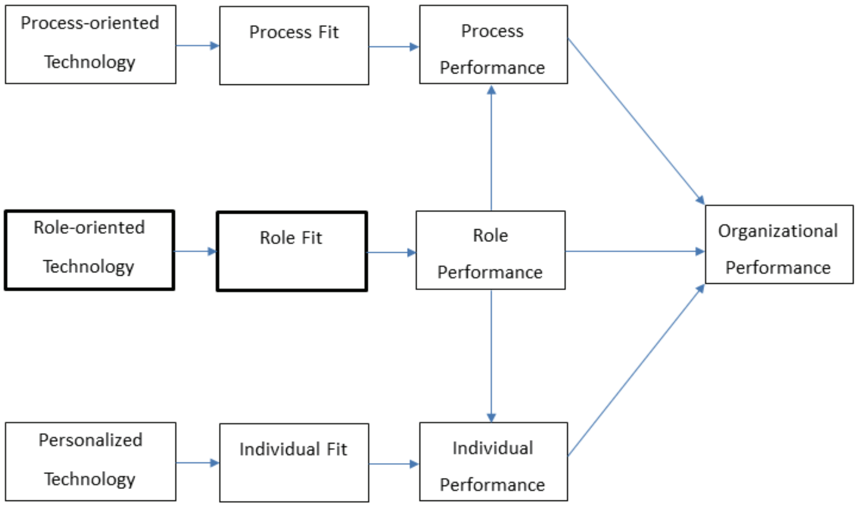


Figure 15. The impact of role-oriented technology on organizational performance.

Beginning with the upper part of Figure 15, we know from previous studies that fit between business processes and organizational processes is essential to process performance (see section 3.4.4) and that process fit is an antecedent of achieving organizational performance and benefits (see section 3.4.1). This business process fit has thus been the focal point of the process-oriented stream of ESs (see section 1.3.2). Switching to the bottom part of the figure we also know that individual fit is key for achieving individual performance and that individual performance in turn impacts organizational performance (see section 3.4.2). The findings from this study and previous research suggest that personalizing systems is one of the means of achieving this fit (see section 4.1.1).

Finally, the research conducted as part of this dissertation (the bold boxes in the middle of the figure) suggests the role-level as an intermediate level, between the process and the individual level for achieving fit. The primary contribution from the findings in this dissertation in relation to use of role-oriented technology (role-oriented ESs) is a better understanding of how this technology influences role fit in organizations. While the research has not been focused on measuring the direct impact of role performance on organizational performance, previous studies suggest that role performance is essential to organizational performance (see section 3.1.3). The research study strongly indicates that role-performance is likely to impact individual performance (see section 3.4.3) which is also supported by organizational role theory (see section 3.1.3) and thus also influences organizational performance indirectly. Likewise, the close connection between organizational processes and organizational roles suggests that role performance is critical to process performance (see sections 3.1.1 and 3.2.1).

4.5 Returning to organizational role theory

Applying our increased understanding of the attributes of role-oriented ESs we may return to organizational role theory with the aim of contributing back to the theory. The presented research suggests that the introduction of role-oriented ESs with predefined roles represented at the user interaction level may influence role structures and role mechanisms in organizations. The findings in this dissertation thus suggest that the predefined roles in role-oriented ES may influence scope, specialization, ambiguity, and narrowing of organizational roles (see section 3.4.5). Even if the system roles are perfectly aligned with the actual roles in the organization, the static nature of system roles imposes a fixation of the roles, inhibiting the process of dynamic role transition.

The predefined system roles of role-oriented ESs are thus not merely influencing the roles in the organization through indirect impact on the human role senders, but rather directly influencing the role taking process by influencing the received role of the focal person. When a user (focal person) is assigned to a system role the system role thus becomes part of the received role as it influences, and to some extent even dictates, the tasks (responsibilities) of the role. Hence, the introduction of role-oriented technology containing predefined system roles is a contributing factor in shaping the role of the users and directly influences the role taking process, independently from the other factors proposed by Katz and Kahn (1966) (see section 3.1.2). Supported by the findings on role-oriented ES we may thus suggest an extension of the original role taking process (see Figure 7) by adding the influence of 'system roles' as depicted in Figure 16.

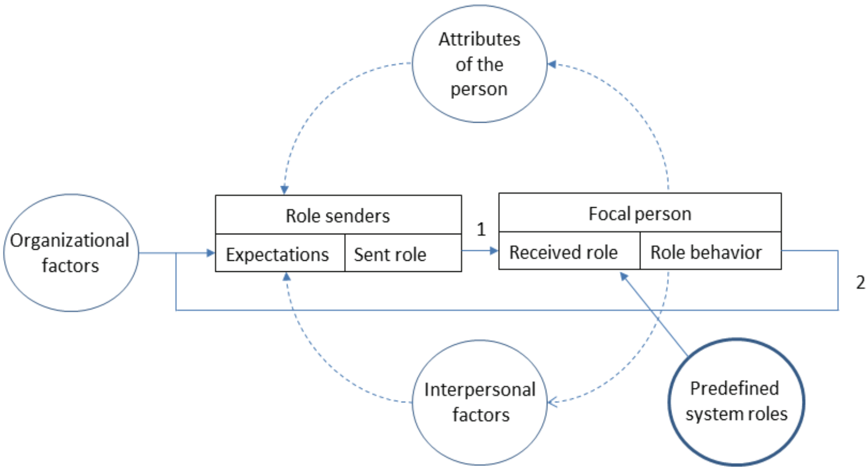


Figure 16. Extension of the role taking process (extended from Katz and Kahn, 1966, p. 187).

Technological impact on organizations has been repeatedly studied in many different contexts in the IS field (e.g. Bjørn-Andersen et al. 1979; Markus and Robey 1988; Orlikowski 1992). The proposition that technology impacts organizations is thus not novel in itself. Still, previous studies on organizations and technology do not explain the process through which technology influences the very forming of organizational roles. Technologies other than role-oriented ones are also likely to influence the role taking process, but the study of role-oriented ESs is particularly suited for explaining this influence as the predefined system roles in these systems are targeted directly at organizational roles of individuals.

4.6 Summary of the chapter

The discussion of design of predefined system roles of role-oriented ESs has advanced our understanding of how role-oriented ESs as tailorable technology may be shaped by the different actors in a software ecosystem, including the individual users. The prescriptive discussion on how to address the role aggregation misfit in the design of deep structures of role-oriented ESs brings improved understanding on possibilities for addressing this issue by illustrating how Personas can be combined with roles as independent concept. The integrated model of organizations, systems, processes, and roles provides suggestions for how to move between different combinations of basis and concepts in requirements analysis during implementation of ESs. The integration of role-oriented technology, role fit, and role performance on organizational performance in the context of use provides improved understanding of how the role-oriented technology influences process and individual performance. Finally, the discussion in this chapter has proposed an extension to the process of role taking in the organizational role theory and thereby extended our understanding of how role-oriented technology with predefined system roles may influence this process.

Having discussed and integrated the findings, I move on to offer some reflection on rigor and relevance of this dissertation along with some suggestions for future research.

5 Reflection and contribution

The following chapter allows me to, in hindsight, reflect on the process of conducting the research project for this dissertation. A central and ongoing debate in the IS field for evaluating research is the topic of rigor vs. relevance. Simply put, rigor refers to the degree to which a work follows prescribed procedures for conducting research and producing results (Simon 2004). Relevance is a little harder to pin down. Some IS researchers argue that relevance relates to relevance to practice (Benbasat and Zmud 1999) while others hold the position that relevant IS research must be actionable in practice to be considered relevant (Simon 2004). Yet others seek to go beyond the distinction of rigor and relevance and argue that responsibility and reverberation should characterize IS by helping to solve the grand issues of the world in general (Desouza, El Sawy, Galliers et al. 2006). Although the research presented in this dissertation has important implications for various areas, it may not fare well when compared to grand issues of humanity in general, and we may thus stick to the frame of rigor and relevance for the purpose of reflection.

This dissertation has primarily applied qualitative research methods for its research design (see section 2.3). A number of concepts have been proposed for evaluating the rigor and relevance of qualitative research. Many of these concepts overlap in definition and aim, and finding a common set of evaluation criteria for qualitative research is thus no trivial task. Miles and Huberman (1994) group some of these concepts into five categories: 'Objectivity/Confirmability'; 'Reliability/Dependability/Auditability'; 'Internal validity/Credibility/Authencity'; 'External validity/Transferability/ Fittingness'; and 'Utilization/Application/Action orientation'. While the first four categories can be related to the rigor of the study, the last category is primarily related to the relevance of the study. We may thus focus on the first four categories as frames when evaluating the rigor and the final category when addressing the relevance of the study.

5.1 Rigor

The following sections provide reflection on the objectivity, confirmability, reliability, internal validity, and transferability of the findings.

5.1.1 Objectivity and confirmability

Objectivity is concerned with *neutrality* of the research and the researcher being relatively free from unacknowledged biases (Miles and Huberman 1994). The role of practice as both the source of inspiration and the domain in which the research was framed may have influenced the objectivity of the findings. By studying how practitioners design and implement role-oriented ESs the research has indirectly been biased by the choices made by these practitioners. While using ES vendors as the empirical source for how to reflect organizational roles in ES design has provided a strong foundation for arguing the very existence of role-oriented ESs as an IS artifact, it has also implicitly shaped the definition. Studying the representation of organizational roles in ESs from an experimental approach might thus have revealed considerably different approaches to representing organizational roles.

Moreover, the collaboration with Microsoft as part of the 3gERP project (see section 2.1) entailed some degree of bias for studying systems and practices that was of interest to that specific vendor. While this bias inevitably shaped both the focus of the research and the empirical data on which the research was based, no pressure was ever exercised by Microsoft on forcing the research in any particular direction. Second, the close collaboration with the vendor came with a condition of signing a non-disclosure agreement (NDA) requiring that Microsoft approved any publication containing information not publicly accessible or regarded as classified. Although signing such an agreement initially lead to some concern for my "academic freedom", Microsoft never attempted to exercise any censorship on any of my publications and always approved my requests for using copyrighted material. In fact, the process of getting acceptance from the vendor exposed a few misunderstandings about the Microsoft software ecosystem and the NAV 2009 RTC system on my behalf and thus strengthened the *reliability* of the findings (further discussion on reliability is presented in section 5.1.2).

Confirmability refers to how well the "audit trail" of the study can be traced, also referred to as *transparency* of the study (Silverman 2006). The consistent transcription of all interviews in the study is thus one factor contributing to the confirmability of the study as external reviewers are able to read the transcripts. A second factor contributing to the confirmability is the application of the ATLAS.ti software in the coding process of the GTM studies. Again, external auditors are able to explicitly identify every underlying piece of data that contributed to the concepts and how the concepts contributed to the categories of the grounded theories. On the other hand, the use of proprietary and confidential documents from vendors and partners and the decision to anonymize the interview respondents and the participating partner and customer companies limits the immediate transparency of the research.

5.1.2 Reliability

The category of *Reliability/Dependability/Auditability* refers to whether the process of the study is consistent, reasonably stable over time and across researchers and methods (Miles and Huberman 1994). Silverman (2006) argues that reliability in the context of qualitative research is often achieved through *transparency* in the research process and Miles and Huberman (1994) suggest that some of the relevant questions to ask in this part of the evaluation are: Is the research design congruent with the research questions? Were data collected across the full range of settings? As part of the evaluation of this part of the research we may thus return to the research questions and the overall research design.

The choice of framing the research questions within design, use, *and* implementation of role-oriented ESs has certain ramifications for the reliability of the findings. While including three different domains of IS research in the study has contributed to a holistic understanding of the phenomenon of role-oriented ESs through *breadth,* it comes at the cost of *depth* within each of the domains. Focusing on a single domain could thus have increased the depth of understanding of that particular aspect of role-oriented ESs and made the findings more reliable and the theorizing more substantial within a particular domain. On the other hand, the breadth of focusing on design, implementation, and use in the research is the very premise for which the opportunity for theorizing across actors in the ES ecosystem rests.

Turning to the research design, the applicability of GTM and Case Study for answering the research questions was thoroughly argued as part of the research design (see section 2.3.1 and 2.3.2) and the usefulness of these methodologies still stands in hindsight. However, the combination of GTM *and* Case Study research in one research project has arguably had some implications on the research process as well as the findings. The guideline of GTM prescribing a theoretical sampling approach of selecting data sources as the analysis and the grounded theory emerges (see section 2.3.2.1) entailed that the partner case companies could not be selected a priori to initiating the collection of data. Instead, ongoing selection of partner companies that would on one hand help saturate the emerging categories of the grounded theory and on the other would fit the case study research design was made as the research progressed (see section 2.5). While the application of mixed methods has been encouraged in both ES research (Schlichter and Kræmmergaard 2010) and in research in general (Greene, Benjamin and Goodyear 2001) and mixed methods to some extend provide method triangulation (Creswell 2007), balancing between the data collection to "satisfy" both GTM and Case Study may have weakened the execution of both methodologies. Applying GTM in isolation might thus have provided possibilities for pursuing other emerging core categories while applying Case Study research in isolation might have allowed "deeper" studies of each of the cases.

Second, while being somewhat familiar with elements of the Straussian approach to GTM from previous research projects undertaken in my training as master student, I was admittedly not fully aware of the implications of undertaking a "full" GTM study. Aware of my novice level of experience with the methodology, I was committed to rigorously following the guidelines proposed by GTM scholars (e.g. Strauss and Corbin 1990; Holton 2007; Urquhart et al. 2010). The mere process of transcribing nearly 300 pages from interview recordings was rather strenuous and the subsequent process of coding the transcripts line-by-line was enough to question the choice of methodology from time to time. I have later learned that this is termed "flooding" and is apparently rather common among novice GTM researchers (Star 2007, p. 89). Thus, at times, I feared ending up in the category of "researchers [who] simply lack knowledge and competence in conceptualization and, as such, they embrace with enthusiasm but without understanding" (Holton 2007, p. 285). On the other hand, the detailed and rigorous analysis of the interview data gave me a confidence that the emerging grounded theory was if not appealing and elegant then at least solidly grounded. This grounding was even more important as the analysis for the GTM studies was conducted solely by me.

The use of the ATLAS.ti software may have been both a curse and a blessing in this context. The software offered significant help in tracking, comparing, and organizing the large amounts of transcribed text, without which I would most likely have succumbed to the process of analyzing the data. However, any inconsistency in relationships between data, concepts, and categories was immediately visible and "begged" for the return to an ordered and structured coherence, which seemed to "stifle" the abduction from the descriptive level of the data and might have limited theoretical abstraction. On the other hand, it gave a certain sense of confidence to see concepts and categories nicely ordered and related. Hence, the "ordered closeness" with data that resulted from this detailed analysis, and seeing the theory slowly emerge, regained my confidence in doing GTM.

In regards to the setting of the data collection, the choice of collecting data across the different agents in the Microsoft ES ecosystem provided the possibility of triangulating part of the data by comparing data on similar topics between the actors. Situations where conflicting information on topics that were presented as "factual" by the respondents could thus be cross-checked with respondents from other levels of actors in the ecosystem which helped to correct factual errors and identify areas with conflict of interest. The risk of the study being biased by one group of agents in the ecosystem could thus be partly mitigated. This has strengthened the reliability of the findings. Another approach to strengthening the reliability of the findings was the collaboration of authors from the ES vendors (paper IV). Having co-authors from each of the two vendors thus gave confidence that the approach of one vendor was not favored over the other and that factual information was double checked.

Finally, an important limitation for the reliability of the findings is that the study on use and implementation of role-tailored ES was primarily conducted through interviews with respondents. This limited the possibilities for triangulating the data from the interviews. Although some observations on the use of the systems were made during the visits at the customer sites, the duration of the observations was too short and too staged to be considered as reliable sources for triangulating the statements in the interviews. This limitation could have been addressed by combining the interview data with data from lab experiments on usability (Rogers et al. 2007). Still, such experiments may not capture the actual work of users in real-world context (Suchman 1983) and data from use *in situ* would thus be preferable in future studies on use of role-oriented ESs. Likewise, studying implementations of role-oriented ESs as they unfolded would have provided more reliable findings for theorizing on implementation approaches.

5.1.3 Internal validity

Internal validity/Credibility/Authencity is concerned with the very essence of the research findings: the truth value (Miles and Huberman 1994). The credibility of the findings is thus the sum of the internal validity of the research. Although the truth value of research may depend to the underlying paradigm of the research (Hirschheim and Klein 1989), Miles and Huberman (1994) suggest that some of the universal questions to ask for when evaluating the credibility are: Are there any areas of uncertainty? Are the presented data well linked to the categories of prior or emerging theory?

The novelty of the concept of role-oriented ESs causes reason for reflection in this regard. The NAV 2009 RTC had barely been released when the data collection was initiated. ISVs, VARs, and customers in the Microsoft ecosystem were thus not very familiar with the system when the research was conducted. Most implementation consultants had not been involved in implementations of the NAV 2009 RTC, and ISVs were in the process of upgrading their solutions to take advantage of the role-oriented approach. While this provided the opportunity for the pre-study on version transitioning, it entailed that the ecosystem had not fully adjusted to the role-oriented approach. Having conducted the investigation at a later point in time when the participants were more familiar with the system might have revealed different findings, especially in the part of the study that focused on approaches to mapping and tailoring the predefined system roles.

Moreover, the lack of existing theory that addresses design, implementation, use, and even the definition of role-oriented ES is influential. While the lack of existing literature describing the phenomenon has been an opportunity for contributing with further understanding, it has also limited the foundation on which the dissertation is built. Although existing theories have been applied in the research, the findings are based on an *inductive* qualitative approach, and the emerging theories have not been validated in other contexts than the ones from which they have emerged. The models and theoretical extensions that I have proposed are thus “emergent” in nature, and need to be subjected to *deductive* research methods to strengthen or contest their “truth value”.

5.1.4 Transferability

Unlike quantitative research, qualitative research does not generalize findings to a predefined population from which a sample is drawn (Creswell 2007). Instead, generalization, or ‘transferability’ as it is often referred to in qualitative research (Lincoln and Guba 1985), can be based on *analytical* extension of the findings to a broader context than the one in which they were found, thereby taking steps towards broadening the scope of the theory. The premise for analytical extension is that each case setting “has a few properties it shares with *many* others, some properties it shares with *some* others, and some properties it shares with *no* others” (Miles and Huberman 1994, p. 29). Identifying the properties of the findings that are different from or consistent with other domains may thus be considered essential for analytic extension.

Reflecting on the focus on Microsoft’s ES ecosystem for studying vendors’ ecosystems, it seems plausible, that the ecosystem was suitable as a ‘revelatory’ case for arguing the extension of the traditional two-stage life cycle with a third group of actors (the ISVs and VARs). However, software ecosystems may vary substantially in structure and purpose (Jansen, Brinkkemper and Finkelstein 2009) and the roles of the ecosystem agents may thus vary across different ecosystems. The choice of leaving all the implementation activities in the hands of the VARs is thus a strategic decision made by Microsoft, rather than a deterministic outcome of the presence of an ecosystem. SAP, for example, has only recently begun to leverage implementations through their partners. The distribution of focus on design and fit between the different ecosystem actors (see section 4.1) may thus vary between ES ecosystems. Still, the shift in focus on fit and design at different levels (country, industry, individual organization etc.) is arguably transferable across ES ecosystems.

The choice of role-oriented ESs targeted at SMEs is also relevant to the reflection on transferability of the findings. As users in SMEs are more likely to occupy multiple roles, the identified misfit related to role-aggregation (see section 3.4.5.1) is likely to be more pronounced in these types of organizations. One would thus expect the extent of the misfit to vary depending on the size of the organization. Still, the role aggregation misfit as a *type* of role-related deficiency misfit of role-oriented ESs is universal.

Finally, the transferability of the phenomenon of role-oriented ESs calls for reflection. While inclusion of predefined system roles for the purpose of representing organizational roles at the user interaction level is particularly relevant to the domain of ESs, due to the variety of the tasks carried out by the users of these systems, the concept of role-oriented systems applies to other domains. The challenges of modeling and subsequently representing roles in deep and surface structures are thus universal in any IS that seeks to capture the notion of roles. The identified benefits of representing the roles of users may thus pertain to other IS technologies, such as groupware (Greenberg 1991) or recommender systems (Schubert, Uwe and Risch 2006), and the role-related deficiency and imposition misfits (see sections 3.4.3 and 3.4.5) are, likewise, transferable to other types of role-oriented technology which include predefined system roles.

5.2 Relevance

Having reflected on the findings of this dissertation, it is now time to return to the question of relevance, by summing up the contributions and the implications for practice, or what Miles and Huberman (1994) refer to as the ‘utilization’, ‘application’ and ‘action orientation’.

5.2.1 Contribution

The purpose of this dissertation has been to gain a better understanding of role-oriented ESs through investigation of design, implementation, and use of the systems. From the answer to the three research questions and subsequent discussion and reflection we may derive a number of contributions to advance this understanding.

First, the presented work has contributed to the very definition of what constitutes a role-oriented ES, which is not present in the existing literature. This definition may contribute to classifying ESs as role-oriented or not, and to framing of future studies of the phenomenon. Second, the finding of roles as embedded or independent concepts in modeling organizational roles of users in deep structures of ESs and subsequent unified or componentized representation in the design of surface structures through multiple user interfaces, contributes to closing the gap in existing knowledge on how to move from the analysis and modeling of roles to representing them at the user interaction level. The investigation of the representation of roles in the design of ESs also suggests, that the traditional RBAC approach is suitable for reflecting organizational roles for the purpose of security and access rights, but insufficient for designing representation of roles at the user interaction level.

The pre-studies for the investigation of role-oriented ESs has contributed to advancing our perception of how the structure of ES ecosystems and how version transitioning occurs in these ecosystems. Additionally, the framing of the study within an ES ecosystem context has provided the opportunity for describing how the design of role-oriented ESs as a tailorable technology can be shaped by the different actors in an ecosystem, and how the deep and surface structures may be controlled and influenced by these actors. While this may be implicitly implied in existing research on ES ecosystems, it has not been explicated and formalized.

Moreover, the study of implementation of role-oriented ESs contributes to our understanding of how the predefined roles may be tailored to fit roles in individual organizations through tailoring for role specialization or tailoring for role narrowing. The investigation of implementation of role-oriented ESs also contributed to developing an integrated model for how to choose between system and organization as basis for ES requirements analysis, and between processes and roles as concepts in that analysis. This integrated model contributes to understanding how organizations, systems, processes, and roles can be aligned during ES implementation and extends the current process-oriented view in ES implementation literature.

The investigation of potential benefits of role-oriented ESs and the following integration of the relationship between process fit, individual fit, and role fit contributes to the theoretical understanding of how role-oriented technology may influence organizational performance. The findings thus contribute with empirical evidence and extension of previously suggested benefits of role-oriented ESs. The findings also contribute to expanding the notions of fit not captured by existing fit theories, such as TTF. The inquiry into role-related misfits contributes to understanding the imposition misfits that are inherent to the role-oriented approach and the deficiency misfits that may be remedied. The classification of role-related misfits of role-oriented ESs thus contributes to a theoretical classification of the misfits that may arise when orienting ESs, and technology in general, towards roles. The findings thus contribute to formalizing previous suggestions of role-related misfits in the literature. Moreover, the proposal for how to remedy the role aggregation misfit as a deficiency attributable to the embedded approach for representing roles in deep structures of systems exemplifies how deficiency misfits may be addressed, and also provides suggestions for how Personas can be integrated with roles as an independent concept. This proposal thus contributes to bridging organizational theory which conceptualizes individuals in organizations as roles, with HCI and CSCW literature which traditionally conceptualizes users through user models.

Finally, the study of role-oriented ESs also contributes to extending the very perception of how roles are formed. The suggested extension of system roles as influencing the perceived role of the focal person thus demonstrates how technology may directly impact the role taking process in organizations. This extension thus contributes to established organizational role theory by extending the theory from which the dissertation draws its theoretical understanding of the concept of organizational roles.

5.2.2 Implications for practice

As the dissertation was inspired by and has drawn its findings from the study of practice, it seems appropriate to attempt to contribute back to practitioners by highlighting some of the findings that may have implications for them. Although ES *vendors* that already have or are contemplating orienting their ESs towards organizational roles or including predefined system roles in their systems have undoubtedly given considerable amounts of thought to how to represent the role concept, they may still learn something from this dissertation. The distinction between modeling roles as embedded or independent concepts and subsequently representing the roles at the user interaction level through either a unified or a componentized approach should be considered explicitly before embarking on designing role-oriented ESs. ES vendors that have already designed role-oriented ESs and are selling them may find the classification of imposition and deficiency role-related misfits interesting and use the classification to identify misfits that can be addressed (deficiencies) and misfits that are inherent to role-oriented ESs (impositions). Moreover, vendors may be pleased to find that the findings in this dissertation explicate how role-oriented ESs contribute to organizational performance. Finally, the vendors may learn from the study of version transitioning when developing strategies for releasing new versions of their ESs into their ecosystems.

Implementation consultants may find the integrated model for aligning organizations, systems, processes, and roles particularly useful. The proposal of moving between different bases and foci in the requirements analysis may provide consultants with the option of beginning their requirements analysis in the combination of basis and focus that best suits a particular implementation context and client organization, and then move on from that point. Implementation consultants may also want to pay attention to the different types of role-related misfits to identify candidates for the misfits among the users early in the implementation project. Finally, consultant companies (VARs) may be inspired by the strategy of developing a “catalogue” of customized roles for reuse across implementation projects.

To the *customer* organizations, this dissertation illustrates the potential benefits they may gain from selecting and adopting role-oriented ESs. Specifically, the findings suggesting a reduced need for training of novice ES users when introduced to role-oriented ESs may be appealing to organizations with many novice ES users. However, customers adopting role-oriented ESs should be aware of the effects of role narrowing and inhibition of organizational role transition. Similarly, customers with certain industry-specific roles should also ensure that the selected role-oriented ES support roles in their industry vertical if they want to avoid role specialization misfits and gain full potential of the role-oriented approach. Finally, customers may want to consider the possibilities of using predefined system roles as inspiration for “designing” organizational roles, but should be aware of how predefined system roles influences the role taking process in their organization.

5.3 Suggestions for future research

While this dissertation contributes to the understanding of role-oriented ESs, further research aimed at validating, falsifying, and extending the findings is needed to further our understanding of the emergence of role-oriented IS artifacts.

This dissertation has primarily drawn its findings and conclusions from the study of two ES vendors. Future research should investigate other approaches to designing role-oriented ES, both theoretically and empirically. The indication that role-oriented ESs are one step towards more personalized, user friendly, and user-oriented ESs also calls for additional research into how personal preferences can be reflected in the design and subsequent tailoring of the systems as they are altered through the ES life cycle.

The identified benefits and misfits of role-oriented ESs need to be extended and validated. For example, usability evaluation studies of the concept of syndicating tasks into different user interfaces based on organizational roles would provide a complementary research design to triangulate the findings on use of role-oriented ESs. Furthermore, future studies should aim at measuring the *degree* of impact of the identified benefits and role-related misfits of role-oriented ESs. Additionally, while the findings in the dissertation provide some suggestion for how role-oriented technology may impact organizational performance, studies with a clearer focus on the financial implications are needed, to gain insight into the monetary aspects of role-oriented ESs. Moreover, the dissertation has only superficially addressed the fit between role-oriented ESs and different *types* of organizational roles. Future research may thus seek to investigate if and how benefits and misfits of role-oriented ESs vary between different types of roles. Such studies would also benefit from including longitudinal components to provide additional understanding of the long-term impact of role-oriented systems in organizations – especially their impact on the process of role taking and role transition.

Finally, this dissertation has been focused on role-oriented technology in an organizational context, but extension of the research to other areas of the IS field is needed to identify the possibilities and limitations of role-oriented IS technology in general, such as the everyday use of ISs. Such research could ask: How can everyday roles of people be represented in ISs? How can user roles be represented to reflect unified interaction across different systems? And how does role-oriented technology with predefined system roles influence how we perceive our own responsibilities and the responsibilities of others?

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Appendix A: Abbreviations and acronyms

ASP	Application Service Provider
ATO	Asset turnover
BOM	Bill-of-materials
BWW	Bunge-Wand-Weber
CBS	Copenhagen Business School
CIM	Computer Integrated Manufacturing
CRM	Customer Relationship Management
DIKU	Department of Computer Science at Copenhagen University
EAI	Enterprise Application Integration
EP	Enterprise Portal
ES	Enterprise System
HRMS	Human Resource Management System
HTF	Danish National Advanced Technology Foundation
ICS	Inventory Control System
IS	Information System
ISV	Independent Software Vendor
ERP	Enterprise Resource Planning
GTM	Grounded Theory Method
MAPICS	Manufacturing, Accounting and Production Information, and Control System
MDCC	Microsoft Development Center Copenhagen
MIS	Management Information System
MPC	Manufacturing Planning and Control
MRP	Materials Requirement Planning
MRP II	Manufacturing Resource Planning
NDA	Non-disclosure agreement
NWBC	NetWeaver Business Client
PC	Personal Computer
PNBF	Perceived net benefit flows
RBAC	Role-Based Access Control
ROA	Return on assets
ROI	Return on investment
RTC	Role-Tailored Client
SaaS	Software-as-a-Service
SCM	Supply Chain Management

SDLC	Software Development Life Cycle
SME	Small and medium enterprises
SOA	Service-oriented architecture
TCO	Total cost of ownership
TTF	Task-Technology Fit
VAR	Value-Added Reseller
Y2K	Year 2000

Appendix B: Paper I

Strategic Management of Network Resources: A Case Study of an ERP Ecosystem

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Abstract

This paper applies the resource-based view (RBV) theory to a case study aimed at identifying the complementary resources among partners in the ERPCorp[6] ecosystem of development and implementation of Enterprise Resource Planning (ERP) for small and medium enterprises (SMEs) in Denmark. Further, the paper analyzes these resources in terms of being valuable, rare, inimitable, immobile, and non-substitutable in the ERP solutions market. The study found four key complementary resources that contribute to competitive advantage, namely: (1) ERP core product; (2) horizontal add-ons; (3) vertical add-ons; and (4) customer specific add-ons. The paper further examines the potential impact of an ERP vendor's business development strategy that includes changing the ERP solution from a horizontal to a vertical focus, and increasing the partner certification requirements to be part of the ecosystem. The evidence suggests that the strategy, if implemented successfully, maintains competitive advantage for the ERPCorp ecosystem through effectively combining resources and leveraging lock-in and network effects.

Keywords: ERP, Ecosystem, Resource-Based View, Competitive Advantage, Strategic Management

1 Introduction

In the Enterprise Resource Planning (ERP) solutions market for small and medium enterprises (SME), a handful of large vendors as well as a substantial number of smaller local vendors compete for market share. While smaller ERP vendors often operate within a certain industry and therefore possess both the industry insight and

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[6] ERPCorp is used as alias for the actual name of the ERP vendors due to reasons of non-disclosure

knowledge about the relevant enterprise system to take on the task of each implementation on their own, larger vendors that want to sell their solutions to a broader range of industries often enter into partnerships to extend their reach into the market. The network created by these collaborative partnerships between and among firms is sometimes referred to as an ecosystem (Iansiti and Levien 2004; Adner 2006), and this ecosystem as a whole plays a critical role in determining whether the firms, individually or as a network, can be competitive in the marketplace. The paper examines how one of the largest ERP vendors utilizes its network of partners as a key complementary resource that enables the firm to be competitive in the market place. The analysis will focus on the company's operations in Denmark where it enjoys a dominant position in the local ERP market for SMEs.

Previous research in the field of strategic management studies has looked at how firms evolve to obtain and maintain competitive advantage by looking at the firm's business and innovation strategies and applying strategic management theories (Porter 1985; Barney 1991; Mata, Fuerst and Barney 1995; Drucker 2002; Porter 2008). According to Mahoney and Pandian (1992), strategic management studies are influenced mainly by three broadly categorized analytical themes: (1) industrial organization literature, such as Porter's "Five Forces Model", which looks at opportunities and threats with respect to the intensity of competition (Porter 2008); (2) organizational economics, such as first mover advantage (Lieberman and Montgomery 1988); and (3) the resource-based view (RBV) theory, which identifies a particular firm's attributes that impact the firm's competitive position (Barney 1991).

The research in the paper, however, will not apply any of the first two analytical approaches outlined above because the ERP solutions market is considered far from being in its infancy stages (Markus and Tanis 2000), so organizational economic theories like the first mover advantage is no longer relevant in relation to determining competitive advantage. Additionally, although the Porterian view of competitive advantage has made a significant contribution to our understanding of strategic management, it is primarily concerned with the analysis of the competitive environment (Porter 2008) surrounding the company, rather than resources of the individual company.

Therefore, this paper focuses on the third category and aims to contribute to the application of RBV to ERP ecosystems. As more vendors enter the SME market, it becomes increasingly relevant to evaluate the competitive status of ERPCorp's ecosystem. The paper thus attempts to answer the following questions: What are the key complementary resources available in the ERPCorp ERP ecosystem; how are they distributed; how do they enable the ecosystem to obtain competitive advantage; and what is the impact of the current business development strategy to the resources? The paper addresses these questions by identifying and analyzing the key complementary resources in terms of being valuable, rare, non-transferrable, non-substitutable, and inimitable (Wade and Hulland 2004). The paper is structured as follows: (1) an overview of previous research regarding competitive advantage in ERP ecosystems; (2) a description of the methodology; (3) a case study analysis of key resources and discussion of findings; (4) conclusion; and (5) implications for future research in ERP ecosystems.

2 Literature Review

2.1 The RBV theory

According to RBV, a firm has the potential to identify and take advantage of its resources, consisting of assets and capabilities. "Assets are defined as anything tangible or intangible the firm can use in its processes for creating, producing, and/or offering its products (goods or services) to a market" (Wade and Hulland 2004). On the other hand, capabilities, which are repeatable processes that markedly enhance the value of assets through the combination of resources with organizational routines, include managerial and technical skills, as well as systems development or integration processes (Andreu and Ciborra 1996; Wade and Hulland 2004). The firm is able to utilize these resources to create strategies to respond to market forces that shape the competitive environment (Barney 1991; Andreu and Ciborra 1996).

The RBV theory proposes that in order to achieve competitive advantage, managers employ economic rationalities and make strategic decisions towards the development of core capabilities in order to maximize "rent" (Barney 1991; Mahoney and Pandian 1992; Andreu and Ciborra 1996). Wade and Hulland (2004) summarized the various terms used by RBV researchers (Barney 1991; Mahoney and Pandian 1992; Andreu and Ciborra 1996) into six resource attributes: valuable, rare, appropriable, inimitable, imperfectly mobile and non-substitutable to assess the strategic importance of a resource to a firm. A resource is considered valuable when it enables the firm to come up with or implement strategies that improve its efficiency and effectiveness (Barney 1991). "Rarity refers to the condition where the resource is not simultaneously available to larger firms" (Wade and Hulland 2004). Appropriability refers to the potential to generate rent relative to the appropriation of the particular resource, which is difficult to access (Grant 1991). Inimitability prevents competitors from copying the resource (Wade and Hulland 2004). Imperfect mobility and inimitability are distinct attributes, where imperfect mobility is the ability to prevent the transfer or acquisition of a resource between firms and does not refer to copying the resource (Wade and Hulland 2004). A resource is said to be non-substitutable when there are no strategically equivalent substitutes (Barney 1991).

Mata et al. (1995) extend the RBV into the domain of IS resources and differentiates "sustainable" competitive advantage from "temporary" competitive advantage, by arguing that "whether or not a competitive advantage is sustained depends upon the possibility of competitive duplication" (Mata et al. 1995). The analysis of firm resources using decision nodes – whether resources are valuable, heterogeneously distributed and imperfectly mobile – provides a suitable framework to analyze resources in an ERP ecosystem to determine the level of competitive advantage. One shortcoming of using Mata el al.'s (1995) model is that it does not use the same terms in evaluating the resources as used by other researchers in the field. Thus the research in this paper will evaluate resources in terms of being valuable, rare, imitable, imperfectly mobile and substitutable, where the last three impact the sustainability of competitive advantage, and will not evaluate resources in terms of appropriability due to the aforementioned difficulties associated with assessing this dimension.

Critics have also pointed out that RBV does not fully explain the connection between the firm and its environment or industry (Eisenhardt and Schoonhoven 1996; Das and Teng 2000). Indeed, due to the nature of the collaborative partnerships and relationships in an ERP ecosystem, it is essential to account for the influence of interorganizational networks in achieving competitive advantage when applying the RBV perspective. Thus, in order to consider the extrinsic resources available in an ERP ecosystem and identify areas of competitive advantage which can be gained across firms, the RBV theory should be extended to the resources of an ecosystem holistically.

2.2 Resources in strategic ecosystems

Network theory, such as the one advanced by Dyer & Singh (1998), suggests that competitive advantage can be achieved in an ecosystem through a firm's position in the network, without regard to the proximity of the other companies in relation to the focal firm (Gulati, Nohria and Zaheer 2000; Greve 2009). From a network perspective, one firm has intrinsic and extrinsic resources, which can be used by itself or in combination with resources of other firms to achieve competitive advantage (Gulati et al. 2000; Greve 2009). While a network of a firm can itself be referred to as a *network resource* and, as such, can be viewed as both an enabler as well as a constraint (Gulati et al. 2000), network resources are valuable market-based assets that generally fall into two categories: relational and intellectual assets. "[R]elational assets are based on factors such as trust and reputation, the potential exists for any organization to develop intimate relations with customers to the point that they may be relatively rare and difficult for rivals to replicate." (Srivastava, Fahey and Christensen 2001). Intellectual assets are intellectual resources that other firms possess about its competitive environment (Andreu and Ciborra 1996; Srivastava et al. 2001).

Network resources "help a firm **create over and above that of stand-alone products**", (Srivastava et al. 2001) which is often referred to as network effects. Naturally, the firm benefits from this network effect because it enhances the value of its products to its customers since networks "provide a firm access to information, resources, markets and technologies" (Gulati et al. 2000). The firm also becomes more agile and is able to innovate better in a network ecosystem because the firm is able to combine different capabilities from multiple partners (Srivastava et al. 2001; Adner 2006; van Heck and Vervest 2007). However, a firm is potentially susceptible to "lock in" effects (Shapiro and Varian 1999) because a network can "lock firms into unproductive relationships or preclude partnering with other viable firms" (Gulati et al. 2000), thus making it costly to move across network groups.

The strategic management decision to engage in a partnership with other firms is primarily influenced by the benefits from "relational rent", which is defined as "supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of specific alliance partners" (Dyer and Singh 1998). Dyer and Singh (1998) supplements RBV for a better understanding of how firms generate relational rents by effectively managing (1) investments in relation-specific assets, (2) complementary resources and capabilities, and (3) knowledge exchange, through effective governance mechanisms.

Investments in relation-specific assets typically associated with specialized assets have a positive effect on performance and relational rents. However, "[g]iven the fixed-cost-nature of some of investments, alliance partners need to assess whether or not they will make the necessary return on the investment during the payback period or length of governance agreement (e.g., length of contract)" (Dyer and Singh 1998).

Finding complementary resources in other firms is largely dependent on several contextual factors such as strategy and organizational structures that would make some companies preferable over others (Srivastava et al. 2001). Complementary resources and capabilities are "distinctive resources to the alliance, which, when combined with the resources of the partner," bring about desired synergistic effects, thereby resulting in resources for the partners that are "more valuable, rare, and difficult to imitate" (Dyer and Singh 1998).

The ability to engage in knowledge-sharing in a partner network is dependent on a particular partner's absorptive capacity – i.e., "the ability to recognize and assimilate valuable knowledge from a particular alliance partner" (Dyer and Singh 1998). A firm can tap into the intangible resources (e.g., culture, relational assets, intellectual assets) of its partners within and across organizational boundaries to enable it to obtain competitive advantage (Andreu and Ciborra 1996; Srivastava et al. 2001).

However, ecosystems might also be negatively impacted by other complementors linked in the chain, and any firm in the ecosystem needs to track partners as much as the firm tracks its own success (Adner 2006; Fox, Wareham and Cano 2009). Thus, there is a call for an effective governance mechanism to address this need. Dyer and Singh (1998) suggest that self-enforcing agreements (e.g., trust, reputation, goodwill) are more effective governance mechanism over third-party enforcement of agreements (e.g., legal contracts). Its advantages include: avoiding contracting costs associated with third-party agreements, preventing opportunistic behavior that may not all be accounted for in legal contracts, lowering adaptation costs, and the fact that these are not subject to time limitations. Additionally, the informal safeguards are “much more difficult to imitate because they are socially complex and idiosyncratic to the exchange relationship” (Dyer and Singh 1998).

2.3 ERP ecosystems

Particularly in the ERP industry, networks have been studied and referred to in various terms: value chain (Johansson and Newman 2010), value networks (Christensen 2003), hub and spoke (Kude and Dibbern 2009); and ecosystems (Adner 2006; Fox et al. 2009). In the following we use the concept of ecosystem, but draw upon work done using the other concepts. In order to understand the value of the ecosystem, Kude and Dibbern (2009) looked at the impact of organizational coupling (tight vs. loose) to the spoke (i.e., partner network) as the hub (i.e., ERP vendor) tries to leverage technological complementarities. Fox et al. (2009) identified various complementary activities between the ERP vendor (product and channel development) and its partners (sales and implementation) in co-creating value.

Kude and Dibbern (2009) found that when partners make ERP vendor-specific investments, lock-in effects lead to an increased threat of opportunistic behavior by the ERP vendor. In spite of the increased threat, partners tighten the partnership with the ERP vendor instead of pushing for a loosely coupled relationship, due to the relation specific investments (Kude and Dibbern 2009). In fact, they found that “[t]he higher the degree of synergistic specificity between the partners’ technological, commercial, and social capital, the higher is the spokes’ striving for a tight organizational coupling with a certain hub organization.” (Kude and Dibbern 2009).

Competitive advantage using RBV has been applied to the study of ERP and can be explained from the different perspectives of the stakeholders within the ERP system – i.e., vendor, reseller, and end-user (Johansson and Newman 2010). Although suggestions have been made to extend the RBV to include interfirm strategic alliances (ibid.), little research has applied RBV to ERP partnerships using empirical data. Xin

He (2004) proposed a framework to aid in the decision-making process to determine whether the implementation of an ERP solution will provide a competitive advantage, but his approach was from an end-user perspective. While Fox et al. (2009) looked at both the ERP vendor and its partners to identify various complementary activities, they did not look at the implications of these activities to obtaining competitive advantage. Indeed, there is a dearth of literature that applies RBV from either the vendor's or reseller's perspective, or both. This paper on the other hand aims to contribute to the available literature by applying concepts of RBV from the ERP ecosystem perspective, which naturally takes into account the vendor's perspective and the partners in the ecosystem. Moreover, it takes into account the firms as a network of actors that achieves competitive advantage through inter-firm dependencies within an ERP ecosystem.

3 Methodology and data collection

The research presented in this paper utilized a case study of the ERPcorp with embedded case studies (Yin 2008) of other partners in the ecosystem. Data for the case study was primarily collected through semi-structured interviews (Kvale and Brinkmann 2008) and document analysis (Bowen 2009) of corporate documents and websites from both ERPCorp and the partners in the ecosystem. A total of 12 interviews were conducted between November 2009 and November 2010 with two (2) respondents from ERPCorp in Denmark and ten (10) from the seven (7) partners. These partners were selected by means of theoretical sampling (Eisenhardt 1989) to reflect partner differences in terms of: size; focus (horizontal and vertical); relationships with other partners, roles, contribution and key complementary resources to the ecosystem. When coding was applied to the interviews and documents, emphasis was put on uncovering the key components of ERPCorp's business development strategy.

To preserve anonymity of the partner firms as well as their respondents, the study only refers to aliases and unique attributes that would disclose identity of these partners have been omitted from the paper. The firm names and position of the respondents are shown in Table 1.

Table 1. Interview respondents

Firm	Position in Firm	Alias
Vendor	Country marketing manager	CMM- Vendor
	Partner technology advisor	IMM – Vendor
Partner 1	CIO	CIO – Partner 1
	Developer	Dev – Partner 1
Partner 2	Project Manager	PjM – Partner 2
Partner 3	Chief Consultant	CC – Partner 3
Partner 4	Product Manager	PM – Partner 4
Partner 5	Product Manager	PM – Partner 5
	Project Manager	PjM – Partner 5
Partner 6	CEO	CEO – Partner 6
	Product Manager	PM – Partner 6
Partner 7	CEO	CEO – Partner 7

The analytical work started with identifying the types of partners in the ecosystem and the relevant background of the network relationships. Following this, the key complementary resources of the partners in the ecosystem were identified through key contributions of each partner type in the ecosystem to the final ERP solution. Consecutively, the authors individually examined the attributes of the resources in RBV terms – i.e., whether they were valuable, rare, imitable, imperfectly mobile and substitutable to each of the key resources in the ecosystem – to determine the competitive situation for the complementary resources both individually and for the final ERP solution as a whole. Finally, the key components of ERPCorp's business development strategy were outlined and analyzed to determine its potential impact on the attributes of the key complementary resources in the ecosystem.

4 Case study: Analysis and discussion

ERPCorp is a major global player offering ERP products for SMEs all over the world and saw an opportunity to expand its portfolio of applications when major ERP players started a period of consolidation in the early 2000s (Jacobs and Weston 2007) by acquiring other companies with core competencies in developing ERP. Through these acquisitions, ERPCorp also acquired a partner network with a long history of inter-firm relationships as well as a solid customer base within various industries.

ERPCorp does not sell its ERP solution directly to customers but offers it through partners. ERPCorp is dependent on these partners to distribute and implement these solutions to the SME customers (see Figure 1). ERPCorp provides its partners with a software development kit (SDK) to extend and customize the ERP core product. The specific roles of each of the partners in the ERP ecosystem will be discussed in depth below.

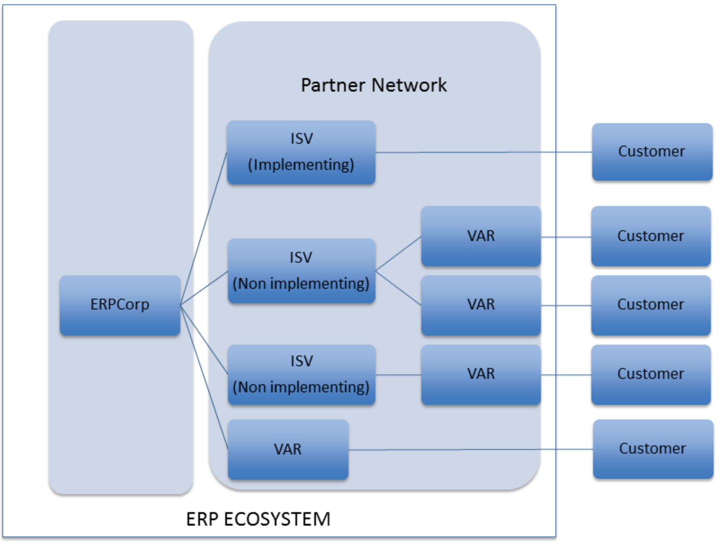

Figure 1. The ERPCorp ecosystem structure

4.1 ERPCorp's key complementary resource

The key resource that ERPCorp contributes to the ecosystem is the *ERP core product* which includes, among others, the architecture of the system and the data model. The ERP core product is valuable to the customers because it underpins the value proposition of an ERP system in the first place and is thus a valuable resource for ERPCorp as well because each implementation generates revenue for ERPCorp through the license fees paid by the customer.

The ERP core product is based on a proprietary code that was once considered a rare resource. However, many other vendors have now developed ERP solutions for the SME market that offer functionality that is comparable to ERPCorp's solutions. This indicates that the technology is no longer rare nor inimitable, which is consistent with Mata et al.'s (1995) argument that proprietary technology as a source of competitive advantage erodes over time. Despite this, the proprietary code still guards against transferability of the resource from ERPCorp.

Substitutability of the ERP core product is a matter of degree that is dependent on the needs and attributes of each individual customer. Some SMEs will indeed be able to substitute ERPCorp's solution with an out-of-the-box ERP system using different technology with some modifications. Others may opt to use best-of-breed pre-packaged software solutions from other vendors (Light, Holland and Wills 2001), or a service oriented solution. Thus, the ERP core product cannot be treated as a non-substitutable resource.

4.2 ISV's key complementary resources

ISVs can be either implementing or non-implementing: The former implement their solutions alone at the customer and generate revenue from both selling the licenses for their add-ons and implementing the final ERP solution; on the other hand, the latter join up with a Value Added Reseller (VAR) that implements the add-ons of the ISV and the final ERP solution. The implementing ISVs possess the same key complementary resources as the VAR, as discussed in more detail below.

ISVs extend the functionality of the core ERP system by developing add-ons that can be reused by a number of customers. These add-ons can broadly be divided into two types: horizontal and vertical. *Horizontal add-ons* are general functional extensions of the core ERP systems that can be reused across many different industries – e.g., payroll, on-line banking, or project management. *Vertical add-ons* are functional extensions applicable to specific industries – e.g. fashion or media.

Thus, an ISV typically possesses two key complementary resources (horizontal add-ons and/or vertical add-ons) which are valuable because of their potential to address the customers' functional requirements. With regards to rarity, the researchers found several examples of ISVs with vertical add-ons that offer unique functionalities not covered by other add-ons. However, functionalities provided by some ISVs were also available in add-ons offered by many competing ISVs, thus lessening the rarity of add-ons.

Imitability-wise, developing vertical add-ons requires substantial knowledge of the relevant industry an ISV caters to, so there are higher barriers for both ERPCorp as well as for competing ISVs to imitate vertical add-ons. However, horizontal add-ons have proven to be imitable and transferable solutions because, on numerous occasions in the past, many functional areas which started out as horizontal add-ons developed by ISVs were later incorporated into the ERP core product either through imitation or acquisition. Moreover, although the code base for the add-ons is protected by copyright and licensing agreements that guard against immediately transferring a resource, an ISV has the option of leaving the ERPCorp ecosystem taking the add-ons with them. However, we have not been able to find examples of ISVs that have left the ecosystem altogether in favor of another ecosystem, primarily we suspect that this is due to the huge transaction involved in leaving the 'gated walls' of one ERP-vendor ecosystem. ISVs are also free to offer add-ons that fit with other ERP vendors' solutions.

The question of substitutability of the horizontal and vertical add-ons largely depends on the same arguments as those of the ERP core product discussed above. Considered in isolation from other resources in the ecosystem, both horizontal and vertical add-ons can be substituted by customizations at the individual customer level. Additionally, a certain industry with special needs for a particular functionality can often substitute a vertical add-on with a system dedicated to handling that functionality (Light et al. 2001).

4.3 VAR's key complementary resource

A VAR sells and implements the final ERP solution at the customer site. The VAR either implements the ERP core product alone or collaborates with one or more ISVs to implement their add-ons on top of the ERP core product. An ERP implementation typically requires the configuration of the system to fit the needs of a customer but, often, additional customization has to be implemented to meet customer requirements. Hence, *customer-specific customization* was identified as the valuable key complementary resource of a VAR.

The additional customization done by the VAR requires substantial insight into the organization and business processes of a specific customer, as opposed to an ISV that develops add-ons that can be reused at a number of customers. Although the VAR can sometimes reuse parts of a customization created for one customer when customizing for another customer, the close tie between customization and customer entails distinct functionality of most customizations, which adds to the rarity of the resource.

As with the ERP core product and the add-ons, the customer-specific customizations are protected through license agreements and copyrights and hence not immediately transferrable to other firms. However, like the ISVs, the VAR has the option of leaving the ecosystem or joining up with another ERP vendor, where we have found examples of the latter (Partner 3). Moreover, the substitutability of the customer specific customizations as a resource is primarily dependent on whether a horizontal or vertical add-on exists that can substitute the need for customization. Other customers, for various reasons, choose to change their business processes to adapt to the system instead rather than having the ERP solution customized (Light et al. 2001).

The VARs have a long history of business relationships and strong ties with many of their customers and continue to implement upgrades and additional customizations after the initial implementation. This business relationship between the VAR and their customers reduces the risk of other firms imitating the resource (Barney 1991). Notably, some relationships have even gone personal. As ERPCorp's country marketing manager put it: "There are a lot of partners that have been in this market for 20-25 years…They have around 50 customers that they know inside out. They know the name of [the customer's] wife and their children and know where they live."

Table 2 summarizes a cross-section of partner roles, size, vertical and horizontal focus and collaboration partnerships.

Table 2: Various Roles and Relationships in the ERPCorp Ecosystem

Company alias	Partner type	Size	Solution focus		Collaboration	
			Vertical	Horizontal	Partners	Vendors
Partner 1	Implemen-ting ISV	30	Production, Trade, Service, Education, and Retail	Payroll, Online-banking, Transportation, and Market info	Several VARs	No

Partner 2	VAR	20	Production and Media services	-	Several ISVs	No
Partner 3	Implemen - ting ISV	250	Textile and Retail	Project management and some minor add-ons	Other ISVs and VARs	Yes
Partner 4	VAR	100	Life science and Warehousi ng	-	ISVs	No
Partner 5	Non-implemen -ting ISV	60	Furniture and fashion	-	One VAR (Partner 6)	No
Partner 6	VAR	60	Furniture and fashion	-	One ISV (Partner 5)	No
Partner 7	VAR	5	Medical, Food and Production	-	No	No

5 Competitive advantage of the ERPCorp ecosystem

The data reveals four (4) key complementary resources in the ERP ecosystem that contribute to a final ERP solution, as follows: ERP core product; horizontal add-ons; vertical add-ons; and customer specific customizations. Table 3 summarizes the analysis of each resource attribute in terms of being valuable, heterogeneously distributed, imperfectly mobile, and inimitable.

Table 3: Attributes of the key complementary resources of the ERP ecosystem

Resource attribute	**ERP core product**	**Horizontal add-ons**	**Vertical add-ons**	**Customer specific customizations**	**Final ERP solution**
Resource location	ERPCorp	ISV (Implementing and Non-implementing)	ISV (Implementing and Non-implementing)	VAR or Implementing ISV	Ecosystem
Valuable	Yes	Yes	Yes	Yes	Yes
Rare	No	No	Yes	Yes	Yes
Imperfectly mobile	No	No	No	No	No
Inimitable	No	No	No	Yes	Yes
Non-substitutable	No	No	No	No	No

The complementary resources identified as core resources for the ecosystem each contribute value, taken separately or in combination with the others, to create a final ERP solution. While neither the ERP core product nor the horizontal add-ons are rare resources, both the vertical add-ons and the customer specific customizations show characteristics of rareness so the final ERP solutions that contain either vertical add-ons or customer specific customizations, or both, can be considered as a rare resource for the ecosystem as a whole.

The customer-specific customization resource is inimitable by firms outside the ecosystem due to the historical development of the relationship between the customer and the company implementing the ERP solution. However, each of the complementary resources can either be transferred out of the ecosystem or substituted to some degree and can hence not be considered as imperfectly mobile. As long as the main complementary resources are at risk of being substituted or transferred out of the ecosystem the final ERP solution cannot be characterized as perfectly immobile and the competitive advantage thus cannot be sustained from a resource based perspective. Thus, the ecosystem currently enjoys a temporary competitive advantage for their final ERP system through the successful combination of key complementary resources.

6 ERPCorps's business development Strategy and its impact

The collaborative ecosystem, wherein ERPCorp and its partners operate, creates mutually beneficial relationships which serve to highlight the fact that these firms are mutually dependent on each other and need the respective networks they have established in order to continue to thrive. For its part, ERPCorp strategically manages complementary network relationships to take advantage of their distinct core competencies in order to maximize relational rents and has devised a partner network strategy to communicate changes in its certification program for its partners. Perhaps recognizing the need to focus more on vertical specialization to remain competitive in the market, ERPCorp is incentivizing its partners to move away from horizontal focus towards vertical focus. According to ERPCorp's country marketing manager: "We want partners that focus on improving themselves and specialize within specific verticals and within certain competency areas." ERPCorp has also changed the certification requirements to include a certain number of employees in the partner firms to be certified. This effectively means that all partners below a certain size will no longer be able to meet the requirements for certification and hence no longer be able to sell the solutions.

The partner certification program is aimed at improving partner skills in marketing, sales, leadership, management and technical qualifications, as well as providing best practices and processes. ERPCorp is providing the partner with tools and resources that is targeted toward partner growth and profitability. These include (1) vertical segment investments (e.g., providing pool of resources with channel expertise, public relations, and joint advertising investments with industry focus); (2) access to partner financing to help partners grow; (3) implementation methodology training; and (4) tools (e.g., tools that allow partners to benchmark their performance against strategic and operational key performance indicators). In return for a catalogue of standardized services, ERPCorp is encouraging its partners to invest in vertical add-ons and increasing the partner certification requirements.

The push towards vertical investments show that ERPCorp is maximizing the network effects that it can gain from the partners' specialization efforts and hope to mutually benefit further from the complementary relationship. The firm and its partners benefit from the complementary relationship that is derived from complex interactions among multiple elements within a network of organizations through co-specialization (Mata et al. 1995; Ennen and Richter 2010). This also shows that the relation-specific investments enhance the ability to integrate vertically and improve on proven repeatable solutions that its partners create.

In the partner certification program, various relation-specific investments and knowledge-sharing efforts are emphasized. Partners can achieve different degrees of certification depending on how many requirements they meet. A higher level of certification provides access to more benefits for the partners and only certified partners are allowed to sell and implement ERPCorp's solutions. Additionally, by encouraging its network partners to increase in size, larger partners are empowered to compete for the market share of larger implementations without losing their dominance in the SME market at the same time increasing efficiencies for ERPCorp by reducing associated costs with managing the partners. According to ERPCorp's executive, the firm currently works with approximately 100 partners, many of whom are companies comprising of 10-15 employees each in Denmark, which means that the increased requirement can have a significant impact to a possible reduction in number of partners in Denmark.

The partner certification program also strengthens the ties with ERPCorp's partners through investing in relation-specific investments, knowledge exchange and complementary resources and capabilities. Additionally, partners are inclined to make relation-specific investments when they foresee that the increased efficiencies gained through inter-firm exchanges in terms of volume and breadth or transactions (Dyer and Singh 1998).

As summarised in Table 4, the potential impacts of ERPCorp's strategic decisions based on the key complementary resources previously identified and analyzed are outlined below.

Table 4: Impact of business development strategy to key complementary resources of the partner ERP ecosystem

Resource Attribute	**ERP core product**	**Repeatable vertical add-on**	**Customer specific customization**
Resource location	ERPCorp	ISV (Implementing and Non-implementing)	VAR or Implementing ISV
Valuable	Yes	Yes	Yes

Rare	Enhance core ERP system with relation-specific investments that allows partners to develop vertical and customizable solutions	Yes	Yes
Imperfectly Mobile	Keep in-house	Lock-in effects from relation-specific investments tied to the ERP core product	Lock-in effects from relation-specific investments tied to the ERP core product
Inimitable	Network effects - harder to imitate an ERP solution with a strong partner network that delivers a highly vertical and customized ERP solution	Network effects - harder to imitate a highly vertical solution that is locked-in to a technology with a long history to its network	Network effects - harder to imitate a highly vertical and customized solution in market that is locked in to a technology with a long history with its network and customers
Substitutability	Network effects - harder to substitute an ERP solution with a strong partner network that delivers a highly vertical and customized ERP solution that is locked-in to a technology with a long history to its network	Network effects - harder to substitute an ERP solution with a strong partner network that delivers a highly vertical and customized ERP solution that is locked-in to a technology with a long history to its network	Network effects - harder to substitute an ERP solution with a strong partner network that delivers a highly vertical and customized ERP solution that is locked in to a technology with a long history to its network

ERPCorp will be able to maintain a competitive advantage with their ERP core product if it continuous to invest in improving its products further to increase the value and rarity of the ERP core product. However, sustainable competitive advantage is dependent on whether ERPCorp is able to guard itself from imperfect mobility, imitability and substitutability of all the key complementary resources. The mobility of the ERP core product itself is mainly dependent on whether or not ERPCorp wants to keep the competency in-house, sell or transfer this resource to another company, as long as ERPCorp's strategy includes building the competency in ERP solutions, they are not likely to sell or transfer this resource to another company. In terms of non-substitutability, ERPCorp cannot completely prevent customers from substituting their product with non-ERP solutions in the market place, but they can still guard against imitability by working closely with its partners to obtain a competitive advantage by developing a product that leverages network effects. Thus, imitability of the resource is dependent on how ERPCorp manages its relationship with its partner network, which serves as the first "customer" of the product. In terms of providing a value to the customers, the ERP solution created by the combination of ERPCorp's core product, combined with highly vertical add-ons and customization will create a product that will be harder to imitate and substitute.

Not only is the ERP solution inimitable, the relationships between ERPCorp and various partners in the ecosystem is also harder to imitate and substitute by competing ERP vendors. ERPCorp will also need to strengthen this relationship with its partners by intensifying the complementarity and relational rents that partners gain from the network collective efforts of the ecosystem. ERPCorp needs to incentivize its partners to continue to make relation-specific investments, so that the ERP ecosystem can achieve a sustainable competitive advantage. By using ERPCorp's business development strategy to require partners to make relationship-specific investments in verticals and increase in size, ERPCorp is in effect taking advantage of lock-in effects to ensure imperfect mobility of the key complementary resources controlled by its partners in the ecosystem.

One risk with the new strategy is that the increased certification requirements may lead to a loss of partners that were not supposed to be eliminated from the ecosystem. These partners may decide to leave the ecosystem by selling off their businesses or moving to another vendor, which also impact imperfect mobility of the vertical add-ons. Interestingly, Kude & Dibbern (2009) found that as focal firms tighten control, spokes tend to also tighten their partnership with the hub. In addition to this, we found that: "Just like ERPCorp tries to tie our employees to them through personal certification […] likewise do we try to tie in the customers by saying, watch out for the big bad ERPCorp", says CIO – Partner 1. Although the full impact of the strategy will not be determined until the certification period ends, we can deduce from the intentions of the respondents we interviewed with that this might not be a big problem.

7 Conclusion

To analyze ERPCorp's business development strategy, the RBV theory proved useful in identifying the key complementary resources and their distribution within the ecosystem that enables the firm to sustain competitive in ERP solutions market for SMEs in Denmark. The analytical framework showed that the partners in the ERPCorp ecosystem collectively take advantage of network effects to create an ERP solution that is valuable, rare and imperfectly mobile.

More specifically, the ERPCorp experience highlights the importance of having a clear partner strategy to develop stronger partner relationships in an ERP ecosystem, incentivized by relational rents to accelerate the pace of growth and innovation. Notably, the study showed that ERPCorp's business development strategy of increasing the requirements for its partners to be "ERPCorp-certified" actually increased the value of the ecosystem as a whole. The use of a certification program provides ERPCorp with a governance mechanism and control of its partners, which allows it to selectively affiliate itself with the partners who are complementary and aligned with its strategy. ERPCorp's partners are able to co-brand with the firm for more effective marketing and advertising purposes and tap ERPCorp for additional resources in the form of KPI tools, training, and optional financing, to help them reach their respective goals. The overall relationship encourages knowledge sharing to be transferred between ERPCorp and its partners in the ecosystem to help maximize relational rents.

What is commendable in ERPCorp's business development strategy is that even though the firm is already a dominant player in the SME market, it still endeavors to effectively combine and leverage both its intrinsic and extrinsic resources in order to improve on the ERP core product and differentiate itself from other competing ERP vendors. By encouraging its partners to make relation-specific investments, ERPCorp augments its ERP core product with a vertical and customizable solution that is harder to imitate. Requiring the partner network to have a stronger vertical focus using its ERP core product also creates a lock-in effect and dependency on the firm. As a result, the firm ensures that resource-specific investments will continually be built on its ERP core product and that the vertical and customized solutions will not easily be transferrable to another vendor.

However, as Achrol and Kotler (1999) pointed out, one of the disadvantages of the approach chosen by ERPCorp is that it creates a large and vertically integrated hierarchy that may be over-committed to specialized structures both upstream and downstream. The potential inefficiency engendered by this hierarchy and mode of governance may indeed impede ability to adapt to change, which is critical in the knowledge-rich ERP environment, or at least make change costlier and/or slower. ERPCorp may be willing to take on the risk because it believes that the market is mature enough and that the risk is outweighed by the increased efficiencies to be gained through the arrangement. If ERPCorp's bet is correct, this business development strategy that leverages multiple partners with a long history with its network, as well as its customers, will create a total ERP solution that is locked-in to ERPCorp's ERP technology, highly vertical, and highly customized for SME customers – thereby yielding higher relational rents for the entire ERP ecosystem.

The degree of substitutability is still dependent on the customer's needs, however it is important to note that the lock-in effects to a customer base that is already using ERPCorp's technologies is high and that it is unlikely for them to substitute with another product. The attribute of the firm's products are more important to new customers, such that ERPCorp is able to increase its value proposition by making their products highly vertical and customized using the ecosystem. The risk of substitutability can be minimized but cannot be eliminated, primarily because there is a wide range of substitutes available in the market especially for information systems.

8 Contributions and implications for future research

This paper contributes to the strategic management field through illustrating the application of RBV to an ERP ecosystem by identifying key complementary resources across roles of the firms within the ecosystem. Moreover, it illustrates how these firms can collectively leverage resources to obtain competitive advantage, and how an ERP solution can be diffused using various partner relationships.

The presented research further contributes to the work by Kude and Dibbern (2009) by presenting indications that as the focal firm tightens the control of the partnership, partners tighten the relationship with their customers. This paper also presents a unique opportunity to document a strategy and assess potential impact to key complementary resources, ex ante.

As the research was conducted at the beginning of the transition, it may not have fully identified consequences from the strategy. For instance, while ERPCorp hopes that its partners will be pushed into mergers and acquisitions among the partners, we found examples of partners that would prefer to leave the ecosystem instead of merging with other partners. Future research will have to be made during and after the implementation of the strategy to determine the full impact. Due to the emergent nature of the findings from a single case study in a single region, future research should look into possibilities of applying some of our findings and extending them across national boundaries and other ERP ecosystems.

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Appendix C: Paper II

Version Transitioning of Enterprise Systems in Software Ecosystems: A Grounded Theory

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Abstract

This paper presents an emerging theory of version transitioning from an old to a new version of a pre-packaged enterprise system among consultant companies in a software ecosystem. The emerging theory proposes the key categories of Perceiving, Pushing, Implementing, and Increased experience as stages in the transition process, and the categories of Technology impact, Supplier impact, Customer impact, Strategy impact, and Market impact as key contextual categories impacting the transition process. The emerging theory proposes an iterative nature of the transition process in which each stage in the process is undergone multiple times by the consultant companies. The integration of the emerging theory with existing adoption and diffusion theories provides an initial step towards a formal theory of version transitioning in software ecosystems.

Keywords: Grounded theory, enterprise systems, software ecosystems, implementation consultants, adoption, diffusion of innovations

1. Introduction

While early implementations of enterprise systems in the '80s and '90s relied on development by a software vendor to fit the individual company, pre-packaged enterprise systems have now become dominant within the past decade [1]. In tandem, the delivery model of enterprise systems is increasingly evolving from two-party (vendor-customer) configurations to loosely coupled networks [2], also referred to as software ecosystems [3].

These ecosystems typically consist of a vendor, also referred to as a keystone [4] or a hub [5], which develops the core of the enterprise system, and a number of partners, also referred to as niche players [4], or spokes [5], who deliver a range of products and services complementing the core system delivered by the vendor [6]. Among the services delivered by the players in an ecosystem is consultancy on the implementation of the enterprise system at the customer organisation which includes solving problems, offering related and required knowledge, assisting with configuration, and deriving value from the enterprise system package [7]. The implementation consultants performing these services are thus an important part of the ecosystem, and previous research suggests that having competent implementation consultants is among the critical success factors for successful implementation of enterprise systems [8, 9].

Furthermore, the inter-linked nature of ecosystems suggests that the success of adoption of innovations in the ecosystems is dependent on adoption of all actors in the ecosystem rather than adoption at any single actor [4]. Previous research has addressed multiple perspectives of enterprise software ecosystems, including the motivation for forming the partnerships [2], coupling and control [5, 10], value creation [6], and competitive advantage [11; Anonymous, 2011].

However, not much research has addressed the process of adoption of new versions of enterprise systems packages released by the vendor into the ecosystems, which precedes the implementation of enterprise systems in customer organisations. Therefore, this paper investigates the transition to a new version of a pre-packaged enterprise system in an ecosystem of a large software vendor for the purpose of uncovering the paths in the transition process from the perspective of the implementation consultants.

The paper is structured as follows: 1) background presentation of the research setting; 2) methodology of the research; 3) the emerging theory; 4) the emerging theory in the context of the research; 5) discussion of the findings and theoretical integration; 6) conclusions; and 7) implications for practice and future research.

2. Background of the research setting

The enterprise system vendor in the study is a major global player in the market for enterprise systems. The vendor followed the consolidation of the enterprise systems market in the early 2000's [12] and acquired a number of enterprise system solutions resulting in a portfolio of systems primarily targeted at small and medium enterprises (SMEs). The vendor releases a new major version of its enterprise systems approx. every 2-3 years, and so-called service packs with bug fixes and other improvements are sometimes released in-between the major releases. The particular enterprise system in vendor's portfolio included in this study has gone through six major releases.

The vendor sells and implements the enterprise system only through an ecosystem of partner companies, and the partner companies thus handle all implementations in customer organisations. The partner companies can broadly be categorised into two different types: Independent Software Vendors (ISVs) and Value Added Resellers (VARs).

The ISVs develop reusable software modules for the enterprise system, called 'add-ons'. There are several hundred add-ons available that complement the core enterprise system in areas ranging from generic horizontal functions such as payroll, online banking, and shipping to specialized vertical solutions such as education, veterinary medicine, legal companies, and furniture manufacturing. Any individual or community with a developer license can extend the enterprise system and develop add-ons, but only add-ons that are developed by certified partners and have undergone quality assurance are listed as official add-ons on the vendor's website. The vast majority of add-ons are thus developed by certified ISV partners. Nearly all implementations in customer organisations include one or several add-ons to complement the core enterprise system package. The business model of the ISVs is thus to sell licenses for the add-ons to customers through the VARs, who in turn get a share of the license fee.

The consultants at the VAR companies take on the implementation of the pre-packaged enterprise system at the customers. The consultants make customisations to the enterprise systems by request from the customers but, unlike the ISVs, the customisations are customer specific and seldom reused across different customers. The VARs generate the majority of their revenue from invoicing the time spent on implementation and customisation, and only a smaller part of their revenue is generated from getting a part of the license fee. On a typical implementation of the enterprise system only 1-2 consultants are involved, depending on the amount of customisation needed. Some of the partner companies have characteristics of both an ISV and a VAR, meaning that they develop reusable add-ons which they sell to VARs, and they have a staff of consultants implementing the enterprise system together with the add-ons from themselves. Figure 1 illustrates the different value chain paths of the players in the ecosystem.

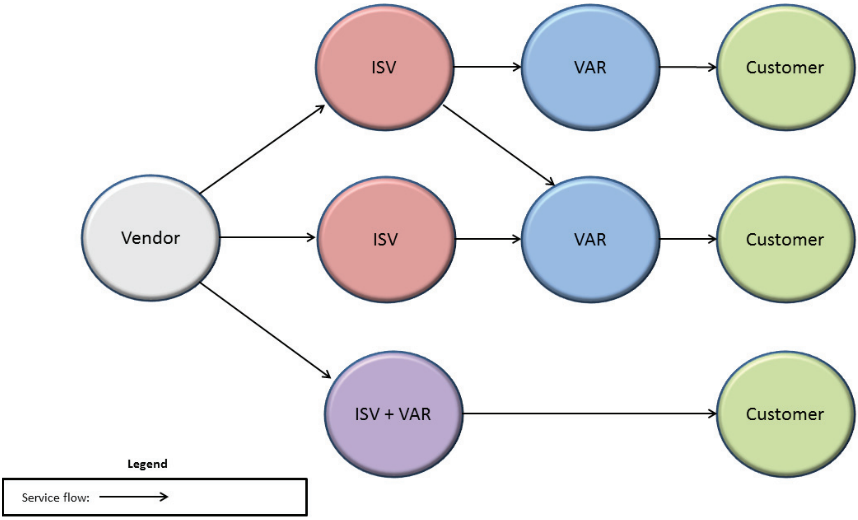

Figure 1 - Value chain of the software ecosystem

3. Methodology

The study was carried out using a Grounded Theory approach [13] as the frame for data collection and analysis. Grounded Theory is a 'data centric' inductive methodology for analysing (primarily qualitative) data for the purpose of building or extending theory [14], and the method has been evolved and applied to multiple research studies in the field of information systems [15].

The method stands out from many other research methods by emphasising that researchers rid themselves of theoretical pre-conceptions about the area of inquiry and that theory should *emerge* from the data – not through deduction or hypothesis testing [16]. The substance of this tenet has fuelled debate, not only among researchers using the method, but also between the two founders of the method, concerning the risk of forcing theory from the data instead of allowing the theory to emerge [17]. The details of this debate is beyond the scope of this paper, but the implications forces a stance on the use of existing theoretical literature in the study. The approach to existing literature in this study was a 'middle of the road' approach, where a general orientation within the literature of adoption of technology and diffusion of innovations was present prior to the analysis of the data, but no pre-existing theoretical constructs were forced on the data. A detailed comparison with existing literature was not conducted until after the emerging theory was present.

Urquhart et al. [18] provides five guidelines for conducting Grounded Theory in the IS field: Constant comparison; Iterative conceptualisation; Theoretical sampling; Scaling up; and Theoretical integration. Besides providing a guide and support for IS researchers embarking on conducting Grounded Theory, the five guidelines also explicate the essence of the method.

Constant comparison is the process of constantly comparing instances of data to a particular concept or category for the purpose of exposing theoretical properties of the concepts and categories. This guideline was followed by constantly comparing all the coded instances of data to other coded instances of data.

Iterative conceptualisation suggests that researchers should increase the level of abstraction and relate categories to each other to expose the different relationships between theoretical constructs. This should be done through the process of *theoretical coding* [19], or axial coding [14]. This guideline was followed by going through several iterations of the coding process, resulting in the same instance of data being re-coded several times in the iterative process of splitting and merging codes. Furthermore, theoretical memos were written as the analysis progressed and the memos were used for generating theoretical codes used for coding the data and for relating the codes to each other.

Theoretical sampling stresses the importance of deciding on analytical grounds where to sample from as the research progresses [20]. This approach helps *saturate* the categories of the emerging theory and ensures that the theory is actually grounded in the data [21]. This guideline had a significant impact on the research, as agreements with interviewees and consulting companies could not be made prior to initiating the research study, but had to be established as the data analysis played out. Furthermore, the data for the study was collected from respondents in companies of various roles in the ecosystem, different sizes, and with various degrees of experience with the new version of the enterprise system.

The guideline of *Scaling up* proposes the grouping of higher level concepts into broader themes to help escape the descriptive level of analysis and help contributing to the generalizability of the emerging theory. This process was aided by extensive use of the theoretical memos and by iteratively visualising the emerging theory through the use of diagrams in order to reach a *substantive theory* rather than mere description.

Theoretical integration calls for integration of the developed substantive theory with other theories in the same or similar fields in order to create a *formal theory* [22] that extends beyond the substantive area in which the theory originally emerged. In this study the substantive theory was related to other theories within and outside the IS field by reviewing literature on theory addressing adoption of technology and diffusion of innovations.

3.1. Data collection

Three types of data were collected and analysed as part of the research: Documents; observations; and interviews. Documents, primarily from the vendor, were used in the beginning of the study for gaining background information about the new version and to gain insight into the documented differences between the old and the new version.

Two types of observations were made during the study. The first type consisted of participatory observations [23] where the observing researcher participated in three presentations and four workshops with consultants concerning the new version. The second type of observations came from in-depth experimenting with a demo version of the new version of the enterprise system, provided by the vendor.

All interviews conducted in the research were semi-structured [24] with the initial interview guides being explorative and open-ended, but as the research progressed, the interview guides became more focused on saturating the emerging categories, and thus varied significantly from the initial interview guides. 12 interviews with consultants and managers in the partner companies in the ecosystem were carried out as part of the research. Additionally, two interviews with representatives from the vendor were conducted for three reasons: First, to provide the background information on the ecosystem; second, to saturate concepts and categories based on the principle of theoretical sampling; and finally, to triangulate statements from the interviews with the consultants. A total of 14 face-to-face interviews were carried out between December 2008 and March 2011. Each interview lasted approx. one hour on average, and all interviews were recorded and fully transcribed to allow detailed coding of the data. An overview of the conducted interviews is shown in **Table 2**. Due to reasons of non-disclosure agreements, the country in which the study was conducted is not revealed, and the names of the vendor, partner companies, and respondents are replaced by aliases.

Table 2 - Participating companies in the study

Company alias	**No. of employees**	**Company type**	**Interviewee title**
Partner 1	28	ISV + VAR	CIO
Partner 2	1100 global/250 local	VAR	Unit Manager
Partner 3	50	VAR	Consultant
Partner 4	14	VAR	Chief Consultant

Partner 5	1	VAR	Consultant
Partner 6	39000 global/250 local	ISV + VAR	Product Manager
Partner 7	50	VAR	Chief Consultant
Partner 8	180	ISV + VAR	Consultant
Partner 9	1800 global/80 local	VAR	Product Manager
			Consultant
Partner 10	23	ISV	CEO
			Product Manager
Vendor	90000 global/1000 local	Vendor	Product Marketing Manager
			Partner Technology Advisor

3.2. Data analysis

In following the guideline of iterative conceptualisation, the analysis of the data began after the first two interviews were conducted with the consultant in Partner 3 and the CEO of Partner 10. The interviews were analysed using *open*, *axial,* and *selective* coding [14] and the coding process was aided by the use of the ATLAS.ti software [25]. Open coding consisted of conceptualising the text in the 246 pages of transcripts of the interviews on a line-by-line basis by marking each line, or occasionally a few words, and assigning a particular concept to that piece of data. While during the stage of open coding, theoretical memos were written to stimulate theoretical sensitivity. The process proceeded to the phase of axial coding in which the concepts were grouped into categories and the concepts and categories were related to each other, resulting in a total of 41 concepts in three categories. Finally, the phase of selective coding entailed the selection of core categories to which other categories and concepts were related. After the first iteration of coding, the concepts and categories were far from saturated and many new questions arose.

The collection and analysis of the remaining 12 interviews focused on saturating and extending the concepts and categories by selecting companies and interviewees based on the guideline of *theoretical sampling*. A non-sequential iteration of open, axial, and selective coding continued through the remaining analysis, and by the end of the final iteration of coding, more than a thousand instances of data had been coded into 22 overall concepts in 9 categories, and numerous theoretical memos of various lengths had been written through the coding process. The final concepts and categories included in the emerging theory were discussed with other researchers to improve reliability of the study [26]. The appendix shows the distribution of concepts across categories along with examples of coded data that led to the concepts.

4. The emerging theory

The theory emerging from the analysis of the study revolves around the *version transitioning* that the consultants go through, as illustrated Figure 2. The figure shows the categories and concepts emerging through the analysis of the study and how they interact with each other, and depicts the paths through the *transition process* that the consultants go through every time they are faced with the prospect of selling an implementation of the pre-packaged enterprise system (lower part of Figure 2), and the *transition context* that influences the process, (upper part of Figure 2). The presented categories and concepts are not proposed as being exhaustive, and only the most central and saturated concepts are presented. In the text describing the emerging theory, both concepts and categories are typeset using italics but only categories have their first letter capitalised.

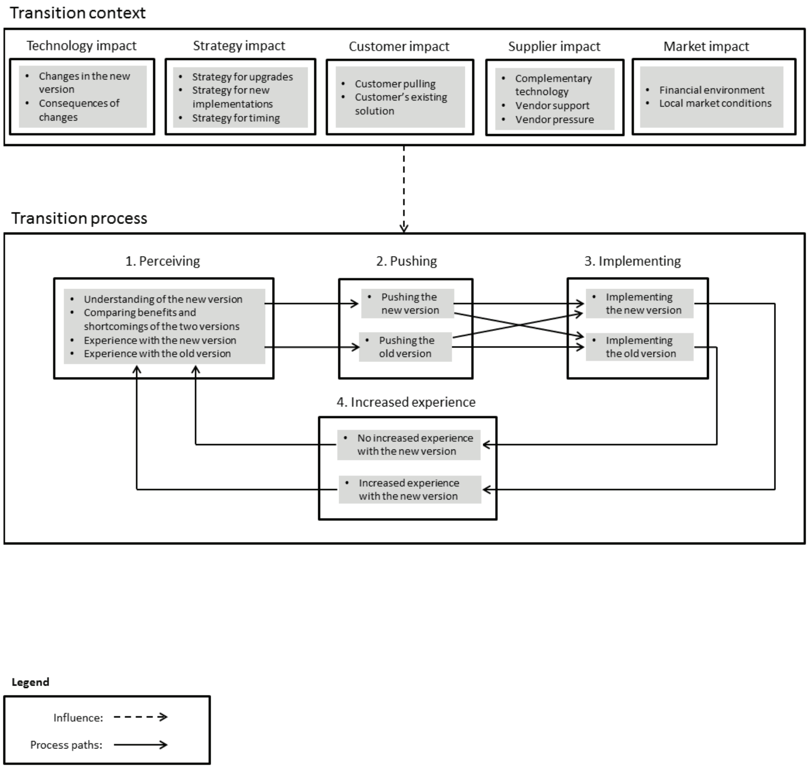

Figure 2 - An emerging theory of version transitioning

4.1. The transition process

The process of transitioning to implement a new version begins with the category of *Perceiving* (stage 1). The category includes the concept of an *understanding of the new version* in which the consultants attempt to understand the changes that have been made in the new version of the pre-packaged enterprise system as compared to the old version. The concept of *understanding of the new version* is closely tied to the concept of *comparing benefits and shortcomings of the two versions* in which the consultants compare advantages of one version over the other in different areas. The concepts of *experience with the old version* and *experience with the new version* conceptualise the consultants' experience with implementing the two versions respectively.

When the consultants face the prospect of selling an upgrade or a new implementation to a customer, the *Pushing* (stage 2) is initiated. At this stage the consultants are either *pushing the new version* or *pushing the old version* when discussing implementation with the customer, depending on the outcome of the *Perceiving* stage.

Once the customer has decided which of the two versions to buy, the process moves to *Implementing* (stage 3) in which the consultants are either *implementing the new version* or *implementing the old version* for the customer. Even though the consultants push one of the two versions at the *Pushing* stage, the customer may still decide not to follow the push from the consultants. The paths from the *Pushing* stage to the *Implementing* stage may thus cross, as illustrated by the crossing of the paths in Figure 2.

Once the implementation is carried out, the consultants go through the stage of *Increased experience* (stage 4). If the consultants were *implementing the new version* in the *Implementing* stage, *increased* e*xperience with the new version* is gained, which in turn influences the *Perceiving* stage at the concept of *experience with the new version*. If the old version is implemented, *no increased experience with the new version* is gained and no influence is exercised on the *Perceiving* stage. On the other hand, if the consultants were *implementing the old version* in the *Implementing* stage, *experience with the old version* is gained and the *Perceiving* stage is influenced at the level of *experience with the old version*, causing *pushing the old version* at the *Pushing* stage.

4.2. The transition context

The transition process is influenced by a number of contextual categories. The category *Technology impact* contains concepts related to the impact of the technology of the new and the old version on the transition process. The concept of *changes in new version* refers to the changes in the technology of the new version in itself, such as architecture and hardware requirements compared to the old version. The *consequences of changes* refer to the derived consequences of the technological changes, such as increased cost of implementation or speed of implementation.

The category of *Supplier impact* reflects influences from the other players in the ecosystem, the vendor and the ISVs, on the transition process of the consultants in the VAR companies. C*omplementary technology* conceptualises the impact relating to the dependence on compatible add-ons of the core enterprise system package. The category also includes the concept of *vendor support*, such as providing formal training for the consultants, service packs, and documentation of the new version. The concept of *vendor pressure* reflects the pressure communicated by the vendor in an effort to persuade the consultants to start selling the new version.

Strategy impact includes the concepts related to the strategies applied by the consultants, which influences the transition process. The concept of *strategy for upgrades* refers to the strategy imposed by the consultants when selling to existing customers that already have a previous version of the enterprise system, and the *strategy for new implementations* refers to the strategy for selling to new customers with another enterprise system or no enterprise system at all. Another central concept of the *Strategy impact* is the *strategy for timing* concerning at what point in time, after a new version is released, the consultants will initially consider selling it to customers.

The *Customer impact* category groups concepts relating to the customers' influence on the transition process. The concept of the *customer's existing solution* denotes any existing solution that a customer may have. The concept influences the transition process, e.g. through the *Pushing category* by determining which of the two versions the consultants try to push. The customers also form and express perceptions of the new and the old version conceptualised as *customer pulling* for one of the two versions, potentially influencing the paths of the transition process from the *Pushing* stage to the *Implementing* stage, as previously explained in the section on the transition process.

The final category influencing the transition process is *Market impact* containing the concepts *financial environment* and *local market*. *Financial environment* reflects influence of the financial climate at any time of the transition process, and *local market* conceptualises conditions in the local market that may impact the transition process.

5. The emerging theory in the research context

In the following section, the categories of the emerging theory and their interaction are discussed in detail in the context of the research from which they emerged. In order to provide insight into the context for the transition process, the categories of the transition context (upper part of Figure 2) are addressed first and second the categories of the transition process (lower part of Figure 2).

5.1. Technology impact

5.1.1. Changes in the new version

The new major version of the pre-packaged enterprise system studied here was launched in late 2008. The changes and additions in the new version included, among other things, a new the front-end client with a new user interface, a change in the keyboard shortcuts, a change in the way of generating and developing customised reports, and the possibility of using a different software development tool compared to the old version. Closely linked to the new front-end client was a change from a two-tier to a three-tier architecture, entailing a requirement for a new database server if the new front-end client was going to be implemented. The new version maintained the possibility of running the old front-end client from the previous version on the new version alongside the new front-end client, although the vendor announced that from the next version this possibility would be discontinued. The first release of the new version had a number of stability issues and lacked some keyboard shortcuts. To remedy these shortcomings the vendor released a service pack in the autumn of 2009.

5.1.2. Consequences of changes

When addressing the consequences of the changes in the new version, some consultants suggested that the new version was more expensive to implement due the higher license fees and higher hardware requirements of the new architecture: "*The new server requirement is probably one of the biggest barriers for the new version, because the old server was free.*" (CIO – Partner 1).

The change in shortcuts was also pointed out as a major change between the two versions by many consultants: "*From the very first versions I have known, postings have always been control-F5. It has never been otherwise in any version. Now it is suddenly completely different, so the change in the shortcuts is major*", said Consultant – Partner 9.

However, the largest consequence of the change between the two versions was attributed to the new front-end client. Many consultants even pointed out that the change to the new front-end client was one of the largest between any two versions in the history of the enterprise system: "*It was a shift in paradigm when we went from DOS to Windows. This is a bigger change*", said Product Manager – Partner 9.

5.2. Strategy impact

5.2.1. Strategy for upgrades

The partners in the ecosystem expressed different transition strategies as being suitable for selling a new implementation to a new customer respectively selling an upgrade to an existing customer. Some of the consultants feared the new front-end client would be difficult for existing customers and end-users to adjust to: "*Unless they were new customers we didn't recommend [the new front-end client]. We did implement the new version but not with [the new front-end client].*" (Consultants – Partner 8). Others saw the new front-end client as an opportunity for the existing users to replace previous customisations of the interface, made by the consultants, with the users' own personalisation. Some of the consultants also emphasised the importance of the first implementation of the new version being at an existing customer: "*Know your customer. It is very important when you make a transition of technology at this level that you know your customer*" (Unit Manager – Partner 2).

5.2.2. Strategy for new implementations

The new front-end client was generally perceived as easier for new customers to adjust to: "*[The new customers] are ready for change. They know that they have to adjust to a new user interface*", said Consultant – Partner 8, and Consultant – Partner 9 added that: "*Many new users think [the new front-end client] looks good*".

The issue of new versus existing customers was intensified by the vendor advising that the new front-end client should only be sold to new customers while existing customers should keep the old front-end client when upgrading to the new version. "*When you as a consultant hear that they [the vendor] only recommend it to new* *customers how much do you really believe in it then? […] I think that announcement has pushed the whole thing by a full year.*" says CIO – Partner 1.

5.2.3. Strategy for timing

"*Every consultant says "no thanks" every time something new comes along […]. Very few [of our consultants] go with the first release of a new version. Let the others take the beating first and then we join in later*", says Chief Consultant - Partner 7, as an example of a strategy of beginning to sell the new version to customers late. The vendor's Product Marketing Manager confirms that this is a strategy of many consultants: *"[The consultants] are very conservative. They stick to what they know*", and elaborates that many of the owners of the smaller consulting companies are close to retirement and do not want to make the investments to carry out the version transitioning. Other consultants had a transition strategy of making the version transitioning as early as possible: "*I am always in favour of implementing the newest version, if it makes sense for the customer*" (Consultant – Partner 5).

The issues with the first release of the new version were also frequently mentioned as a reason for late transition timing: "*We said, we don't want to touch [the first release] and so we waited for the first service pack. When that came we evaluated it and found that now it was working and then we could begin to move existing customers [to the new version]*", said Consultant – Partner 8. Finally, the difficulties of understanding the technological changes in the new version were perceived as a cause for late transition timing by some respondents.

5.3. Customer impact

5.3.1. Customers pulling

Even when the consultants did not feel completely ready for implementing the new version, some of the customers still had a positive impression of it, and asked that the consultants implemented the new version instead of the old: "*It was actually the customer that asked for [the new front-end client]. I was not ready to implement it yet because i did not feel I had a complete overview of how to do it, so I just had to catch up*" (Consultant – Partner 8). At other times the customer chose the old version over the new, even when the consultants were pushing for the new version.

5.3.2. Customer's existing solution

As described above in the section about *Strategies for upgrades*, the strategies deployed by the partners were different when selling a solution to an old compared to a new customer. This entailed that the customer's existing solution became an import concept in the transition process of the new version, especially since most customers already had an existing solution: "*They always have something*", said Product Manager – Partner 9.The partners also explained that the existing solution was also generally used as reference when implementing a new version: "*[The customer's] existing solution fulfils an existing need that we also fulfil with the new version. You cannot implement a new version that does not fulfil that need*", said CEO – Partner 10. Moreover, the frequent occurrence of customized implementations entailed that upgrading from previous versions to the new version of the system required considerable consultant resources to ensure that customer specific customizations would be compatible with the new version.

5.4. Supplier impact

5.4.1. Complementary technology

As the new version of the core enterprise system package in the study included substantial changes to the architecture and a new front-end client, some of the frequently used add-ons were not fully upgraded to work with all aspects of the new version before late 2010, nearly two years after the new version was released.

The vendor's Product Marketing Manager and many of the consultants explained that regardless of the customer type nearly all implementations included one or more add-ons to complement the core package: "*I cannot imagine carrying out an implementation without any add-ons*" (Unit Manager – Partner 2). This was especially the case for vertically specialised customers but also more horizontally oriented customers, such as small trade companies, required a number of add-ons, such as payroll and online banking, in order for the solution to meet their requirements. This entailed that the consultants were dependent on the ISVs to deliver new versions of the add-ons that were compatible with the new version of the core package: "*One of the major factors in this has been that some of the add-ons we always implement when we are selling have not been ready for [the new front-end client]. And many of the add-ons have only been ready within the past three months so we have not been able to deliver the solutions we wanted*", said Product Manager – Partner 6.

The ISVs in turn were depending on the vendor to deliver documentation for the code and executable code before being able to upgrade the add-ons: *"[The ISVs] have been waiting for some fundamental elements from [the vendor]*" says Unit Manager – Partner 2, linking the concept of *complementary technology* to the concept of *vendor support*.

The ISVs also appeared to be driven by a demand from the VARs before they began to upgrade their solutions: "There is no doubt that the ISVs have massive expenses associated with this transition […] they are very demand driven, so when we ask for [an upgrade of an add-on] they evaluate it carefully if they haven't already [upgraded it]" (Unit Manager – Partner 2).

5.4.2. Vendor support

The vendor supported the transition from the old to the new version in a number of ways. First, the vendor provided service packs which included updates and technical fixes for the new version. Second, the vendor offered a vast amount of documentation in the form of white papers, web casts, blogs, and implementation guidance for supporting the various steps in the implementation process of the enterprise system. The vendor also provided formal training and certification for the consultants, aimed at explaining the new features and underlying technology of the new version.

Finally, the vendor ran a number of projects together with key ISVs and VARs prior to the release of every major version. The projects were primarily aimed at testing the new version in a real-world customer company. However, for the partner companies it also served as an opportunity for testing the new version before it was released, while simultaneously getting special support from the vendor.

In addition to the regular projects, the vendor also organised a special workshop for six selected consulting companies 14 months after the initial release of the new version, specifically aimed at explaining the potential benefits of the new front-end client: "*Then we participated in [the workshop]where we went more in-depth with the ideas and that was really an eye-opener. The ideas are extremely well-thought, but extremely poorly communicated to the consultants.*" says CIO – Partner 1.

5.4.3. Vendor pressure

The vendor applied a lot of pressure on the consultants to make the transition to the new version: *"[We] push a lot for things to change – perhaps too much. They feel stressed and then they rely on what they know.*" says the vendor's Product Marketing

Manager. However, some of the consultants also indicated that the pressure from the vendor was necessary in order for the ecosystem to speed up the transition.

5.5. Market impact

5.5.1. Financial environment

Some respondents pointed out that the financial environment had a substantial impact on the transition from the old to the new version: "*There is no doubt that the timing has been bad, because right after the release, the financial crisis came crashing down and that means that none of the consultant companies has been willing to make the required investments in training and so they cling to the old version because they know they can make some money on that […] I don't think we would have made the investment [in upgrading the add-ons] if we had begun half a year later*.", said CEO – Partner 10, referring to their participation in one of the vendors projects prior to the initial release.

5.5.2. Local market conditions

"[In other countries] the product does not have the same market share as it does here. [In our local market] any company that considers acquiring an enterprise system will consider [our products]. They may not end up buying them but the will consider them. So we do not have to put up big posters in the airport like many others have to", said the vendor's Product Marketing Manager, indicating a market leadership in the local market, which was also confirmed by documentation. The consultants also suggested that the local market was somewhat saturated, meaning that most implementations were either upgrades of existing customers with an older version or customers that had another enterprise system.

In summarising the contextual impact on the transition process of the consultants in the study, **Table 3** illustrates the distribution of the expressed barriers and enablers. Note that *pressure from the vendor* is categorised as both a barrier and an enabler, as findings from the study indicated this as both hindering and enabling the transition process.

Table 3 - Barriers and enablers of transition to the new version

Contextual categories	**Barriers**	**Enablers**
Technology impact	• Poor stability • Changed keyboard shortcuts • Higher license fees • Increased hardware requirements • Poor fit between existing users and new front-end client	• New front-end client was "future proof" • New front-end client appeals to new customers and users • Less need for customisation of user interface
Supplier impact	• Pressure from the vendor • Lack of add-on compatibility	• Pressure from the vendor • Support from the vendor
Customer impact	• Pull for old version • Pull for new version with old client	• Pull for new version
Market conditions	• Financial crisis • Saturated market	• Market leadership

5.6. Perceiving

This section describes the stages of the transition process of the emerging theory in the context of the research study and exemplifies the contextual impact on the transition process.

5.6.1. Understanding the new version

The initial understanding of the new version was hard for some of the consultants: "*It is rather complicated to get [the new version] running and it is something we have never done before, because the whole technology is different.*" says Product Manager – Partner 9. Especially the changes in the new front-end client caused a great deal of difficulties in understanding: "*It is a new technology and a new way of thinking*" (Product Manager – Partner10).

5.6.2. Comparing benefits and shortcomings of the two versions

The benefits expressed by the consultants were primarily related to the increased usability of the new front-end client in terms of possibilities of personalisation for the individual user: "*The users can put their personal touch on [the new front-end client] to achieve the approach that is best for them and that part is really cool*", explained CEO – Partner 10, and the consultants generally perceived the new front-end client as more "future-proof" that the old client: "*It is the only way to go. The [old front-end client] is old in the worst kind of way. It is just not up to date on how you do things today. That goes for the technical aspects as well as the usability. You cannot display a graph in the old client. I mean, we are talking 2010 and you cannot display a graph. What is going on?*" said Product Manager – Partner 9.

Many respondents pointed out that the development of reports was easier in the old version: "*We have had a report generator that all consultants are world champions in using. Then [the vendor] decided that when you run the [new front-end client] you have to use this new technology […] and that part should have been done differently*" (Product Manager – Partner 6). The conversion of old reports to fit the new version was also perceived as a challenge: "*One thing is that it takes a long time but is also extremely boring. Nobody wants to do it. It really has to be an emergency before I do it*", said Product Manager – Partner 9.

Finally, all the consultants explained that the stability issues and bugs in the first release of the new version had significant negative impact on the transition: "*The first release should never have been released because it was straight out unusable.*" (Product Manager – Partner 6).

5.6.3. Experience with the new version

The experience with the new version was limited for many of the consultants: "*Even though we have been working with the new version since 2007, we still have more experience with the old version*" explained Product Manager – Partner 10. The consultants also pointed out that experience with implementing the new version entailed a more positive perception of it: "*Once I get [the new version] under my skin then I think it will be fantastic. So if the customers are buying from me, then they will get [the new version]*" (Consultant – Partner 5).

5.6.4. Experience with the old version

Many of the consultants in the ecosystem had substantial experience with implementing previous versions of the pre-packaged enterprise system: "*Many of the consultants have been in the business for 20-25 years*", explained the vendor's Product Marketing Manager. The consultants pointed out that regardless of which version was implemented, it typically took in excess of two years before a new consultant had in depth experience of how to implement the system. The extensive experience with the old version and the lack of experience with the new version caused many of the consultants to push for implementing the old version at the customers.

5.7. Pushing

5.7.1. Pushing the new version

During the study, several examples were found of partners pushing the new version to the customer: "*So we asked [the customer] if they were interested in [the new version]. […] So I would not say it was the customer that initiated it. We initiated it and convinced them*", said Consultant – Partner 3.

5.7.2. Pushing the old version

The respondents explained that when the customers ended up choosing the old version it was often due to a push from the consultants: "*I don't believe it is the customers that choose the [old front-end client]. It is the partners. And when we are under pressure we do the same thing. We say, let us start out with [the old front-end client] and then we can switch over to [the new front-end client] later[…] If [the customers] had a 100% free choice then I think they would always choose [the new front-end client]. It is definitely the partners that push the old one to the customers and then promise them that they can upgrade later. And we all know that is probably not going to happen once you have begun the implementation*", said CEO – Partner 10. The Product manager of Partner 9 also confirmed that they were driven by a demand for the new version rather than pushing it: "*We are driven by customers asking for [the new version]*" (Product Manager – Partner 9).

5.8. Implementing

5.8.1. Implementing the new version

Some of the implementations did result in a the new version with the new front-end client being implemented: "*[The customer] was in the process of implementing the new version with the old client but then they saw [the new front-end client] and did not want to have the old one implemented*" said Chief Consultant – Partner 4.

5.8.2. Implementing the old version

The partners explained that the push for the new version did not always result in the new version being implemented and when it did, it often did not include the new front-end client. The vendor's Product Marketing Manager supported this impression by explaining that one year after the new version was released, only very few customers' had purchased a license for the new front-end client.

5.9. Increased experience

5.9.1. No increased experience with the new version

The respondents stressed that if the consultants did not implement the new version they could not gain any experience with it: "*They are not world champions when they are done with [the training courses] because you only become that through working with practical cases and it is only customer implementations which gives that*" (Product Manager – Partner 6). Due to various contextual factors, little new experience was gained when the old version was implemented at a customer: "*[...] when you have done 50 implementations [of the old version] then there is not much new*" (Chief Consultant – Partner 7).

5.9.2. Increased experience with the new version

The consultants explained that the first couple of implementations with the new version gave them a significant increase in experience: "*We knew this was new territory but also that this is the way the wind is blowing. So it was an option for us for getting to know [the new version]. And we succeed with it through blood, sweat, and tears and gained experience*", says Chief Consultant – Partner 3, when referring to his first participation in an implementation of the new version.

6. Discussion of findings

The findings from the study indicates that poor stability of the first release of the new version, and other barriers associated with the technology of the new version, were some of the main barriers for transition of the new version among the implementation consultants in the ecosystem. Many consultants considered the first release too unstable to implement in customer organisations, and thus the ISVs had little incentive to upgrade their add-ons to be compatible with the new version. When the service pack was released by the vendor and the new version was considered mature enough to implement, the lack of upgraded add-ons was evidently perceived as a barrier, causing inertia in the version transitioning. The study thus illuminates some of the challenges of software ecosystems in respect to transitioning to a new version of a pre-packaged enterprise system by highlighting the dependence on complementary technology, in the form of add-ons, in order for the consultants to deliver a complete solution of the enterprise system package to the customer. The findings thus support the importance of addressing business strategies from a network perspective rather that looking at individual companies in isolation [27].

The influence of increased experience on the *Perceiving* stage of the transition process suggests a reinforcing effect in the transition process once initial experience is gained with implementing the new version. The crossing paths in the transition process between the stages of *Pushing* and *Implementing* (see Figure) further indicate that the customer's pull for one of the two versions can change the pursued transition paths of the consultants, hence enabling or hindering the transition to the new version of an enterprise system. The findings are thus consistent with previous suggestions that neither a technology-push nor a customer-pull perspective in isolation is sufficient for understanding adoption and diffusion of innovations [28]. Instead, a more integrated perspective is needed. To reach such an integrated perspective the guideline of *theoretical integration* in the Grounded Theory methodology may help integrating the emerging *substantive theory* with existing diffusion theories as an initial step towards creating *formal theory* [13].

6.1. Integrating the emerging theory

Previous research on adoption of innovations has addressed the stages in the adoption process of innovations. The adoption process in diffusion theories has been conceptualised differently by different researchers, but a particularly useful approach for integrating the transition process may be the two-stage adoption process of *Initiation* and *Implementation* as suggested by various authors [29-31]. In this view, the *Initiation* stage consists of activities related to perception, information gathering, and attitude formation leading to the decision to adopt, and the *Implementation* stage consists of events and actions pertaining to modifications in both the innovation itself and the organisation and utilisation of the innovation [29]. The emerging theory of version transitioning from the research thus resembles both of these aspects, in that the categories of *Perceiving* and *Pushing* are comparable to the Initiation stage and the *Implementing* category is comparable to the Implementation stage.

Integrating the transition process part of the emerging theory with the stages of Initiation and Implementation may thus provide an appropriate lens through which to *scale up* the emerging theory and reach a higher level of generalisation. As described above, the first three of the four stages in the emerging theory are readily comparable to the stages of Initiation and Implementation. However, the stage of *Increased experience* in the emerging theory falls between the categories in the two-stage conceptualisation. Preserving the relationship between *Increased experience* and the grounded categories of *Implementing* and *Perceiving*, the integrated theory suggests iteration between the categories of *Initiation* and *Implementation*, as illustrated in Figure 3.

While the transition process stages of the emerging theory may thus be integrated with innovation adoption stages in existing diffusion theories, the *context* categories of the emerging theory should be compared to contextual, rather than processl, factors from existing theories. Existing diffusion theories suggest a number of contextual factors that may enable or inhibit the diffusion process. While several of these contextual factors may be comparable to the contextual factors of the emerging theory of version transitioning, Orlikowski's [32] study of adoption of CASE tools as a process of organisational change may be particularly suited for theoretical integration with the contextual factors of the emerging theory.

Orlikowski proposes three contextual categories which influences adoption and use: *IS Context*, *Organisational Context*, and *Environmental Context*. Integrating the contextual categories of the emerging theory with these contextual categories provides a suitable foundation for integrating the theory and generalising the context categories. In this perspective the categories of *Supplier impact*, *Customer impact* and *Market impact* can be compared with the *Environmental Context*, the category of *Strategy impact* with the *Organisational Context*, and *Technology impact* with the *IS Context*, all of which influence the adoption stages. Furthermore, Orlikowski (ibid.) also proposes that the contextual categories themselves are influenced by the adoption process as it progresses as depicted in Figure 3.

Although the purpose of theoretical integration in the Grounded Theory methodology is not to apply the integrated theory back to the data set from which parts of the theory emerged, the integrated theory of version transitioning has more explanatory power compared to the emerging theory. First, the division of the transition process categories into Initiation and Implementation provides distinction between the "planning" activities (Initiation) in which the consultants, often prior to the release of the new version, would form a perception and strategize about the transition to the new version and the "action" activities (Implementation) in which the strategy for transition to the new version would be executed and subsequently revised based on increased experience. Second, extension of the emerging theory with the reciprocal relationship between process and context fits and extends the emerging theory to assist in understanding of the mutual influence on the players in the ecosystem, including the push/pull configuration between the VARs and the ISVs in regards to development of compatible add-ons and the mutual influence between VARs and their customers in regards to selection of the new or the old version. Finally, the division of the contextual categories of the emerging theory into Environmental, Organisational, and IS context provides a clearer view of which overall areas the contextual categories of the emerging theory are attributable to, which, in turn, provides general indications for if and how the categories can be influenced by the actors in the ecosystem.

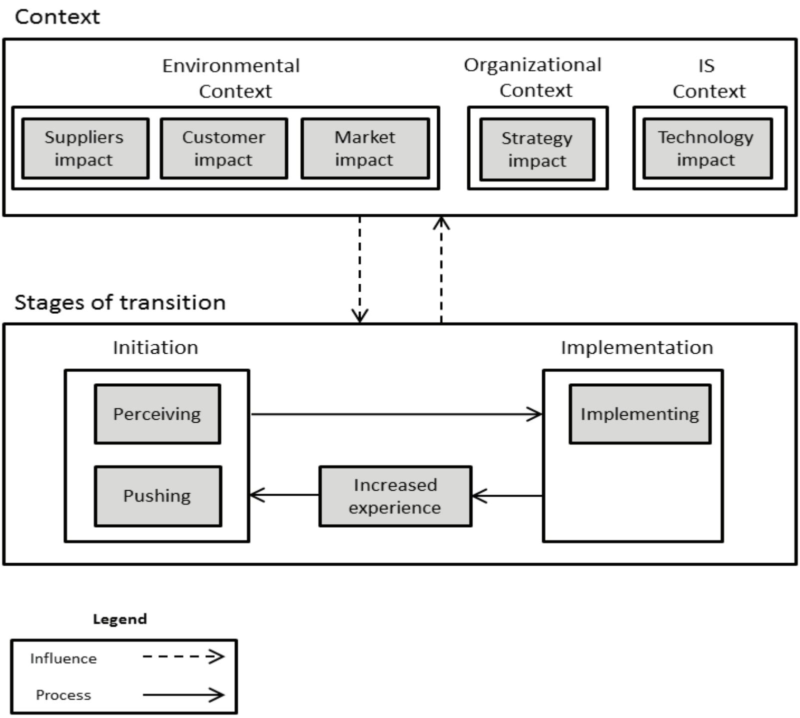

Figure 3. An integrated theory of version transitioning

7. Conclusions

The study of transition from an old to a new version of an enterprise system in an ecosystem context has provided an opportunity for theorizing about the transition process that partner companies undergo, and the contextual factors that influence and are influenced by the transition process. The emerging theory thus provides us with initial understanding of how actors in software ecosystems experience enterprise system version transitioning, and also illustrates the substantial effect the phenomenon has on the consultant companies in the ecosystem. The emerging theory suggests the transition process is an iterative process in which the actors repeat each stage in the process multiple times before the transition is complete, as opposed to traditional adoption theory in which the stages are only undergone once by each adopter for a particular innovation [30]. Although the introduction of a new version of a an enterprise system in the ecosystem will eventually lead to the discontinuation of the old version, the process resembles that of a gradual transition rather than adoption at one particular point in time, and aligns with the perspective that "*as innovation develops and diffuses, learning occurs; the old and the new exist concurrently, and over time these are linked together*" [33].

8. Implications for practice and future research

The research presented in this paper suggests that managers in software vendor companies orchestrating ecosystems indeed need to pay close attention to the dependencies on complementary technology in software ecosystems. Just as important, the interconnectedness of players in the ecosystem also entails that there is little gain in releasing inferior or unstable releases of new versions in the expectation that bugs and shortcomings can be fixed along the way, as rejection in any part of the ecosystem causes a barrier for transition in other parts. Finally, managers and consultants should consider the reinforcing effect of experience gained from implementing new versions of pre-packaged enterprise systems as indication of the value of facilitating trial of implementations through, e.g. wider investment in formal adoption programs and influencing of potential early adopters among customers.

The inherent limitations of building theory from the study of transition of a single new version in a single ecosystem suggest that future research should look into version transitioning and adoption in other software ecosystems. Version transitioning in other *types* of ecosystems with different configurations of actors should be investigated to further extend the current integration of the emerging theory into a more generalizable formal theory. Furthermore, the research presented in this paper leaves room for future studies of the effects of supporting the simultaneous use of two different front-end clients on the same version of an enterprise system as a means of allowing partial and even more gradual transition to a new version. Finally, the ambiguous findings of the effects of vendor pressure on the transition process suggest further research in this area. Future studies may thus benefit from a holistic network perspective on the influence applied by the different actors in software ecosystems.

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10. Appendix

Transition process		
Categories	**Concepts**	**Examples of data from the study**
Perceiving	Understanding of the new version	“It is seriously a different way of thinking”(Product Manager – Partner 10) “You have to understand the concept of [the new version] to see the point” (CIO – Partner 1)
	Comparing benefits and shortcomings of the new version	“Much of the key functionality from [the old version] was not there” (Product Manager – Partner 6) “[The new reporting tool] has some tools that are much smarter than the old reports” (Consultant – Partner 3)
	Experience with the new version	“I only have experience from one implementation” (Consultant – Partner 3) “It was very new to me” (Chief Consultant – Partner 7)
	Experience with the old version	“[…] and I had much experience with the old version […]” (Consultant – Partner 5) “[…] the classic version that we are used to […]” (Product Manager – Partner 6)
Pushing	Pushing the new version	“So we asked [the customer] if they felt like trying out [the new version]” (Consultant – Partner 3) “[…] and that convinced them” (Unit Manager – Partner 2)
	Pushing the old version	“The are many that offer the old version” (Product Manager – Partner 6) “[The new version] was not interesting for us to try to push […]” (Consultant – Partner 8)
Implementing	Implementing the new version	“We have actually carried out a relatively large project of [the new version] where 30 users got [the new version]”(Chief Consultant – Partner 4) “The is not doubt that when you are implementing [the new version] then […]

		”(CEO – Partner 10)
	Implementing the old version	“I was once in an implementation of [the old version]…” (Consultant - Partner 5)
Increased experience	Increased experience with the new version	“So we got our pilot project and a lot of experience” (Chief consultant – Partner 4) “Part of implementing [the new version] at the customer is also a matter of training for us […]” (Unit Manager – Partner 2)
	No increased experience with the new version	“[…] when you have done 50 implementations [of the old version] before, then there is not much new” (Chief Consultants – Partner 7) “[…] most of it you do not get “into the spine” unless you do implementations [of the new version]” (Consultant – Partner 9).
	Context	
Categories	**Concepts**	**Examples of data from the study**
Technology impact	Changes in the new version	“The change in the keyboard shortcuts is huge” (Product Manager – Partner 9 “[The vendor] chose to use a new technology for the reports in the new version” (Product Manager – Partner 6)
	Consequences of changes	“Developing a report [in the new version] takes longer than in the old version” (CEO – Partner 10) “It takes half a day to install the old version in the new it takes at least three days” (Consultant – Partner 9)
Supplier impact	Complementary technology	“One of the major factors in this is the [compatibility] of the add-ons we always offer in the implementation” (Product Manager – Partner 6) “That is a little special about our business because we nearly always use add-ons for both payroll and online banking” (Consultant – Partner 8)
	Vendor support	“I think the information [the vendor] provided was OK. They put up some good examples on blogs…” (Chief Consultant – Partner 4) “[…] also in relation to the attention we get

		from [the vendor]" (CIO – Partner 1)
	Vendor pressure	"We pressure, pressure, pressure the partners" (Product Marketing Manager – Vendor) "[…] in order to keep a certain status with [the vendor]" Product Manager – Partner 6)
Customer impact	Customers pull	"[…] so it was actually the customer that asked for [the new version]" (Consultant – Partner 8) "The customer would not implement the old version" (Chief Consultant – Partner 4)
	Customer's existing solution	"Their current system[…]" (CEO – Partner 10) "[…] and because the system they had was out dated […]" (Consultant - Partner 8)
Strategy impact	Strategy for timing	"We want to be on the newest technology" (Unit Manager – Partner 2) "Only very few go with the first release" (Chief Consultant – Partner 7)
	Strategy for new implementations	"We have had the approach with selling to the new customers" (CIO – Partner 1) "All new implementations are [the new version]" Unit Manager (Partner 3)
	Strategy for upgrades	"Most of the times where we implement the new version are new implementations" (Product Manager – Partner 9) "Whether we recommend existing customers to upgrade is a totally different matter" (Chief Consultant – Partner 7)
Market impact	Financial environment	"There is no doubt that the timing in the market has been very unfortunate" (CEO – Partner 10) "[…] but then the financial crisis struck and now it is on hold" (Chief Consultant – Partner 7)
	Local market conditions	"Because [the local market] is so small […]" (CIO – Partner 1) "[…] and perhaps that is because of [the local market] and the wide spread of [the enterprise system]" (Unit Manager – Partner 2)

Appendix D: Paper III

Toward a Foundation for Analysing Organizational Roles in Enterprise Systems: A Case Study of a Vendor

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Abstract

Gaps between enterprise systems and organizations have long been of primary concern to both researchers and practitioners. While much attention has been paid to the fit of business processes, enterprise systems vendors have recently begun to focus on representing organizational roles in their systems as a mean of closing the gaps between system and organization. This paper presents findings from a case study of how a large enterprise systems vendor represented role-related concepts in its enterprise model and system with emphasis on role content and role relationships. A key finding from the study was that while the majority of role-related concepts were represented in the vendor's enterprise model, the implementation of roles in both the model and the actual system lacked support for remodelling and reassignment of the tasks contained in the roles.

1 Introduction

Throughout the past three decades enterprise systems have developed from a focus on material requirements planning (MRP) over enterprise resource planning (ERP) to encompassing and supporting most business processes in the modern business organization (Adam and Sammon 2004). With the increased inclusion of business functionality gaps between the functionality provided by the enterprise system and the needs of the customer organization are common (Soh, Kien and Tay-Yap 2000). There are generally two ways of closing these gaps; either the organization has to adapt to the standard functionality of the enterprise system or the system has to be customized to fit the organization (Rolland and Prakash 2000; Soh et al. 2000). Customization of the system requires significant knowledge of the inner workings of the enterprise system which often necessitates the use of consultants, incurs additional cost for the organization, and increases the risk of failure of implementation (Brehm, Heinzl and Markus 2001).

Previous research has primarily focused on closing the gaps between the *business processes* of the enterprise systems and organizations. However, in recent years some of the major enterprise systems vendors (e.g., SAP, Oracle, and Microsoft) have begun to include and focus on the concept of *organizational roles* to close the gaps between the system and the organizations (Johansson 2009). The role concept has been extensively researched in the fields of organizational science and Information Systems (IS) but research into the application of organizational roles in the context of enterprise systems has been scarce. This paper attempts to remedy this scarcity by addressing: How an enterprise system vendor represented the concept of organizational roles in its enterprise model and subsequently implemented the concept in one of its systems.

The paper consists of the following parts: 1); Theory and related work; 2) the methodology for conducting the research described in the paper 3) presentation of the findings, and 4) conclusions and discussion in the context of implications and future research.

2 Theory and Related Work

In an effort to minimize gaps between enterprise systems and organizations both practitioners, and researchers have paid much attention to the modelling and fit of business processes (Everdingen, Hillegersberg and Waarts 2000). Process models, such as ARIS (Scheer 2000), has frequently been applied when modelling enterprise systems (Worley, Chatha, Weston et al. 2005; Almeida, Guizzardi and Santos 2009), which is not surprising given that many enterprise systems have their origin in the manufacturing industry. However, Katz and Kahn (1966) describe the very definition of an organization as a system of roles and understanding organizational roles in the context of enterprise systems may be viewed as an alternative foundation for understanding the needs and requirements of organizations. Representing roles on the user level has also been associated with improvements in the interaction between the users and the system by tailoring presentation of information to the individual role (Shneiderman and Plaisant 1994; Carlsson and Hedman 2004; Worley et al. 2005).

Despite an intuitive understanding of the notion of "playing a role" and common use of the role concept in the IS field no common definition of the term has been agreed upon (Zhu and Zhou 2008). Zhu and Zhou (2008) even go as far as stating that: "The actual situation of role applications in information systems is definitely in a chaos" . In an effort to understand the use of the role concept, we must thus clarify the relating terms composing the concept of organizational roles in the context enterprise systems.

At times, the term position is confused with the notion of role. The two differ in that a position is concerned with hierarchical relations and privileges, while a role is concerned with the obligations of the position (Pareek 1994). Despite the definitional difference between a position and a role, the terms are used interchangeably in much of the academic and practical literature. Worley et al. (2005) introduces the term 'actor' as synonymous of an individual and describes the relationship as "the actor occupies a position (job description) characterised by one or several roles" . This is illustrated in Figure by relating a position to one or more roles.

In an organizational structure roles are commonly grouped into *departments* (Mintzberg 1979). In some approaches to enterprise modelling (e.g. Barros, Duddy, Lawley et al. 2000) the composition of roles into organizational units is argued as creating a larger role resulting in collective behaviour and thus behaviour at different levels of abstraction. While the idea of collective behaviour in departments is certainly a valid perspective, the concept of a role is reserved for individuals in the analysis in this paper.

Some of the main expectations towards an organizational role relates to the notion of the *work* an individual has to carry out as part of fulfilling the expectations of a role. Furthermore, the rather broad concept of work may be divided into smaller units of *tasks* or *activities* (Pareek 1994). In the context of IS the notion of work is often equated to describing the relationship between the role and the individual tasks – effectively defining a role as a collection of tasks and activities (e.g., Barros et al. 2000; Worley et al. 2005). This is illustrated in Figure 1 by relating a role to one or more tasks/activities. These tasks and activities simultaneously form the elementary parts of a *business process* (Davenport and Beers 1995) that describes the coordination and timing of the tasks in sequence (Becker and Kahn 2003), some of which may be dependent on the *industry* in which the organization operates.

2.1 Role Content and Relationships

Based on this discussion of the role concept, we can derive that the simplest relation between a role and an individual is when an individual holds only a single position, the position is associated with only a single role, and the tasks of a role are constant over time. Although this simple and static constellation is theoretically possible it is often more complicated. So for the purpose of analysis of the case study distinction is made between the tasks contained in a role, termed *role content*, and the relationship between position and roles, termed *role relationships*.

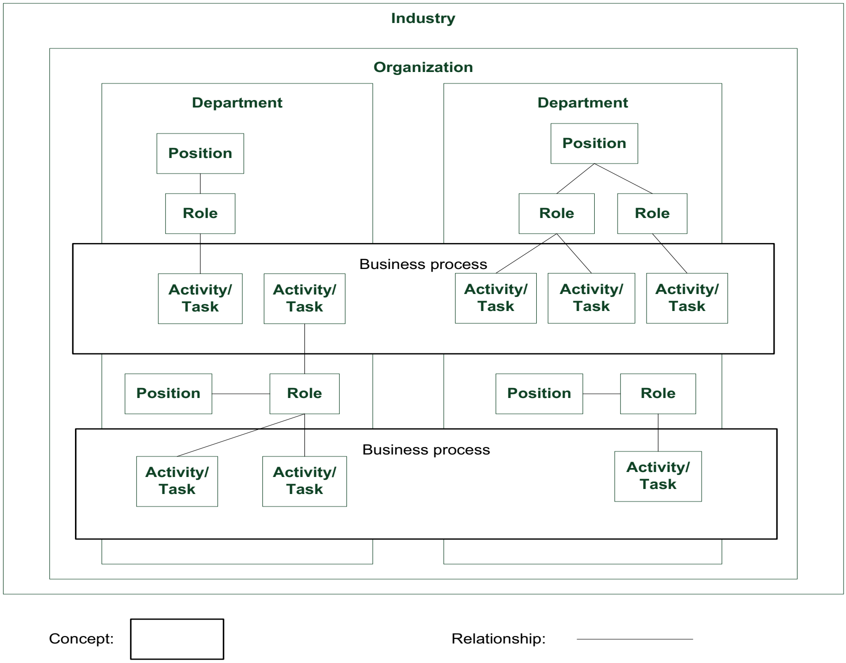


Figure 1. Role-related concepts and their relationships based on a theoretical generalization.

A fundamental aspect of the tasks contained in a role is the division of work between the roles in an organization, often referred to as *specialization* (Mintzberg 1979). The division of work between roles and the related tasks changes over time with the evolution of goals and processes in the organization (Allen and van de Vliert 1984). Ideally, the enterprise model and the enterprise system should thus support *remodelling* and *reassignment of tasks*.

A single position often occupies multiple roles simultaneously (e.g., a professor who occupies the roles of a conference organizer, researcher, and lecturer), also referred to as *role aggregation* (Almeida et al. 2009). This multiple relationship entails that an enterprise system must support the association of multiple roles with a single position. The roles associated with a position will often change over time, also referred to as *role transition* (Nicholson 1984), thus requiring support for including new roles and abandoning existing ones.

3 Methodology

The research described in this paper was carried out as a case study (Yin 2008). This methodological approach is particularly appropriate for problems and research areas that are in their early formative stages (Benbasat, Goldstein and Mead 1987). The enterprise model of Microsoft Dynamics was chosen as enterprise model for the case and Microsoft Dynamics NAV 2009 was chosen as the system for the case.

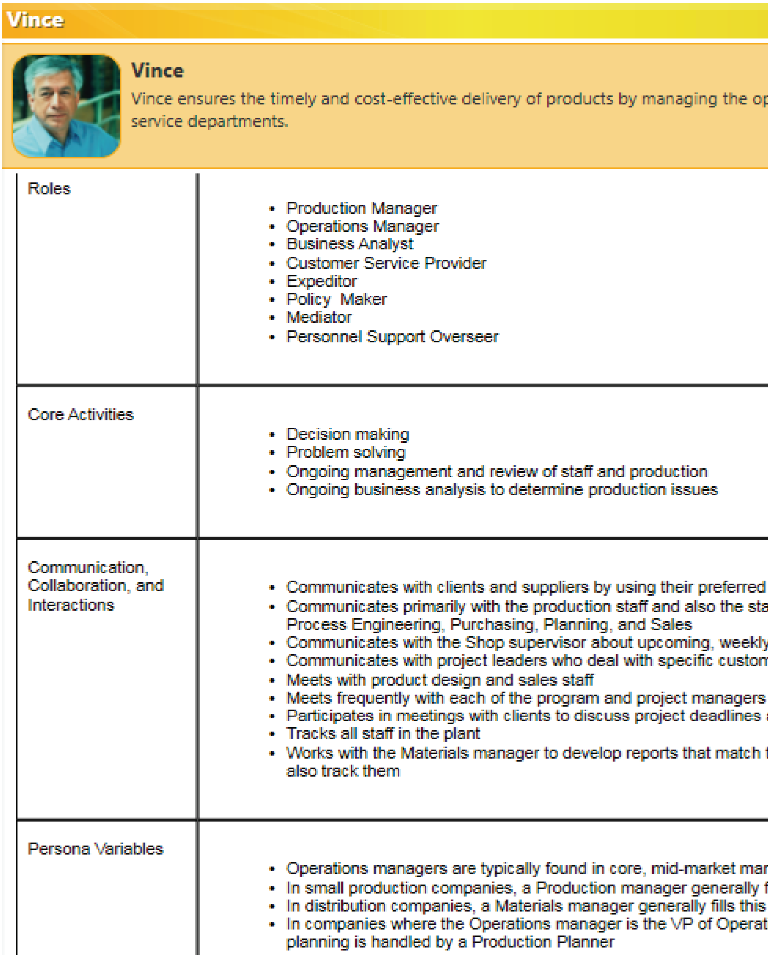
Firstly, documents describing and documenting the enterprise model were collected from the vendor's website to gain insights into the vendor's official motivations for using and representing roles in its enterprise systems. The document analysis (Bowen 2009) was carried out with emphasis on understanding the definitions relating to and surrounding the role concept in the enterprise model to establish a foundation for analysis of the case study.

Secondly, a software version of the enterprise model and a demo version of the enterprise system were obtained from the vendor to observe and compare the role-related concepts in the enterprise model with the implementation of the concepts in the system. The software version of the enterprise model also served as a means of validating the statements made in the online documentation in regards to the properties and features of the model.

Finally, a semi-structure interview (Kvale and Brinkmann 2008) with the manager responsible for implementing the role concept in the enterprise system was conducted to elaborate on the background related to implementing the concept in the enterprise system. At the time of the interview the manager had left the vendor, so in order to triangulate the statements of the manager and to elaborate on some of the specific implementations in the system a second interview was conducted with a so-called ‘user experience developer’ at the vendor. Both interviews were recorded, fully transcribed, and summarized through the use of notes.

4 Role-Related Concepts in the Enterprise Model

The vendor’s enterprise model contained a total of 61 personas, which were defined as “a typical view of the people that can occur within an organization defined primarily by the collection of roles they have”. Each persona was linked to a job position and contains information, such as ‘demographic’, ‘psychographics’, and ‘goals’. In the literature, personas has been used for describing properties, such as goals, technology attitudes, and work activities, of fictitious users for the purpose of communicating requirements when designing information systems (Pruitt and Grudin 2003).



Vince

Vince

Vince ensures the timely and cost-effective delivery of products by managing the op
service departments.

Roles	• Production Manager • Operations Manager • Business Analyst • Customer Service Provider • Expeditor • Policy Maker • Mediator • Personnel Support Overseer
Core Activities	• Decision making • Problem solving • Ongoing management and review of staff and production • Ongoing business analysis to determine production issues
Communication, Collaboration, and Interactions	• Communicates with clients and suppliers by using their preferred • Communicates primarily with the production staff and also the sta Process Engineering, Purchasing, Planning, and Sales • Communicates with the Shop supervisor about upcoming, weekly • Communicates with project leaders who deal with specific custon • Meets with product design and sales staff • Meets frequently with each of the program and project managers • Participates in meetings with clients to discuss project deadlines • Tracks all staff in the plant • Works with the Materials manager to develop reports that match also track them
Persona Variables	• Operations managers are typically found in core, mid-market mar • In small production companies, a Production manager generally f • In distribution companies, a Materials manager generally fills this • In companies where the Operations manager is the VP of Operat planning is handled by a Production Planner

Figure 2. Persona from the vendor's enterprise model. Copyright of Microsoft Corp.

The vendor's representation of personas in the enterprise model was generally consistent with the perspective from the literature but besides the aforementioned properties, the personas also contained a number of roles. Each role was defined as a specific grouping of tasks and activities, such as ‘manage inventory’ or ‘generate financial reports’, that a persona was responsible for or participated in (see Figure 2). A few roles were included in more than one persona and the 61 personas in the model contained a total of 233 unique roles. Excerpt from a persona in the enterprise model is shown in Figure 2.

The personas were grouped into departments which were part of either ‘large’ or ‘small’ organizations in the model. The ‘large’ organizations did not mirror differences in industry. However, for ‘small’ organizations, the vendor model suggested to differentiate between ‘retail’ and ‘service’ industry.

The model also contained (business) processes such as ‘consolidate orders’ or ‘route shipments’ and each of the processes consisted of a structure of activities, as shown in Figure 3. Although the names of some of the activities in the processes suggested a link to the activities described in the personas, there were no explicit relationships between them.

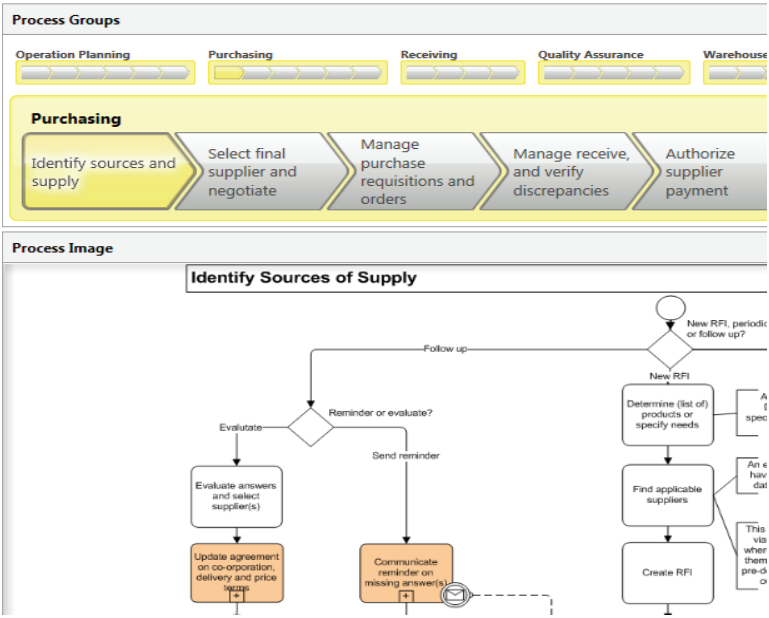


Figure 3. Processes and activities/tasks in the vendor's enterprise model. Copyright of Microsoft Corp.

5 Role-related Concepts in the Enterprise System

The enterprise system contained 21 out of the total 61 personas in the form of 'role-centers'. A role-center is the "home" of the user and contains activities and tasks based on a corresponding persona. Besides activities and tasks the role-centers also included integration to information from other systems giving them resemblance to enterprise portals (Carlsson and Hedman 2004). The 21 role-centers covered 116 of the total 233 roles in the enterprise model, but the roles themselves were not explicit in the system – only the role-centers were, as illustrated in Figure 4.

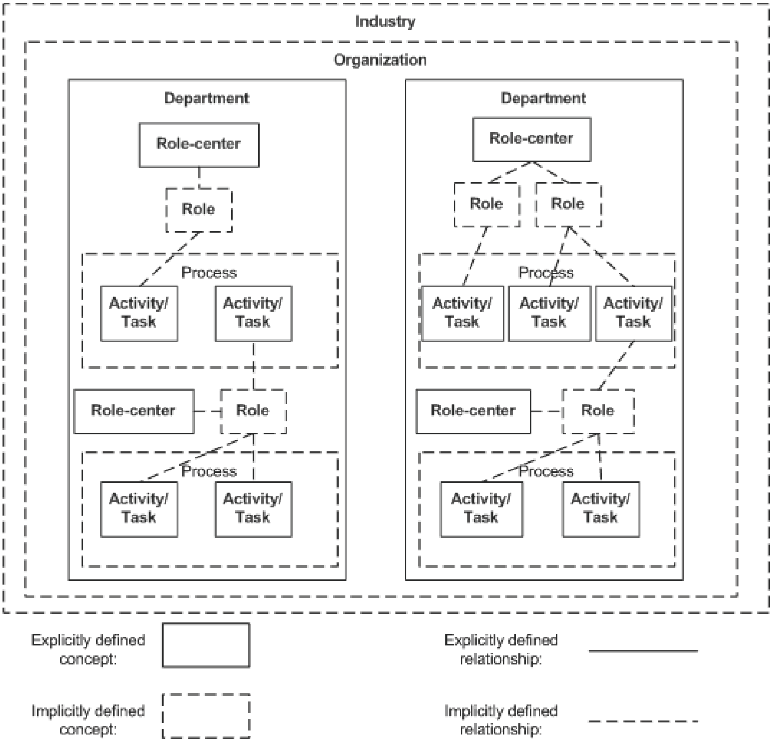


Figure 4. Role-related concepts as implemented in the vendor's enterprise system.

The names of the role-centers were based on the name of the primary role contained in the persona. Figure 4 shows the role-related concepts as they appear in a standard implementation of the enterprise system with a distinction between explicitly and implicitly defined concepts and relationships.

6 Role Content and Relationships in the Enterprise Model and Enterprise System

As previously described, each persona had multiple roles and thus supported the aggregation of organizational roles to a single position. In the implementation of the roles in the system each user login was assigned to a role-center and the assigned role-center could be changed by an administrator. All roles were pre-assigned to the role-centers and roles could not be added or omitted. The original idea behind the roles was that the user should be able to join the different roles together (Former Manager), but neither the enterprise model nor the enterprise system supported transition of roles from one persona to another. Since a user could only be assigned to a single user profile at any given time and a user profile was linked to only a single role-center, all the roles of an end-user were aggregated into a single user interface.

There were no apparent industry specific variants of roles in the model but some of the personas contained ‘persona variables’, reflecting alternative collections of roles depending on the organizational structure in which they were part (see Figure 2). In the system there were specializations of three role-centers, reflecting differences in the ‘CEO’, ‘Shop Supervisor’, and a ‘Shipping and Receiving’ persona.

In the enterprise model it was not possible to remodel the described tasks and activities or reassign the tasks and activities to other roles or personas. Remodelling and reassignment of tasks and activities in the enterprise system was not supported explicitly either and required customization of the code base of the system. Table 1 contains a comparison of the supported role dynamics in the enterprise model and the system.

Table 1. Role content and relationships.

Role content	Vendor's enterprise model	Vendor's enterprise system
Role specialization	Persona variables	Role-center variations
Remodelling of tasks	-	Required customization
Reassignment of tasks	-	Required customization
Role relationships	Vendor's enterprise model	Vendor's enterprise system
Role aggregation	Multiple roles in one persona	Multiple roles in one role-center
Role transition	-	Associate login with a different role-center

7 Conclusion and Discussion

This paper contributes to some foundations for analysing how enterprise system vendors address the representation of organizational roles in their enterprise models and enterprise systems by emphasizing how role-related concepts are explicitly or implicitly represented and how role content and role relationships are supported.

Comparison between the vendor's enterprise model, the system, and the generalized role-related concepts showed that most of the concepts were represented but that representation of organizational structure and industry in the roles and personas was limited. The role concept itself was implemented in the system but only implicitly and the differences between industries and the variance in organizational structure, as reflected in the enterprise model, were not implemented in the system. The comparison also showed that although the enterprise model implied a connection between personas and processes the lack of explicit relations between the activities contained in the personas and the activities contained in the processes essentially caused a disconnection between roles and processes in the model, which was also inherent in the system.

The support for role relationships in terms of aggregation was present by means of aggregating multiple roles into the same persona in the enterprise model and into the same role-center in the system, but neither the enterprise model nor the system supported explicit remodelling of tasks or reassigning tasks to different roles or personas. The lack of support for reassigning or remodelling tasks is potentially an issue when deploying the system in customer organizations as fitting of the predefined tasks and roles to the organization relies on customization of the code base rather than configuration.

While the introduction of organizational roles as a concept in enterprise systems could potentially reduce the gap between enterprise systems and organizations, the absence of support for remodelling or configuring role content and relationships may lead to an increased need for customization – resulting in higher cost of deployment. Future research will thus need to address the fit between predefined standard roles and customer organizations. Furthermore, the implications of using personas as representations of users in enterprise modelling should be further investigated. Finally, further research is required on actual implementations in customer organizations of enterprise systems that are adapted to organizational roles.

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Appendix E: Paper IV

Role-Oriented Enterprise Systems: Case Studies of Two Vendors

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Abstract

This paper examines the concept of role-oriented enterprise systems by investigating motivations for and approaches to constructing and reflecting predefined organizational roles in user interfaces of packaged enterprise systems. The research is conducted as case studies of Microsoft and SAP, constructed from interviews, documents, and examples of role-oriented enterprise system packages from both vendors. The research indicates that the primary motivation of the vendors for including predefined roles is to complement a function-centric approach with a user-centric approach to the design of user interfaces of enterprise systems. The research furthermore identifies strategies of an embedded and an independent approach to modeling the role concept and a unified and a componentized approach to reflecting role aggregation in user interfaces.

Keywords: Enterprise Systems, Organizational Roles, User Interfaces, SAP, Microsoft.

1 Introduction

Enterprise systems are important to the daily operations of most modern organizations. While early acquisition models relied on in-house development or individual software contractors, packaged systems now dominate the enterprise software market (Janson and Subramanian 1996; Davenport 1998; Markus and Tanis 2000). The universal nature of packaged software entails potential issues of gaps, or misfits, between enterprise systems package and individual customer organizations. (Rolland and Prakash 2000; Soh, Kien and Tay-Yap 2000). While much attention has been paid to the fit of business processes and functions (e.g., Koch 2001; Luo and Strong 2004; Huq, Huq and Cutright 2006), *user satisfaction* has long been acknowledged as playing an important role for the success of information system implementations (DeLone and McLean 1992). Previous research indicates that usability of enterprise systems is closely linked to user satisfaction (Calisir and Calisir 2004) but that several usability issues exists in the user interfaces of enterprise systems, such as easy identification of and access to needed functionality (Topi, Lucas and Babaian 2005). It has been suggested that multiple user interfaces may improve the usability of enterprise systems (Calisir and Calisir 2004) and that a focus on the *organizational roles* of the users may help provide a better fit between enterprise systems and human actors (Worley, Chatha, Weston et al. 2005; Johansson 2009). In tandem, enterprise system vendors have begun to focus their attention on the organizational roles of users (Sleeper 2004; Johansson 2009).

Previous research into the role concept in the fields of organizational role theory and Information Systems indicates that while no common definition of the concept exists (Biddle 1986), the role concept is extensively applied in the IS literature (Zhu and Zhou 2008). Several enterprise models thus include organizational roles (Scheer 2000; Almeida, Guizzardi and Santos 2009) and the role concept is frequently used for managing security rights of end-users in enterprise systems (Kern, Kuhlmann, Schaad et al. 2002; She and Thuraisingham 2007). Furthermore, previous research has addressed approaches for reflecting organizational roles in the user interface of Information Systems in general (e.g., Shneiderman and Plaisant 1994) and in enterprise systems in the form of Enterprise Portals (Carlsson and Hedman 2004; Puschmann and Rainer 2004). However, little empirical research has investigated why and how vendors apply organizational roles to the user interfaces of enterprise systems. This paper thus seeks to answer this question by comparing the approach to role-oriented enterprise systems from Microsoft and SAP.

The remaining parts of the paper are structured as follows: 1) Presentation of previous research relevant to the concept of role-oriented enterprise systems to organizational roles and to representing roles in user interfaces; 2) the research design of the empirical study; 3) presentation of the findings; 4) discussion of the findings; and 5) conclusion and future research.

2 Previous research

Before embarking on the empirical study to answer the question of how enterprise systems vendors orient their system to organizational roles, we must look into previous research relevant to the concept of organizational roles and approaches to reflecting roles in information systems.

Katz and Kahn (1966) perceive the very essence of organizations as “the patterned activities of a number of individuals” and define a role as: “standardized patterns of behavior required of all persons playing part in a given functional relationship, regardless of personal wishes or interpersonal obligations irrelevant to the functional relationship.” . The term ‘role’ is often mistaken as synonymous with the notion of ‘position’ or ‘job title’ and the concepts are often used interchangeably in the literature. However, the terms differ conceptually as roles are concerned with *responsibilities* and *obligations*, whereas positions or job titles are concerned with *hierarchical relations* between individuals in the organization (Pareek 1994). Job titles and positions in isolation may thus not capture the “actual work” carried out by individuals in the organization. The concept of organizational roles is closely related to the concept of ‘processes’ or ‘business processes’ of the organization (Barros, Duddy, Lawley et al. 2000). Business processes may be defined as “[A] structured sets of work activities that lead to specific business outcomes for customers” (Davenport and Beers 1995). Organizational roles thus carry out the activities, or tasks, needed to complete the business processes.

An individual in an organization may occupy several roles simultaneously (Katz and Kahn 1966), also referred to as ‘role aggregation’ (Almeida et al. 2009). Individuals in small organizations often occupy multiple roles at a time, as opposed to large organizations where individuals typically only hold a single role. Fitting enterprise systems to organizational roles by means of predefined roles thus requires addressing the concept of role aggregation to fit organizations with various degrees of role aggregation. Closely related to the concept of role aggregation is the concept of '*role specialization*'. Role specialization is concerned with the distribution of tasks between roles (Pugh, Hickson, Hinings et al. 1968). Roles in SMEs are typically less specialized than roles in large organizations – or as put by Mintzberg (1979): "While it is not uncommon for the president of a small company to roll up his sleeves and fix a machine, or to serve in the role as an analyst in designing an inventory system, we would be surprised to see the president of a large company do these things." . The distinction between the concept of role aggregation and role specialization is arguably of little concern to users of enterprise systems, as they primarily focus on the actual tasks they carry out and not whether the tasks belong to one role or another. However, the two concepts conceptually differ, as described above and illustrated in Figure 1, and are important to a role-oriented enterprise system, as the system needs to fit both the level of role aggregation and role specialization, in order to fit the roles of the users.

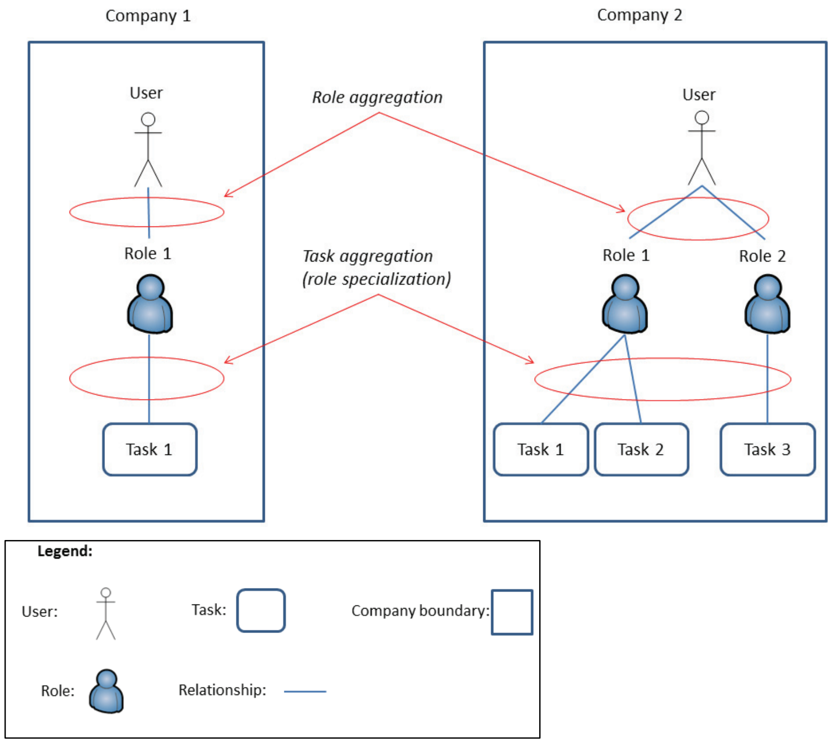

Figure 1. A meta model of role aggregation and specialization.

Organizations may operate in a particular industry, also referred to as an industry vertical. Some organizational roles, such as a 'Bookkeeper' or a 'Sales Order Processor', are found across many different industries. We may term these roles as 'cross-industry'. Other roles, such as an 'Insurance Salesman' or a 'Real Estate Agent', are specific for the industry in which the organization operates and we may thus refer to these roles as 'industry-specific' roles. While there is no clear definition distinguishing cross-industry and industry-specific roles, predefined roles in packaged enterprise systems will have to address the issue of support for both types of roles.

2.1 The application of roles in Information Systems

Zhu and Zhou (2008) make an extensive survey of the use of the role concept in the Information Systems field and conclude that while the concept has been extensively applied to various areas of the field, no commonly accepted definition of the term can be found. Previous research in the area of enterprise modeling has addressed organizational roles of users from a modeling perspective. Much of the literature on enterprise modeling, such as UML (Object Management Group 2007) and BPMN (White 2004), allows non-human agents, such as organization units and information systems, as occupants of organizational roles. While this abstraction offers a wider application of the role concept, it is of little relevance when addressing the topic of predefined roles as a means of supporting end-users in organizations. We thus reserve the occupation of organizational roles to human agents when addressing the topic of role-oriented enterprise systems. In the ARIS business process modeling (Scheer 2000), roles are defined as “a certain type of employee with clearly defined qualifications and skills” and are allocated to business functions. Roles are assigned to one or more ‘positions’ and positions may occupy multiple roles. ARIS thus addresses the concept relationship between roles and business processes, and the structure of role aggregation from a modeling perspective. While ARIS and other enterprise models capture the basic notion of organizational roles and their relationships to other business concepts, enterprise models are not aimed at capturing how to *reflect* organizational roles in the design of packaged enterprise systems.

Role-Based Access Control (RBAC) has been used extensively for managing security rights of users in enterprise systems (Kern et al. 2002; She and Thuraisingham 2007) and thus represents one approach to reflecting the role concept in design of enterprise systems. However, while implementation of RBAC-roles in enterprise may provide the first step towards reflecting organizational roles in enterprise systems, RBAC-roles has limitations when representing organizational roles in user interfaces. Firstly, RBAC is concerned with security, not with design of user interfaces. Secondly, security rights are "binary" – either the user has access to a specific function or not. Security rights do thus not address the frequency with which an organizational role accesses a certain function or the importance of easy access to certain information.

2.2 Reflecting organizational roles in user interfaces

In the field of Computer Supported Collaborative Work (CSCW), Greenberg (1991) suggests multiple user interfaces to accommodate differences in user roles and individual preferences. The implementation of multiple user interfaces has also been suggested in the field of enterprise systems to accommodate increasing diversity of enterprise system users and to increase overall user satisfaction (Calisir and Calisir 2004). Shneiderman and Plaisant (1994) suggest a 'Personal Role Manager' (PRM) as a means of reflecting roles in the user interface by allowing users to select the user interface matching the role they are currently occupying. The purpose of the PRM is thus to reduce "distraction while working in a role, and facilitate shifting of attention from one role to another" (Shneiderman and Plaisant).

In the field of enterprise systems, Enterprise Portals have been used to provide a single point of access to organizations' internal and external systems by syndicating information from different sources (Carlsson and Hedman 2004). The very essence of enterprise portals is thus to "group together applications and information through a *role-based* user interface" [italics added] (Puschmann and Rainer 2004). Carlsson and Hedman (2004) evaluate 329 predefined roles in SAP's mySAP Workplace Enterprise Portals and conclude, that while the roles have a strong internal and control focus, they lack external focus and support for top managers. Carlsson and Hedman (ibid.) furthermore explicitly suggest further research into the value of applying the role concept in enterprise systems and call for research into the potential issue of role aggregation in SMEs.

Armed with this preliminary understanding of the definition of organizational roles, approaches to modeling roles in the IS field, and previous attempts and suggestion for how to reflect organizational roles in user interfaces of enterprise systems, we proceed to outline the methodology for the empirical research presented in this paper.

3 Methodology

The research presented in this paper was conducted as case studies (Yin 2008) of two enterprise system vendors. The case study research is especially useful for investigating problems in which research and theory are in their early stages, and a multiple case study design allows a higher degree of generalization of the findings and emerging propositions (Benbasat, Goldstein and Mead 1987). Selection of the two cases was based on finding vendors that advertised their enterprise systems as oriented towards organizational roles of users. Selecting *large* vendors was emphasized to produce findings that would cover a larger population of customer organizations, as large vendors, all else equal, have a larger customer base. Microsoft Dynamics and SAP AG were thus selected as case study companies for the research, as both vendors explicitly advertise organizational roles as a key concept in the design of their enterprise systems and together they have a combined global market share of more than 1/3 of all enterprise system implementations (Panorama Consulting Group 2011). Data for the case studies consisted of semi-structured interviews (Kvale and Brinkmann 2008), an example of an enterprise system package from each vendor that included and reflected predefined roles in the user interface, and an extensive number of documents describing the role concept and implementation of the concept in the case systems.

Selection of respondents for the interviews was based on finding representatives in each case company who had participated in the process of constructing and implementing the predefined roles. Three interviews with respondents from Microsoft and two interviews with respondents from SAP were carried out, lasting between 51 and 108 minutes. The interviews were conducted between December 2008 and July 2011 and were fully transcribed to allow detailed analysis of the statements from the interview respondents. After the interviews were conducted, a representative from each vendor agreed to participate as co-authors of the paper, ensuring accuracy of the presented findings. Table 1 provides an overview of the positions of the respondents. The Usability Manager from Microsoft had left the company shortly before the interview was conducted to work as an external consultant advising about the role concept to Microsoft's partner companies. After careful consideration, and acceptance from the co-author from Microsoft, the manager was included in the research, as the information provided by the manager provided invaluable insight into the motivation reflecting the role concept in user interfaces at Microsoft.

Table 1. Interview respondents

Company	Respondent title
Microsoft	Usability Designer
	(Former) Usability Manager
	Partner Technology Advisor
SAP	Vice President of New Product Concepts
	Vice President of Product Solutions

Selecting the examples of enterprise system packages from the two vendors of systems was based on identifying system packages that included multiple role-oriented user interfaces, were readily comparable, and were available in the Danish market. At Microsoft, the NAV 2009 RTC with service pack 1 was selected as an example of how the company implemented the role concept. At SAP, the All-in-One version 8.81 with the NetWeaver Business Client version 3.0 was selected for comparison. Both systems are targeted at SMEs and allow 'on-premise' implementation at customer companies. While NAV 2009 RTC comes with a fixed number of predefined role user interfaces for the Danish market, the role content for SAP All-in-One is delivered in separate packages available from the vendor. The SAP 'Base line' package version 1.604 with cross-industry roles for the local Danish market was thus selected as the example of predefined roles at SAP.

To determine functionality of the two role-oriented systems and to triangulate statements from the interview respondents, an extensive number of documents were obtained from the two vendors. Most of the documents were publicly available, but some were acquired from internal sources. Especially the documents describing the internal process of constructing and communicating the predefined roles at the two vendors were not publicly available. Analysis of the data for the case studies was based on answering the research questions by uncovering: The very motivation for reflecting organizational roles in the user interfaces; the process of constructing the predefined roles and the constructs used in the process; how the predefined roles were reflected in the user interfaces of the systems; and approaches to tailoring and extending the predefined roles to individual customer companies.

4 Findings from the case studies

Table 2 provides a summary of the findings from the case studies of the two vendors. The findings are elaborated in greater details in the following paragraphs.

Table 2. Summary of research findings.

Analysis category	Analysis concept	Case study findings	
		Microsoft Dynamics	**SAP AG**
Motivation	Motivation for reflecting the role concept in user interfaces	Shift from a function-centric to a user-centric perspective Easy access to functionality for users Syndication of information	
Modeling of roles in enterprises	Framework for modeling roles	‘Customer model’	ARIS/Contextual Design
	Constructs modeling the role concept	Personas Roles Activities/Tasks Business Processes (See Figure 2)	Roles WorkSets Tasks Business Processes (See Figure 3)
Reflecting organizational roles in user interfaces	Example of role-oriented enterprise system	NAV 2009 RTC SP1	All-in-One 8.81 with NWBC 3.0
	No. of predefined role user interfaces in example systems	21	35 (‘Base line’ package)
	Characteristics of the predefined roles	Cross-industry	Cross-industry (‘Base line’ package)
	Extending predefined roles to specific industries	Partners	In-house and partners

4.1 Motivation for reflecting the role concept

The documentation accompanying the introduction of reflecting organizational roles in the user interfaces of enterprise systems at Microsoft states the motivation for orienting the systems to organizational roles as founded in “*combining the worlds of business process automation and personal productivity*” (Microsoft Dynamics 2007). The Usability Manager at Microsoft elaborated the motivation by emphasizing that the focus on organizational roles entails a move from a focus solely on *functions* to a focus on the needs of the *users*: “*Of course there is also a focus on functionality but that is more in the background. So there is a focus on that the user gets what the user needs.*

That means that all the information that the user needs is located so that it is easy to access". The manager further elaborated that the overall goal is to save time for the users: "*By the end of the day, it's about saving time. If [the role-oriented approach] works at is supposed to, then it should save the user a lot of time when looking for information [...] needed to take the right decisions and take action.*" The motivation for focusing on organizational roles at Microsoft was furthermore related to syndicating information from different sources in into one user interface.

The SAP documentation explains the purpose of reflecting roles in the user interfaces of the vendor's enterprise systems as: "In SAP systems, roles provide a convenient way to structure a user's daily tasks into groups of services and transactions, making them accessible from a personalized menu."(Schneider 2002). The SAP respondents further explained that, similar to the motivation at Microsoft, the primary reason for introducing the role concept was to center the attention on the users as opposed to the functions and processes of the system: "*The way ERP systems used to treat roles is really more system-centric. So there was a whole layer of access profiles in the back-end systems where you say, if we give this access role to this user they have access to this and this data or transaction [...]. So there was an obvious need for a concept that really thinks about what a user really needs in a certain role.*" (VP of New Product Concepts, SAP). The motivation for introducing the role concept in the enterprise systems of SAP was also related to syndication of information coming from different sources both from within the SAP systems and from external sources: "*So it's a mix of navigation and syndication*", explained the VP of New Product Concepts, SAP.

4.2 Conceptual modeling of organizational roles in enterprises

The vendors apply a number of methods and techniques for conceptual modeling of roles in enterprises. The models are based on studies of the work carried out by users in organizations in order to capture the *actual* work of users, rather than founding the models on what the enterprise systems already offer. The goal of the models is to eventually integrate the models with the different enterprise systems to support easy tailoring of systems to fit the individual customer companies.

4.2.1 Roles as embedded concept

At Microsoft, the conceptual modeling of organizational roles is communicated through a ‘Customer Model’ consisting of a number ‘Personas’ and their relationships to ‘Departments’ and ‘Processes’ (Microsoft Dynamics 2007). Besides description of ‘Demographics’, ‘Psychographics’, and a fictitious picture, each ‘Persona’ contains a description of the ‘Primary’ and ‘Secondary’ roles occupied by the Persona. A description of relations to ‘Core Activities’, such as ‘Approve quotes’ and ‘Pay company bills’, is also described for each Persona along with relationships to ‘Processes’, such as ‘Consolidate Orders’ and ‘Route Shipments’. The ‘Core Activities’ and the ‘Processes’ are thus *implicitly* linked to the roles through the Personas, as illustrated in Figure 2. The motivation for using Personas as part of the conceptual modeling of roles is to provide a unified view of typical user of enterprise systems.

The respondents at Microsoft further explained that the benefits of using Personas as part of the Customer Model are related to mapping the individual customer companies with a general enterprise model, and hence easier mapping to the predefined roles of the enterprise system: “*If you go to a customer and say, here is the Customer Model and then you tell me who takes care of your warehousing. If his name is Paul, then we find the place in the Customer Model where it says Eduardo [the Production Planner] and replace with Paul. In that way you get a dialog with the customer and put the customer in context with the Customer Model.*” (Usability Designer, Microsoft).

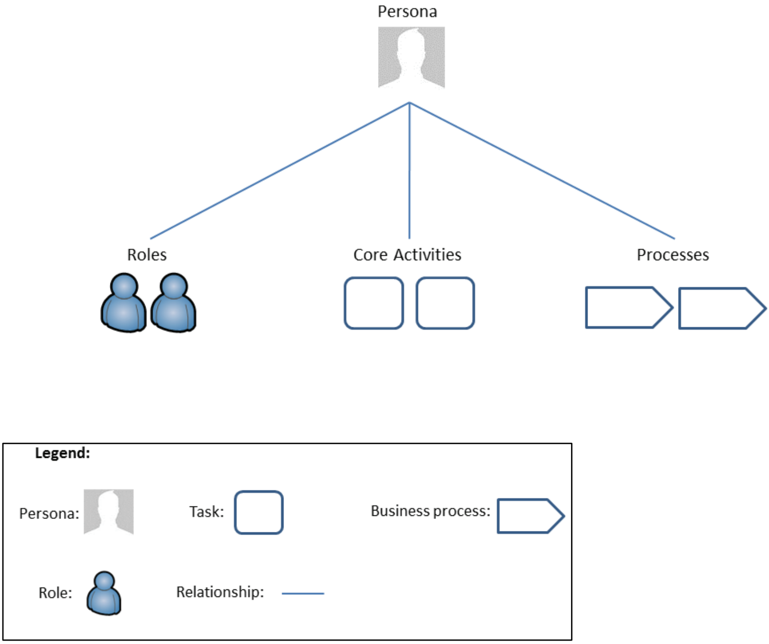

Figure 2. Meta model of roles as embedded concept with implicit relations.

4.2.2 Roles as independent concept

The underlying methodology for enterprise modeling at SAP is ARIS (Scheer and Habermann 2000; SDN 2008). However, Contextual Design (Beyer and Holtzblatt 1998) was used as the overarching methodology for collecting data about users and modeling their roles. The motivation for using Contextual Design as part of the modeling of roles is based on the perception that the method focused on the actual work of the users as opposed to simply modeling the roles based on the users' job descriptions: "*In reality people have certain responsibilities. This might be associated with a job title but is not necessarily so. Some people have a job title but do something* *else, e.g. generic management responsibilities. Contextual design is more a bottom up approach and only keeps the job title as a title for the role.*" (VP of New Product Concepts, SAP).

The constructs for designing the predefined roles at SAP consist primarily of so-called 'WorkSets': "It's a kind of bundle of tasks and responsibilities which very nicely hang together. And they might be associated with a job title but it's not mandatory" (VP of new Product Concepts, SAP). Each role is thus modeled as a number of WorkSets which in turn include a number of 'Tasks', related to 'Business Processes, as illustrated in Figure 3. The motivation for using WorkSets is founded on the principle that while the combination of roles of users is likely to vary between customer companies, the WorkSets themselves are reusable across many different companies, and can thus be combined in different ways to reflect different roles.

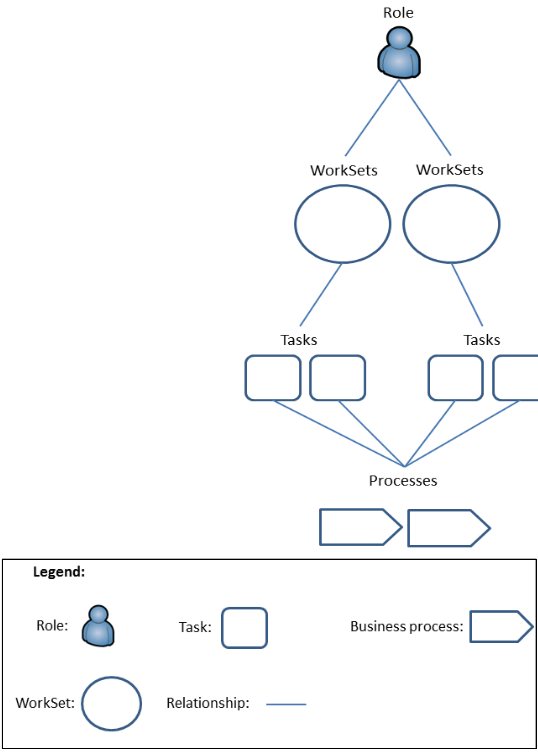

Figure 3. Meta model of roles as independent concept with explicit relations.

4.3 Reflecting predefined roles in user interfaces

While both vendors had long applied the role concept for managing security and data access rights in their enterprise systems, the vendors had extended the application of the role concept by including *predefined role-oriented user interfaces* in their systems. Both examples of role-oriented enterprise systems from the vendor thus included a number of predefined role user interfaces to use “out-of-the-box”. While the vendors aimed at providing a good fit between the predefined user interfaces and the actual user in organizations, both vendors agreed that it is difficult to include a set of predefined user interfaces that will match all users in all companies: "*The SAP role concept was essential for the information architecture of the Enterprise Portal*[7]*, but it was also a big step forward to accelerate the deployment and adoption of SAP solutions (e.g. Business One). Customers had a good out-of-the-box starting point which they could tailor over time to 100% match the role profiles of their company*." (Vice President of New Product Concepts, SAP).

4.3.1 Predefined role aggregation in the user interfaces

The NAV 2009 RTC ships with 21 predefined so-called 'Role Centers', available to any customer organization acquiring the system. Each Role Center are based on a corresponding Persona in the Microsoft Customer Model and reflected cross-industry roles, such as 'Sales Order Processor' or 'Bookkeeper'. The Role Centers are aimed at supporting users through a *predefined set of aggregated roles* by placing the tasks and information perceived to be of most importance to the multiple roles of the user at the forefront of the user interface. Consistent with the approach of aggregating multiple roles into the same user interface the NAV 2009 RTC only allows association of a user login to a single Role Center at a time, as the goal is for the users to work in a role aggregated user interface, rather than switching between different interfaces. If the predefined user interfaces do not match the tasks associated with the roles in customer organizations, the interfaces can be tailored by implementation consultants or the users themselves to include a different combination of tasks. Users can furthermore personalize various aspects of a Role Center to reflect their personal preference. A screenshot of a Role Center in NAV 2009 RTC can be found in Appendix 1.

4.3.2 Componentized reflection of roles in user interfaces

The NetWeaver Business Client 3.0 implements the role concept by supporting the notion of so-called 'Work Centers', defined as: "*central work environments that*

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[7] The SAP Enterprise Portals was the first product to reflect roles of user in the user interface.

provide access to role-specific functions."(SAP AG 2011). A user can have multiple Work Centers included in his or her user interface and switch between the Work Centers, through the use of tabs, as portrayed by the conceptual illustration of a Work Center in Appendix 2. The users can furthermore personalize various aspects of the Work Centers to fit their personal preferences and SAP, furthermore, offers a 'Control Center', which syndicates tasks from different Work Centers (WorkSets), to create a unified interface for the user. The actual content for the Work Centers is delivered separately in packages available from SAP. Several hundred predefined roles are available from the vendor for organizations to aggregate into the combination that best fits the role sets of their users. An example of a package of roles from SAP that is comparable to the user profiles in the Microsoft NAV 2009 RTC is the 'Base Line' package for Danish SME companies, containing 35 predefined cross-industry roles, such as 'Asset Accountant' and 'Finance Manager'.

4.3.3 Extending the predefined role user interfaces

While both vendors support and encourage extension and tailoring of their predefined role user interfaces, the strategies for extension vary between the two vendors. The strategy of Microsoft relies primarily on an ecosystem of Independent Software Vendors (ISVs) for extending their enterprise systems to different industry verticals. This strategy also applies to the extension of the predefined cross-industry user profiles with industry-specific variations. SAP, on the other hand, develops their own industry-specific variations of the predefined roles. The strategic intend of SAP is thus to cover up to 80% of an industry's requirements and let implementation consultants and partner companies add and tailor the remaining 20% to fit the individual customer organization (SAP AG 2010).

5 Discussion

Studying two of the largest enterprise system vendors indicates that both vendors find the reflection of the role concept in user interfaces useful for complementing a *function-centric* perspective on enterprise systems with a *user-centric* perspective, for the purpose of providing easier access to functions and save time for the end-users. The inclusion of predefined role user interfaces in the enterprise systems reflects an extension of the traditional application of roles for access control (RBAC). While predefined role user interfaces are included to provide some initial fit with actual roles of the users in customer organizations, both vendors acknowledge that tailoring of the predefined roles are necessary to achieve a perfect fit with users in the individual organizations. The position by both vendors confirms that the use of 'job titles' or 'positions' is insufficient for capturing the full perspective of the actual work carried out by the users.

However, the different approaches to modeling organizational roles in customer organizations suggests different perspectives on what the role concept may contribute with. The *embedded* modeling of roles as part of a Persona in the Microsoft Customer Model reflects a strategy of focusing on modeling at the *user level*, rather than the role level itself. While the use of Personas, both at Microsoft and in the literature, is primarily used for communicating requirements of the users (Grudin and Pruitt 2002; Pruitt and Grudin 2003; Nielsen 2004), the extension of the Persona technique to the domain of enterprise modeling presents a potential path for bridging user centered design with conventional enterprise modeling. Although the embedded approach to modeling the roles in the Personas entails implicit relationships between the roles and other business entities, the use of Personas does not inherently entail implicit relationships. The approach could thus be extended to include *explicit* relationships between the roles and the other entities, thereby keeping the Personas as the overall user model, while increasing explication of the concepts in the model.

The *single profile* approach of user interfaces of the Microsoft NAV 2009 RTC restates the emphasis on aggregating tasks at the user level, rather than the role level, to ensure a *unified* reflection of all user roles in a single screen. This approach entails some dependence on the predefined role aggregation of profiles fitting the role aggregation of the actual users, if further tailoring is to be avoided. Again, reflecting the roles as an explicit concept in the user interfaces might provide an intermediary level of tailoring between the low level tasks and the high level user profiles.

The strategy of modeling roles as *independent* concepts at SAP reflects a perception of the concept as useful in its own right. This approach corresponds to the conventional approach to modeling the role concept in most of the enterprise modeling literature (e.g., Barros et al. 2000; Almeida et al. 2009) (Scheer and Nüttgens 2000). However, the use of WorkSets as a collection of tasks adds a layer of aggregation between the concepts of tasks and roles, not commonly found in the enterprise modeling literature. Having both the WorkSets and the roles as layers of aggregated tasks thus provides a very *componentized*, although slightly convoluted, approach to modeling of roles. The fit of the WorkSet approach thus depends on the fit of the predefined task aggregation with task aggregation of the actual users.

The delivery of roles in packages and the possibility of combining multiple predefined WorkCenters in the user interface of NetWeaver Business Client restate the componentized approach to tailoring the user interfaces at SAP. All roles of the user is thus accessible in the same user interface and role aggregation is handled by users switching between different roles, much like in Shneiderman’s (1994) concept of a PRM. Although this approach entails a more flexible approach to tailoring the user interfaces, the approach involves switching between roles rather than working from a single screen. However, the inclusion of the Control Center ensures that users can chose to interact with the system in a *unified* interface, if role switching becomes cumbersome or a syndicated interface is preferred.

An overview of the approaches to modeling and reflecting the role concept is presented in Table 3.

Table 3. Strategies for modeling and reflecting the role concept.

Strategies of modeling the role concept	Strategies for reflecting role aggregation in user interfaces
Embedded vs. independent	Unified vs. componentized

6 Conclusions and future research

The research presented in this paper suggests that enterprise system vendors orient their systems to organizational roles to complement a function-centric perspective with a user-centric perspective to ensure a focus on easy access and a clear overview of tasks and information needed by the users. Inclusion of predefined role-oriented user interfaces may provide an initial degree of fit with the actual roles of users in organizations, although some degree of tailoring is still needed to ensure optimal fit between users and user interfaces. The comparison of the two vendors indicates variations between an *embedded* and a *independent* approach to modeling the roles and differences between a *unified* and a *componentized* approach to reflecting role aggregation in user interfaces. These findings contributes to the scarcity of literature addressing the topic of reflecting organizational roles in user interfaces of enterprise systems and confirms the conceptual distinction between roles and positions, proposed by the literature on organizational roles theory.

While this paper provides some initial insight into reflecting organizational roles in user interfaces of enterprise systems, further research is needed. First, the findings in this paper are based on the enterprise system vendors' perspectives. Empirical research in customer organizations is thus needed to investigate whether the proposed benefits of reflecting organization roles in user interfaces of enterprise systems materialize in real world organizations and how well the predefined user interfaces fit the actual users. It will especially be relevant to study the implementation of the predefined role user interfaces in SMEs to establish if role aggregation presents an issue in real world implementations. Second, the implications of pursuing a *unified* as opposed to a *componentized* reflection of roles in user interfaces should be addressed through usability evaluation studies of user in customer companies. Third, as indicated by both case studies, vendors expect and encourage tailoring of the predefined role user interfaces to fit individual customer organization. Future research should thus look into the process of tailoring the predefined user interfaces to establish how implementation consultants and other partner companies approach the concept of role-oriented enterprise systems. Finally, more case studies of the motivations and approaches of other enterprise system vendors should be conducted to extend and validate the findings proposed in this paper.

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Appendix F: Paper V

Tailoring Role-Oriented Enterprise Systems: Challenges and Applied Strategies

Unpublished

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Abstract

Enterprise system vendors, practitioners, and researchers have dedicated much attention to fitting packaged enterprise systems to organizations, based on *business processes*. However, enterprise system vendors are increasingly complementing the focus on the fit of business process with a focus on the fit of *organizational roles* of the users, by reflecting predefined roles in the user interfaces of their systems. This paper addresses challenges of related to fit of the predefined roles and strategies for tailoring the predefined role-fitted user interfaces to the actual roles of users in customer organizations. The paper is based on a study of how a number of partner companies in an enterprise software ecosystem tailor the predefined user interfaces of a role-oriented enterprise system. The findings suggest that the predefined role user interfaces may provide an initial degree of fit to the users in customer organizations. However, the research identifies potential misfits related to the *role scope* and *industry-specific roles* of the predefined roles. Based on the findings on misfits, a classification of role misfits is proposed. The strategies applied by the partner companies for addressing the misfits consisted of moving from a level of role fit to a level of personal fit, when addressing the scope misfits, and reliance on independent software vendors for developing industry-specific roles, when addressing the industry-specific role misfits. Based on the findings on tailoring, a classification of role tailoring is proposed.

Keywords: Organizational Roles, Enterprise Systems, NAV 2009 RTC, Tailoring Strategies, Misfits

1 Introduction

Enterprise systems are standard in most modern businesses and are often referred to as "the price of entry for running a business" (Kumar and van Hillegersberg, 2000). While early implementations of enterprise software in the 70's and 80's were developed specifically for the individual organizations in which they were implemented, off-the-shelf or *packaged* systems have now become the dominant form of acquiring enterprise systems (Janson and Subramanian 1996). As the very essence of packaged software entails a universal approach in the way functions and processes are supported, gaps, or misfits, may arise between the universal functions of the system and the processes and workflows of the individual customer companies (Light 2005). Previous research has thus addressed the issues of fit and gaps between packaged enterprise systems and the organizations in which they are implemented (e.g., Rolland and Prakash 2000; Soh, Kien and Tay-Yap 2000). Researchers and practitioners alike have dedicated much attention to the issues of gaps and misfits from a *business process* perspective (e.g. Koch 2001; Luo and Strong 2004; Huq, Huq and Cutright 2006).

However, the success of enterprise system adoption does not hinge on the fit of business processes in isolation. The fit between the business processes of the enterprise system and the workflow of the users carrying out the activities as part of the business processes is arguably an important aspect of enterprise system success (Calisir and Calisir 2004). Recent research has suggested that focusing on *organizational roles* may help adapt business processes of enterprise systems to better fit the human actors carrying out the enterprise activities (Worley, Chatha, Weston et al. 2005; Johansson 2009).

Meanwhile, enterprise system vendors have increasingly begun to focus on supporting users in customer organizations through incorporation of *organizational roles* in their enterprise system packages (Carlsson and Hedman 2004; Johansson 2009). Both Microsoft Dynamics (Microsoft) and SAP AG thus offer enterprise system packages that includes a number of predefined organizational roles to support roles of the end-users. While the concept of roles has been applied extensively for various purposes within the IS field (Zhu and Zhou 2008), limited research has addressed the concept of fitting enterprise systems to organizational roles (Carlsson and Hedman 2004). Little is thus known about the very concept of reflecting user roles in enterprise systems.

Furthermore, the concept of supporting users through incorporation of predefined roles entails potential issues of misfits between the predefined roles and the actual roles of the end users. This paper thus seeks to address the emerging concept of role-fitted enterprise systems by attempting to answer the questions of:

- What is the overall motivation of vendors for reflecting organizational roles in enterprise systems?
- What are the types of misfits that may arise when fitting packaged enterprise systems to organizational roles of users in customer organizations?
- What strategies do vendors and implementation consultants apply to address the misfits?

The remaining parts of the paper are structured as follows: 1) A presentation of previous research relevant to the concept of fitting enterprise systems to organizational roles and misfits of packaged enterprise systems; 2) Background for the research and the research design; 3) Presentation of the findings; 4) Discussion of the findings; and 5) Conclusion and future research.

2 Reflecting organizational roles in enterprise systems

The study of fitting enterprise systems to organizational roles of end-users calls for investigation of previous research on the topic of reflecting organizational roles in enterprise systems. In the quest for relevant literature we may draw upon two streams of literature. Firstly, the literature on organizational role theory provides insight into the very definition of the concept of organizational roles and the structures and mechanisms related to the concept. Secondly, the IS literature offers insight into previous efforts in reflecting organizational roles in enterprise systems, the types of misfits that may arise, and approaches to addressing the misfits.

2.1 The definition of organizational roles

Much contemporary literature on organizational role theory stems from Katz and Kahn (1966) and their seminal work of on social psychology of organizations. In this stream of organizational theory the very definition of organizations is: “the patterned activities of a number of individuals” (Katz and Kahn 1966). Organizational roles of the individuals are defined as: “standardized patterns of behavior required of all persons playing part in a given functional relationship, regardless of personal wishes or interpersonal obligations irrelevant to the functional relationship” . The notion of roles is closely tied to the notion of *business processes*, which may be defined as: “[A] structured sets of work activities that lead to specific business outcomes for customers” (Davenport and Beers 1995). We may thus perceive roles as responsible for carrying out some of the tasks and activities which constitutes the business processes (Worley et al. 2005).

A single individual may occupy several roles in the organization (Katz and Kahn 1966). The structure of a single individual occupying multiple roles is also referred to as *‘role aggregation’* (Almeida, Guizzardi and Santos 2009). Individuals in SMEs typically occupy multiple roles as opposed to individuals in large enterprises who often occupy the same organizational roles (Mintzberg 1979). Based on the definition of roles and their related concepts we may perceive the structure between the concepts as illustrated in Figure 1.

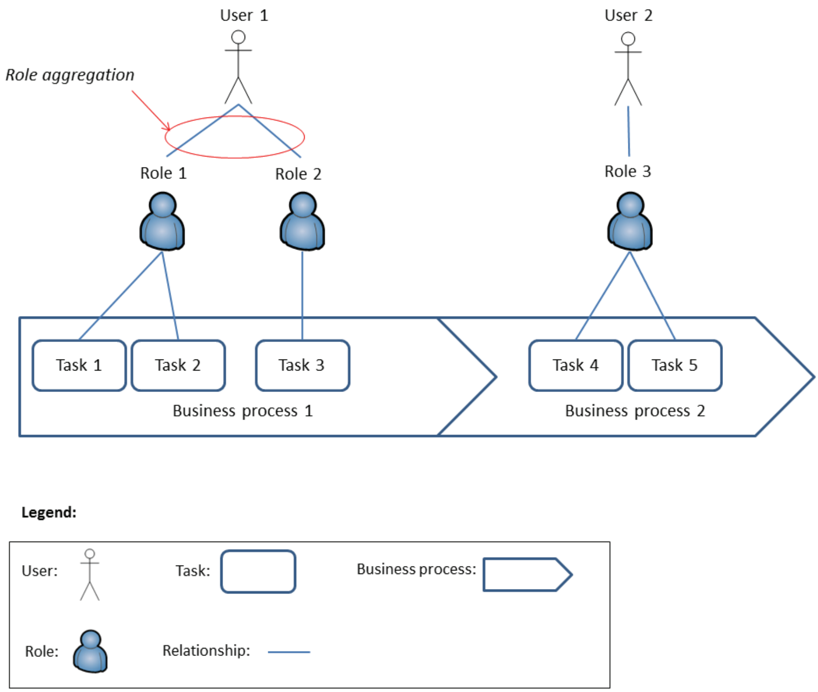

Figure 1. A meta model of the structure of roles and their related concepts

2.2 Reflecting organizational roles in enterprise systems

The concept of roles in general has been applied for various different purposes in the IS field (Zhu and Zhou 2008). Worley et al. (2005) propose the notion of roles in enterprise systems for the purpose of describing human interaction with the system and Johansson (2009) suggests role-*based* enterprise systems as a means of identifying requirements of users and bridging the gap between processes and end-users. Zhu and Zhou (2008) define a role-based information system as system that is "analyzed with role-based *models*, designed by role *structures*, and constructed with roles as first-order *components*" [italics added] .

The modeling and structure part of role-based information systems has been addressed in several methods for enterprise modeling, such as ARIS (Scheer 2000) and UML (Object Management Group 2007). In most of these approaches, enterprise activities are carried out by entities referred to as ‘actors’, ‘agents’, or ‘objects’ that play a ‘role’ in these activities (Almeida et al. 2009). Much of the enterprise modeling literature thus allows non-human entities, such as organizations, departments, or information systems, to occupy roles for the purpose of abstraction. While this abstraction allows a broader application of the role term, the occupation of roles by non-human entities is of little relevance for the purpose of supporting organizational roles of end-users. We thus reserve the occupation of organizational roles to human beings in this paper.

In the field of Participatory Design, various approaches to modeling user groups have been proposed, such as the Persona technique. The Persona technique was originally developed for the purpose of communicating user requirements internally within a design team through the portraying of fictitious users (Cooper 1999) but has later been extended to the IS field (e.g., Pruitt and Grudin 2003; Nielsen 2004). The ‘foundation document’ used in some variations of Personas (Grudin and Pruitt 2002) contains the notion of ‘work activities’ which includes ‘job description’ and ‘role at work’. The foundation document in the Persona technique may thus be perceived as a ‘container’ for describing the relationships between users and organizational roles. The literature on Personas does, however, not address the concept of roles on an organizational level or the detailed workflow of the organizational roles, and it has been proposed that the Persona technique in isolation is too simplistic for describing detailed user requirements (Holtzblatt 2002). Personas in isolation may thus not be suitable for capturing the full perspective of organizational roles in the context of enterprise systems without integration with more detailed models of organizational business processes.

The construction of role-based information systems with roles as 'first order components' may take several forms. Role-based access control (RBAC) has been used as a component for managing the security rights of users in their interaction with information systems in enterprise environments for several decades (Zhu and Zhou 2008). The central notion of RBAC is that permissions are associated with roles and that users are assigned to the appropriate roles (Ferraiolo, Cugini and Kuhn 1995; Sandhu, Coyne, Feinstein et al. 1996). Various extensions have been proposed to best fit RBAC models to the field of enterprise systems (e.g., Oh 2003). However, while the literature on RBAC may provide insight into the bridging of organizational roles and enterprise systems, the technique is primarily concerned with security rights and not with the *workflow* of users. Second, security rights are "binary" – either the user has access to a specific function or not. Security rights do thus not address the *frequency* with which an organizational role accesses a certain function or the importance of easy access to certain information. Finally, the RBAC technique does not aid in the design of role-oriented user interfaces in terms of *displaying* information to fit organizational roles. The application of RBAC in isolation does not reflect all aspects of fitting enterprise systems to organizational roles and reflecting roles in the user interface.

2.3 Reflecting organizational roles in user interfaces

Multiple user interfaces in enterprise systems has been suggested as a means of improving user satisfaction, by accommodating the increasing diversity of enterprise system users (Calisir and Calisir 2004). Personalizable groupware with multiple user interfaces has furthermore been suggested as a means of accommodating individual preferences and increase acceptance of systems among users (Greenberg 1991). Specifically addressing the reflection of multiple roles in user interfaces, Shneiderman and Plaisant (1994) propose the application of a 'Personal Role Manger' (PRM) as a way of "organizing information according to the roles that an individual has in an organization" . The concept of the PRM is that users with multiple roles can explicitly shift between the different roles in the users interface to "improve performance and reduce distraction while working in a role, while facilitating shifting of attention from one role to another” .

The concept of reflecting organizational roles in user interfaces has also been extended into the field of enterprise systems. The increasing application of *Enterprise Portals* thus reflects one approach to incorporating the role concept in enterprise systems. Enterprise Portals, also referred to as Process Portals, are designed as single point of entry to organizations’ information systems with the goal of presenting users with a role-based and personalized view of information (Puschmann and Rainer 2004). Enterprise Portals may thus incorporate a number of predefined roles perceived to fit the organizational roles of the organizations in which they are implemented (Carlsson and Hedman 2004).

Armed with this initial understanding of the definition of organizational roles and how previous research has addressed the reflection of organizational roles in enterprise systems, we may proceed to investigate previous research on the topic of misfits and tailoring of packaged enterprise systems.

3 Misfits and tailoring of packaged enterprise systems

Misfits and misalignment of enterprise systems arise when the organizational structures are in opposition to the structures embedded in the technology (Soh, Kien Sia, Fong Boh et al. 2003). Alignment and fit is often focused at the *business process* level (e.g. Koch 2001; Luo and Strong 2004; Huq et al. 2006). However, Rolland and Prakash (2000) argue that the business process level is often too detailed and that organizations think in terms of *goals* and objectives and that goal-driven alignment should be the level of focusing the fit. Soh, Kien, and Tay-Yap (2000) further propose data, functional, and output as types of misfits that may arise between packaged enterprise systems and customer organizations. Wu, Shing, and Heng (2007) propose a classification of misfits at goal, scenario, and activity level of the enterprise. The classification of misfits is useful for identifying misfits at different levels of abstraction. The classification by Wu et al. (2007) does however not include the misfits at the role level or misfits related to *how* data and output is represented at the user level.

Limited research has explicitly addressed the notion of fit of enterprise systems at the *role* level. Johansson (2009) suggests some initial challenges for reflecting organizational roles in enterprise systems and points to the aggregation of multiple roles of users in SMEs as a possible source of misfit. Carlsson and Hedman (2004) analyze the focus of 329 predefined roles in SAP Enterprise Portals using the Competing Values Model (Quinn and Rohrbaugh 1983), and conclude that while the predefined roles have a strong internal and control focus, they lack external focus and support for top management roles.

At the *user* level, Topi, Lucas, and Babaian (2005) investigate issues specifically related to the usability of an ERP implementation and find, among other issues, that identification of and access to the necessary functionality requires an unreasonable amount of effort for users of the system. Calisir and Calisir (2004) find usability, or lack thereof, to significantly influence end-users satisfaction – a classic measure of IS implementation success (DeLone and McLean 1992).

Based on previous research we may categorize misfits between packaged enterprise systems and organizations as depicted in Table 1.

Table 1. Categories of misfits.

Misfit category	Examples of authors
Enterprise goals	(Rolland and Prakash 2000)
Business processes	(Soh et al. 2000; Koch 2001; Luo and Strong 2004; Huq et al. 2006)
Organizational roles	(Carlsson and Hedman 2004; Johansson 2009)
Users	(Calisir and Calisir 2004; Topi et al. 2005)

When misfits arise between the enterprise system package and the customer organization a spectrum of choices must be made between two fundamentally different approaches to addressing the misfits. Either the customer organization has to change to meet the functions of the enterprise system, or the enterprise system has to be tailored, also known as 'customized', to meet the requirements of the organization (Soh et al. 2000). Extensive tailoring may complicate future upgrades and increase risk of failure and budget overrun (Luo and Strong 2004). Conventional wisdom has thus held that tailoring of enterprise systems should be avoided if possible (Bingi, Sharma and Godla 1999; Sumner 1999). However, some degree of tailoring is always necessary to get the system up and running (Brehm, Heinzl and Markus 2001) and forcing organizations and users to adapt to the system may decrease productivity (Soh et al. 2000) and deteriorate competitive advantage gained through differentiation (Davenport 1998). Hence, tailoring is in itself not inherently good or bad – but necessary (Light 2005).

Summarizing the review of previous research into reflecting and incorporating organizational roles in enterprise systems we have defined the concept of organizational roles and some basis relationships to other business entities, addressed previous research on reflecting and implementing organizational roles in enterprise systems, and categorized potential misfits of packaged enterprise systems.

4 Background of the research setting

The empirical research for this paper consisted of studying the fit and tailoring of the Microsoft NAV 2009 packaged enterprise system by studying how the Microsoft partner companies in the software ecosystem (Messerschmitt and Szyperski 2005) perceived the fit of the predefined roles and their strategies for addressing the misfits that occurred when implementing the system in customer companies.

4.1 The NAV 2009 RTC

The Microsoft NAV product line is targeted at small and medium enterprises (SMEs). The system has evolved from a focus on financial management in the 1980's to support an increasing number of organizational processes, much like other contemporary enterprise system packages (Adam and Sammon 2004). The system has thus traditionally had a strong focus on support for financial management but has increased its focus on a wider set of business functions, such as manufacturing, sales, and human resource, over the past two decades. A new major version of the NAV system is released approx. every 2-3 years and minor versions including service packs and minor improvements are released in-between the major releases. In more recent releases, the NAV package has included a front end-client with a single user interface offering some possibilities of adding "short-cuts" to different functions, but further fitting to the end-users relies on tailoring by implementation consultants.

The NAV 2009 was released in late 2008 and a service pack was released in the autumn of 2009. The new release includes an additional front-end client. The new front-end client is termed the 'role-tailored client', abbreviated RTC by the vendor, and can be implemented alone or alongside the old front-end client in a so-called 'mixed mode' environment where users can choose between the two front-end clients. The new front-end client includes a total of 21 predefined user interfaces targeted at supporting different organizational roles of end-users in customer companies. The predefined 'role user interfaces' are based on a Persona model of end-users in typical customer companies for the NAV product line. Although the underlying Personas conceptually includes description of multiple roles and their tasks, the implementation of the predefined user interfaces focuses on supporting the primary role of the Persona, and the user interfaces are named accordingly – e.g., 'Sales Order Processor' or 'Bookkeeper'.

The role concept in NAV 2009 RTC front-end client is reflected by only displaying the functions and information deemed to be relevant to the particular roles that the different user interfaces is designed for. Furthermore, each user interface includes a ‘role-center’, comparable to a home page, which consists of functions and information most frequently accessed by end-users occupying the particular role that the user interface is designed for. Appendix 1 shows a screenshot of the predefined user interface for a ‘Sales Order Processor’ role user interface. Complementary to the predefined role user interfaces, the new front-end client supports further personalization to the individual end-users. Users can thus add and remove certain functions and change the layout of information on their role-centers to personalize the user interface. If requirements of the users cannot be met through the options for personalization, implementation consultants or system administrators can tailor the user interfaces. The new front-end client only supports association between a user login and a single predefined user interfaces at any given time, thus requiring users to associate their login with a different user interface or have multiple logins if they wish to switch between the predefined user interfaces.

4.2 The Microsoft software ecosystem

The Microsoft enterprise system ecosystem consists of two types of partner companies, broadly speaking: The Independent Software Vendors (ISVs) and the Value Added Resellers (VARs). The Independent software vendors develop and sell reusable software add-ons complementing the functionality of the core enterprise system package delivered by the vendor, also referred to as ‘bolt-ons’ in the ES literature (Glass 1998). The add-ons can, broadly speaking, be divided into two types: cross-industry and industry-specific. The cross-industry add-ons extend the core enterprise system package with functionality used across different industries and include features, such as payroll, online banking, and project management. The industry-specific add-ons add functions and modules required by specific industries, such as textile design, veterinary medicine, and furniture manufacturing. The ISVs generate revenue through sale of licenses to the add-ons, and virtually all implementations of the core NAV enterprise system package are complemented by one or several add-ons when implemented at customer organizations.

The VARs carry out the implementation of the core enterprise system package and the add-ons at the customer organizations. The consultants in the VAR companies gather the requirements of the customer organizations and tailor the enterprise system if necessary. Unlike the add-ons developed by the ISVs, the tailoring made by the VARs is primarily customer specific and are not developed for reuse with other customers. Microsoft only sells licenses for the core enterprise system package through the VARs, and no direct contact is made between the vendor and the customer during an implementation. The VARs thus generate revenue by receiving a share of the license fee of the core enterprise package and the add-ons and through billable hours spent by consultants on the deployment and tailoring of the NAV system in the customer organizations. Some companies in the Microsoft ecosystem contain characteristics of both an ISV and a VAR, meaning that they both develop reusable add-ons and have a staff of consultants implementing the core enterprise system package together with their add-ons at the customers.

5 Research design

The research design followed an inductive approach the collection and analysis of data. The data for the study was collected from partner companies in the Danish market which has a well matured partner network due to the origins of the development of the NAV product line in a Danish software company, prior to the acquisition by Microsoft. Three types of data were collected between December 2008 and January 2010: Interviews; observations; and documents. The interviews consisted of semi-structured face-to-face interviews (Kvale and Brinkmann 2008) lasting between 41 and 108 minutes with an average of approx. one hour. The partner companies and respondents were selected to reflect differences in partner type, company size, and position of the respondents. A total of 16 interviews were conducted divided between four (4) interviews with representatives from Microsoft and 12 interviews with respondents in 10 different partner companies. One of the respondents representing Microsoft (the Usability Manager) had left the vendor shortly before the interview was conducted but had significant insight into the design of the new front-end client of NAV 2009 and was thus included in the research. All interviews were audio recorded and fully transcribed to allow detailed analysis and coding of the transcripts. Table 2 provides an overview of the interview respondents and their affiliation. A more in-depth description of the different partner company types included in the case is provided in the section on background of the research setting.

Table 2. Interview respondents and their affiliation.

Company alias	No. of employees	Company type	Interviewee title
Microsoft	90000 global/1000 local	Vendor	Partner Technology Advisor
			Product Marketing Manager
			Usability Designer
			Usability Manager
Partner 1	28	ISV + VAR	CIO
Partner 2	1100 global/250 local	VAR	Unit Manager
Partner 3	50	VAR	Consultant
Partner 4	14	VAR	Chief Consultant
Partner 5	1	VAR	Consultant
Partner 6	39000 global/250 local	ISV + VAR	Product Manager
Partner 7	50	VAR	Chief Consultant
Partner 8	180	ISV + VAR	Consultant
Partner 9	1800 global/80 local	VAR	Product Manager
			Consultant
Partner 10	23	ISV	CEO
			Product Manager

Observational data consisted primarily of participatory observations (Angrosino 2005) collected from a total of two Microsoft conferences, two Microsoft presentations, and three workshops with partner companies. A second type of observations was collected as part of in-depth observation of a demo implementation of the NAV 2009 RTC core enterprise package, obtained from Microsoft. Finally, documents describing the NAV 2009 RTC core package and the underlying enterprise model were obtained from Microsoft.

The collected data were analyzed using Grounded Theory (Glaser and Strauss 1967) as inspiration for identifying concepts, organizing concepts into categories, and identifying relationships between the concepts and categories. Collection and subsequent analysis of the data was carried out as an iterative process to allow concepts and categories that emerged from the analysis to be further saturated through additional data collection. The emerging categories and concepts and examples on how they were coded in the data are available in Appendix 1.

6 Findings

6.1 The motivation for introducing predefined roles

The marketing material accompanying the release of the NAV 2009 RTC described the purpose of role-fitting as: "*combining the worlds of business process automation and personal productivity*" (Microsoft Dynamics 2007). The Usability Manager explained that the idea behind making a role-fitted front-end client for the NAV product line was to shift, or complement, the focus on functions alone to a focus on which tasks the end-users carried out and how to best support these tasks. "*[The shift in focus] naturally entails that the users save time. And that is what it's all about – saving time. If the role-tailored client works as it's supposed to, then it should save the users the hassle of looking for the information [...] they need to make decisions or take action.*" (Usability Manager, Microsoft). The manager indicated that, in principle, most information systems could be role-fitted but that it was especially useful in the domain of modern enterprise systems, as so many diverse users interact with the systems.

The need for fitting enterprise systems to organizational roles was not new to some of the partner companies: "*The way of thinking that is introduced in the role-tailored client is something we have been developing for our customers for many years because the need has always been there*", said Product Manager, Partner 6. The implementation consultants in the VAR companies further indicated that while the support for role-fitting was limited in previous versions of the NAV product line, they had found ways of tailoring the system through the use of shortcuts and configuration of menus to fit different organizational roles. The majority of the respondents in the partner companies thus perceived the possibilities of role-fitting as positive – especially for new users: "*You can just put a user who does sales orders in front of the screen and say: "Do it!". You can see the flow of your orders and that's it. It is limited to what they need to see. [...] So the training of the users is really simple compared to the old client.*", said Chief Consultant, Partner 7.

The perceived benefits were also related to a simpler and 'cleaner' interface for the users: "*If we don't need this field then we just remove it if it is obstacle. That is one of the things that make people happy about this.*", said Consultant, Partner 8. When comparing the new and the old front-end client, the Consultant in Partner 5 stated that: "*If you wanted to do that in the old days then you had to program different windows and do all kinds of weird stuff.*" The respondents in the partner companies also generally indicated that the customers and the end-users were very excited about the new front-end client and that some even demanded implementation of the new client despite hesitation among the consultants, due to lack of experience with implementing it: "*If the customers were given a 100% free choice then I think they would choose the role-tailored client every time*", said CEO, Partner 10.

6.2 Understanding the role concept

Most of the respondents indicated that while it was important to have a technology in the form of a front-end client that supported the concept of user roles, the concept was more about the "mindset" than about the actual product. "*It is more a mindset than a product, because it is really a mindset*", said Unit Manager, Partner 2, and the Product Manager in Partner 10 elaborated by stating that: "*Previously we just thought about menu structures and showing the functionality – product, product, product. With the role-centers you create value for the people using the system. You have to think about creating an environment so that e.g. a sales order processer feels at home and that is a totally different way of thinking. It is seriously a different way of thinking*".

However, the change of mindset into thinking in tailoring the system to organizational roles was not so easy for all of the partner companies: "*It is somewhat difficult for me to comprehend that after 21 years with the same type of front-end client and the same ways of doing things, this is something totally different. In those 21 years I have never experienced such a big difference*", said Consultant, Partner 9. Other respondents in the partner companies elaborated on the difficulties of understanding the role-fitting concept and attributed the difficulties to poor communication of the concept from Microsoft: "*A very good concept that was very poorly explained to the partner companies.*" (CIO, Partner 1). The respondents from Microsoft were also aware of the difficulties among some partner companies of understanding the role-fitting concept. The Usability Manager also pointed to the cacophony in the communication of the role-fitting concept from the vendor as contributing to the confusion among the partner companies, while others attributed the lack of embrace of the concept to a general conservatism and resistance to change among the partner companies.

The difficulties with comprehending the role-fitting approach also worried the partner companies when they had to explain the benefits of the approach to their customers: "*We had a very hard time understanding and communicating this. How were we going to explain this to our customers? [...] When we meet customers and say "role-center" then they only think about their own world in isolation. If you talk to the sales department then they don't care about the people at the warehouse. And the people at the warehouse don't care about the bookkeepers.*", said CIO, partner 1.The respondents also emphasized the importance of everyone understanding the role-fitting concept in the partner companies and in the software ecosystem if the approach was to be embedded in the entire value chain from the vendor to the customer organizations: "*So many [parties] have to adjust to this way of thinking. The customers, the partner companies, the developers, and the consultants*", said Consultant, Partner 5.

6.3 Choosing among the predefined roles

Accompanying the release of the role-fitted client, Microsoft had released a simplified version of the enterprise model with the Personas used to design the predefined role user interfaces to help the partner companies match the user interfaces to the users in the customer organizations. However, none of the respondents in the partner companies reported using the enterprise model offered by Microsoft when choosing among the predefined role user interfaces, and some did not know it even existed. "*I have seen [the enterprise model] and I like the idea. But no matter how extensive it is it will never cover [the customer companies] 100%. And if it becomes more extensive then it also becomes more complex and then we will not bother to use it.*", explained Chief Consultant, Partner 7.

The approach to choosing among the predefined user interfaces for the users in the customer organizations varied significantly among the partners in the software ecosystem and between different implementations. Some consultants engaged in workshops with the end-users to enable them to choose their own role user interfaces. In other implementations of the role-fitted client the consultants chose the predefined role user interfaces provided by the NAV 2009 RTC system and assigned the user interfaces to the users: "*We [the consultants] can sit down and look at each other and define what the customer's business is really about. We have implemented solutions in the furniture manufacturing industry since 1990, so we know what roles they have*", said Consultant, Partner 5.

Most of the implementation consultants thus followed an 'ad-hoc' approach to choosing the role user interfaces. The approach involved that the consultants initially based their selection on the name of the user interface, e.g. 'Sales Order Processor', and then browsed through the user interface to further determine the fit: "*It is pretty straight forward really. When we began the implementation I browsed through [the predefined user interfaces] and saw that there is a Sales Order Processor. What does* *that contain? Oh, it contains pretty much what I need, but maybe I need to tweak it a little. And then I went on to the Purchaser role and it pretty much contained what I needed too*", said Chief Consultant, Partner 7.

6.4 Cross-industry and industry-specific fit of the predefined roles

The partner companies indicated both a *cross-industry* and an *industry-specific* dimension to the notion of fit of the predefined role user interfaces. The respondents expressed that the predefined role user interfaces primarily fitted companies in the 'trade' industry: "*The [predefined] roles are for trade companies. And it doesn't really matter which branch of trade the companies are in, as long as their business model is to receive some orders and ship some goods*", said Chief Consultant, Partner 7. The respondents further indicated that some of the predefined roles, such as the Sales Order Processor, fitted most companies, regardless of the industry they were operating in: "*The [predefined] 'Sales Order Processor' will be a pretty good match for any Sales Order Processor in any industry vertical context. We don't need to add anything.*", said Consultant, Partner 8.

However, the respondents in the partner companies pointed out that certain user roles in other industries were not as well supported by the predefined role user interfaces, leaving an industry-specific gap between the predefined user interfaces and actual user roles: " *[...] so will it require that we tailor the predefined role-centers to address industry verticals? Yes it will. Otherwise there is no button to press to activate the features that we have made that are industry vertical specific.*", said Consultant, Partner 8, referring to a need and industry-specific role user interfaces that would include the functions of the industry-specific add-ons supplied by the ISVs. A number of cross-industry add-ons had not been upgraded by the ISVs to fit the new front-end client either, leaving a cross-industry misfit of the predefined role user interfaces. Access to both industry-specific and cross-industry add-ons that had not been upgraded thus relied on users opening the old front-end client to access the add-ons.

We may thus perceive the cross-industry and industry-specific fit of the predefined role user interfaces, as conceptually illustrated in Figure 2.

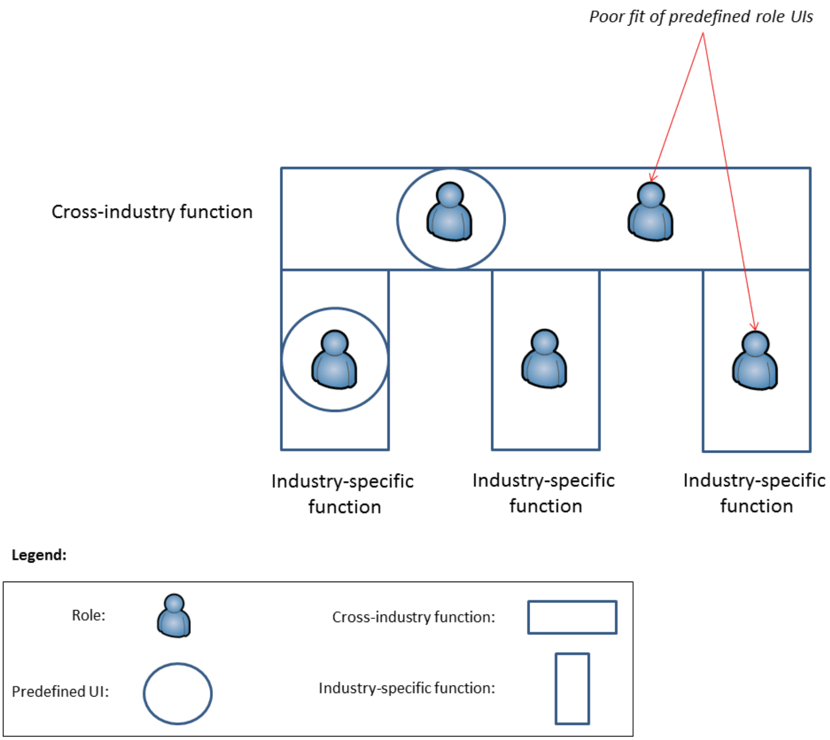

Figure 2. Cross-industry and industry-specific fit of the predefined user role user interfaces

6.5 Scope fit of the predefined roles

After choosing the predefined role user interfaces that best suited the users in the customer companies the consultants would evaluate how well the predefined roles fitted the different users. Some of the predefined roles had a high degree of fit with the user roles in customer organizations: "*If we implement the [predefined] 'Sales Order*

Processor' for users that are Sales Order Processors or Warehouse Managers in smaller companies then we probably get a 95% fit", said Consultant, Partner 8.

However, the predefined role user interfaces did not always fit the scope of the user roles in the customer organizations. Some participants pointed to a poor fit between the predefined role user interfaces and end-user with multiple roles that included tasks located across different predefined role user interfaces. The consultants had observed that especially end-users in SMEs often had multiple roles that did not readily fit into one single predefined role user interface: "*When we go to [the customer] and talk to an Order Processor then they are not only Order Processor. They also do purchasing […] or they take a look at production to see if they can put something in the production plan and so on. So many of the roles that are defined by Microsoft are too narrow for a typical Danish company*", said CEO, Partner 10, indicating that the issue was amplified by the relatively large share of SMEs in the Danish market. We may thus label this type of misfit between the predefined roles and the roles of the users as a 'scope misfit', as conceptually illustrated in Figure 3.

Some consultants had observed that when scope misfits occurred, end-users were prone to abandoning the role-centers in their user interface and navigate the system through the use of menus or even switching between the predefined user interfaces. The general perception among the respondents was thus that users experiencing scope misfits were not gaining the full potential of role-fitting unless the predefined role user interfaces were tailored to make it possible for the users to work in a single user interface.

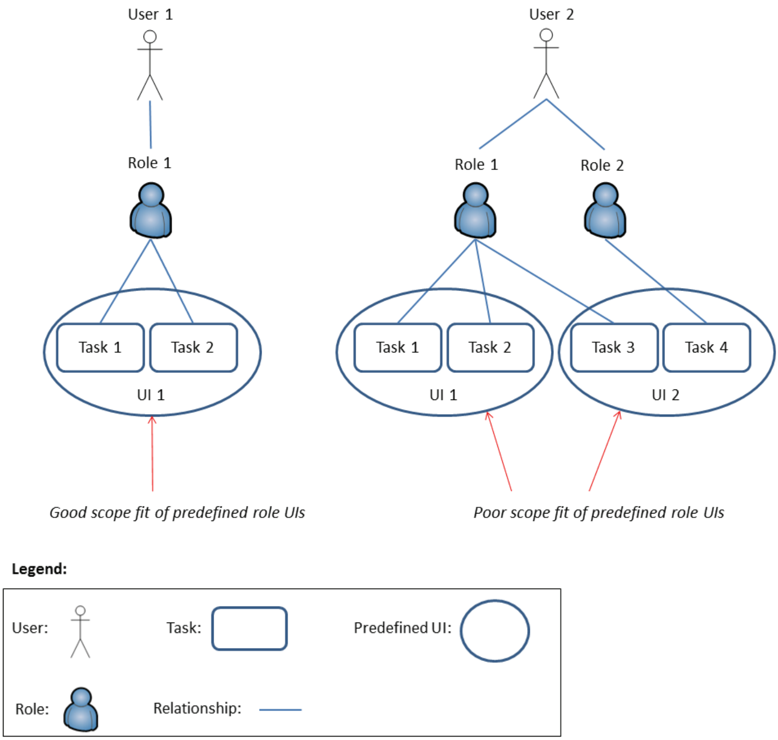

Figure 3. Scope fit and misfit of predefined role user interfaces

6.6 Strategies for addressing the misfits of the predefined roles

When misfits occurred between the predefined roles of the system and the user roles in the customer organizations, the partner companies applied a number of different strategies for addressing the misfits. The strategies were not mutually exclusive and several respondents reported using a combination of the strategies to address the misfits.

6.6.1 Extending cross-industry and industry-specific roles

The lack of focus on predefined roles in some cross-industry and industry-specific functions was an intended strategy by Microsoft. "*It is the partner companies that have* *to adjust their vertical industry solutions to the new versions that Microsoft releases. They are selling the combined solution to the customers and not the standard NAV solution to the customers*." (Product Marketing Manager, Microsoft). This strategy was shared by the ISV companies that provided industry-specific add-ons: "*If you look at Customer Model [the predefined persona model] there is a need for extending that to [specific] industry verticals to some degree. But that is not Microsoft's job. That is our job.*" (Consultant, Partner 8). When addressing the industry misfits of the predefined roles, the implementation consultants in the VAR companies thus primarily relied on the ISVs with industry-specific add-ons to develop industry-specific roles. However, as explained previously, only few of the ISVs in the partner ecosystem had upgraded their add-ons to be compatible with the technology of the new front-end client by the time NAV 2009 RTC was released. The few ISVs that had upgraded their add-ons had not integrated the functionality in specific role user interfaces but rather made the functions generally available across the predefined UIs.

6.6.2 Addressing the scope misfits

When addressing the scope misfit of the predefined role user interfaces, the implementation consultants needed to ensure that users would not have to switch between the predefined UIs to gain access to the information and tasks they needed to carry out their daily work, as illustrated in Figure 4. Two variations of the strategy for addressing the scope misfit were observed among the partner companies: Fitting *with* tailoring and fitting *without* tailoring.

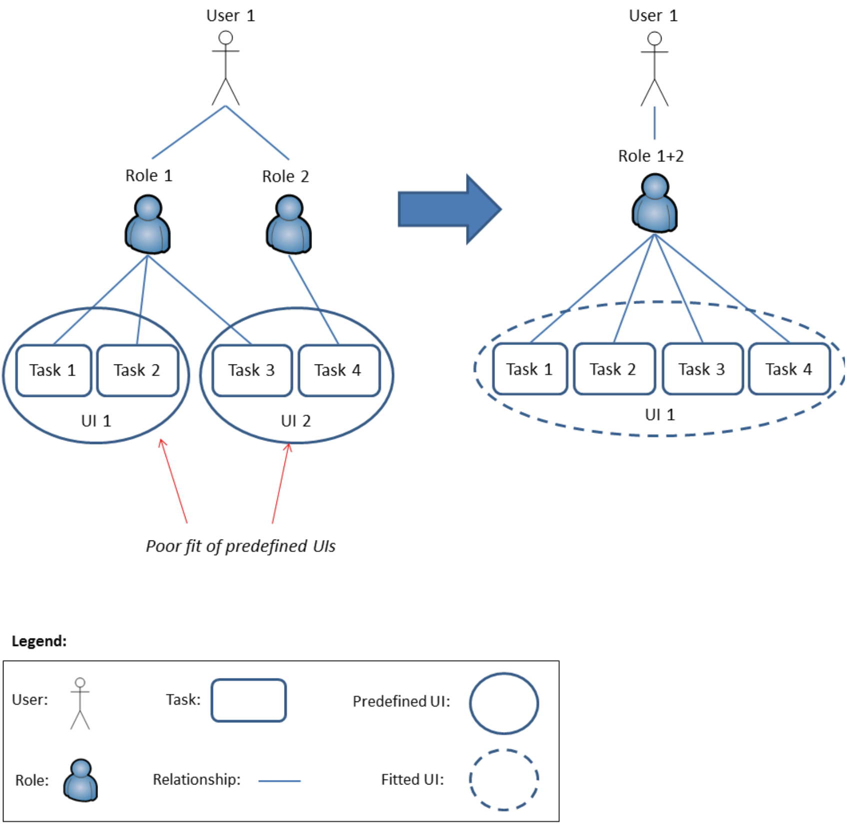

Figure 4. Addressing the scope misfit of the predefined roles.

6.6.2.1 Fitting through tailoring

Some partner companies saw tailoring as nearly inevitable in the process of addressing the scope misfits of the predefined role UIs. One approach to tailoring the predefined user interfaces originated in identifying the gaps between the selected predefined role user interface and the individual user and then add or remove functionality to the predefined role user interface: "*We did a quick fix by making a new role-center based* *on the 'Sales Manager' role-center and then add the tasks from the 'Purchasing Agent' role-center, so in 45 minutes [...] we made a new role-center based on components from other role-centers.*" (Consultant, Partner 8).

This strategy of fitting through tailoring the predefined role user interfaces initially incurred additional costs of the implementation. However, the partner companies following this strategy argued that the tailored role user interfaces would be added to the "portfolio" of predefined roles and thus be reusable in other customer companies: "*We have the 21 predefined roles. Then we add to that from [one customer] [...] and from another customer so that we get a repository of perhaps 30 roles that other customers can choose from.*" (Unit Manager, Partner 2). The process of fitting through means of tailoring thus became a way of building a portfolio of predefined roles that would eventually provide a better initial foundation for matching the user interfaces to the individual preferences of the end-users.

6.6.2.2 Fitting without tailoring

Other partner companies preferred as little tailoring as possible and tried to "squeeze" the users into the predefined roles: "*With the help of the [predefined] roles we force the customer into a category and say: "You get the Sales Order Processor". [...] If there is something the customer simply cannot live without then we tailor it.*", said Unit Manager, Partner 2. One of the ISV companies (Partner 10) had even based their business model on that their VAR partners would have to do as little tailoring as possible when carrying out an implementation: "*We could have chosen to make a compromise with our standard practice and build some roles specifically for [the customer]. But our philosophy is that we are not too happy about that. I think [the VAR that carried out the implementation] did make one custom role for [the customer], but that was it.*" (CEO, Partner 10).

Arguments for avoiding tailoring in general pointed to difficulties with upgrading to later versions of the NAV product line if the implementations included too much tailoring. Other respondents pointed to the increased costs as a reason for avoiding fitting through tailoring: "*It would be just fine [to tailor] if you didn't consider the financial aspect. I will have to spend three to four hours with a user to make sure that is a UI for the functions he uses. When that is done you have to do the actual tailoring. […] It's way too expensive.*" (Consultant, Partner 9).

Instead, the respondents in the partner companies who preferred to keep tailoring to a minimum emphasized the possibility for users to *personalize* their own user interface as a key feature of the new front-end client: "*I think the option of designing their own workplace is so cool! And they can do it easily without even calling the partner company.*", said Consultant, Partner 5. The goal of this strategy was thus to train the users to be able to personalize their own user interface, or alternatively train the system administrators in the customer organizations to tailor the interfaces instead of having the implementation consultants do it. The CEO, Partner 10, furthermore pointed out that personalization was beneficial even if there was no scope misfit: "*[…] even if there are two users in a company that do more or less the same thing there will still be differences in how they want the setup.*".

7 Discussion of the findings

The findings from the case study indicate that the primary motivation for introducing the concept of predefined organization roles was to encourage a shift in focus from fit at the functional level to fit at the user level. The espoused primary benefits of a role-fitted approach were related to easier access to information and improved learnability, indicating that role-fitting could potentially improve previously identified issues with usability of enterprise systems (Calisir and Calisir 2004; Topi et al. 2005). While the introduction of predefined role user interfaces in the new front-end client was perceived as useful by the partner companies, the identified misfits suggest that predefined roles only provide an initial level of fit with the role of the end-users. Table

3 provides a summarized overview of the types of misfits and the strategies for addressing them, as identified in the study.

Table 3. Misfits and strategies for addressing them.

Types of role misfits	Strategies for addressing the misfits in the study
Cross-industry misfits	Reliance on ISVs for extending cross-industry roles
Industry-specific misfits	Reliance on ISVs for developing industry-specific roles
Scope misfits	Fitting with tailoring Fitting without tailoring (user personalization)

The purposeful focus on cross-industry functions in the predefined roles, as part of a strategy of having ISVs develop industry-specific extensions, entailed industry-specific misfits between the predefined roles of the core enterprise system package and actual roles of users in some industries. While the findings indicate that this was a deliberate strategy of the vendor, the delay of upgraded industry-specific add-ons that included industry-specific roles may delay the creation of value necessary for specialized companies to adopt the role-fitted concept.

The add-hoc approach among implementation consultants to selecting the predefined role user interfaces presents another potential challenge for the concept of role-oriented enterprise systems. While the ad-hoc approach is not inherently problematic, as long as users are assigned to the role user interfaces that best fit their role, the combination of the ad-hoc approach with difficulties of understanding the role-fitting concept among some implementation consultants may result in sub-optimal fit between users and user interfaces. The issues of understanding the role-oriented concept and the delay in developing industry-specific roles both confirm the importance of matching the innovation strategy to the software ecosystem (Iansiti and Levien 2004; Adner 2006).

The strategies applied by the implementation consultants in the VAR companies for addressing the scope misfits each have their strengths and weaknesses. While the training of users to personalize their own user interface may overcome provide a better fit to the preferences of the individual user, the segregation of tasks and information into different user interfaces in NAV 2009 RTC could not be changed through user personalization alone. Some degree of tailoring is thus inherently necessary if tasks and information that are accessed by the user are located across several predefined user interfaces.

While addressing the scope misfit through tailoring ensures a closer fit between the user interface and the individual roles of the users, the costs of doing so may outweigh the benefits, as pointed out by one of the respondents. However, the strategy of building up a catalogue of tailored roles for use in other customer companies may reduce the added costs for customers over time. The needed tailoring could furthermore be reduced through a design of the enterprise system that allows easier aggregation of multiple roles into a single interface without the need for tailoring. Another approach for limiting the consequences of scope misfits may be to facilitate easier *switching* between the predefined user interfaces (Shneiderman and Plaisant 1994; Johansson 2009).

Regardless of the strategy for closing the scope misfit, the misfit suggests a fundamental issue of predefined roles in role-oriented enterprise systems. As the degree of role aggregation varies between organizations (Mintzberg 1979) a universal fit of scope of the predefined roles seems difficult. The findings further indicate that the differences in role aggregation between SMEs and large enterprises amplify the issue of scope of the predefined roles, as suggested in previous literature (Johansson 2009). The issue of scope misfit is highlighted by but not isolated to the domain of enterprise systems and thus constitutes a challenge for predefined role user interfaces in general.

8 Conclusion and future research

This paper has presented research on the concept of organizational roles as a means of providing a better fit between the packaged enterprise systems and end-users in customer organizations. The analysis of the case study suggests that while the inclusion of predefined roles in packaged enterprise systems is likely to provide an initial level of fit to end-users, the identified misfits requires strategies for addressing these misfits. The identified misfits of industry specificity and scope suggest that enterprise system vendors, consultants, and future research will need to focus their attention on these issues if role-oriented enterprise systems are to be a successful in bringing enterprise systems and end-users closer together.

While the research presented in this paper may provide an initial foundation for addressing the fit of predefined roles in role-oriented enterprise systems, further research is needed to address the phenomenon. Firstly, the presented research is based on the study of a single system from a single vendor and its partner companies. Additional studies of more vendors are needed to provide a deeper understanding of different approaches and technologies used for reflecting organizational roles in enterprise systems. Secondly, future research needs to address the potential benefits and issues of role-fitted user interfaces in enterprise systems in the context of actual use in customer organizations. This research should aim at addressing the potential benefits and issues of predefined organizational roles in enterprise systems and identify which roles are occupied by end-users of enterprise systems. Finally, future studies should address the usefulness and validity of the classification of predefined role misfits, proposed in this paper.

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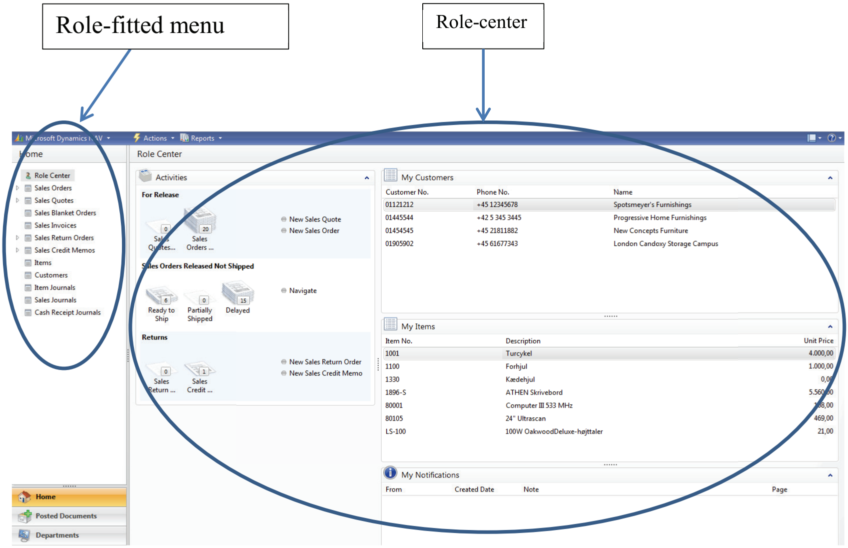
10 Appendix 1



11 Appendix 2

Category	**Concept**	**Examples of coding from the data**
The introduction of a 'role-fitted' font-end client	The motivation for introducing predefined roles	"*enables the people-ready business by combining the worlds of business process automation and personal productivity*" (Microsoft Dynamics 2007)
		"*[The shift in focus] naturally entails that the users save time. And that is what it's all about – saving time. If the role-tailored client works as it's supposed to then it should save the users the hassle of looking for the information […] they need to make decisions or take action.*" (Usability Manager, Microsoft)
		"*You can just put a user who does sales orders in front of the screen and say: "Do it!". You can see the flow of your orders and that's it. It is limited to what they need to see. […] So the training of the users is really simple compared to the old client.*" (Chief Consultant, Partner 7)
	Understanding the role concept	"*We had a very hard time understanding and communicating this.*" (CIO, Partner1)
		"*There was a lot of consultants and developers who didn't see the light before the role-centers were introduced*" (Unit Manager, Partner 2)
		"*It requires that you understand the more usability-like approach. They [the partners] has to understand what the individual user is doing. And I am a little surprised with how little they understand. Some of course have a better understanding than others.*" (Usability Manager, Microsoft)
	Choosing among the predefined roles	"*I have seen [the enterprise model] and I like the idea. But no matter how extensive it is it will never cover [the customer companies] 100%. And if it becomes more extensive then it also becomes more complex and then we will not bother to use it.*" (Chief Consultant, Partner 7)

		"*We [the consultants] can sit down and look at each other and define what the customer's business is really about. We have implemented solutions in the furniture manufacturing industry since 1990, so we know what roles they have*" (Consultant, Partner 5)
		"*It is pretty straight forward really. When we began the implementation I browsed through [the predefined user interfaces] and saw that there is a Sales Order Processor. What does that contain? Oh, it contains pretty much what I need, but maybe I need to tweak it a little. And then I went on to the Purchaser role and it pretty much contained what I needed too.*" (Chief Consultant, Partner 7)
The fit/misfit of the predefined roles	Scope	"*When we go to [the customer] and talk to an Order Processor then they are not only Order Processor. They also do purchasing […] or they take a look at production to see if they can put something in the production plan and so on. So many of the roles that are defined by Microsoft are too narrow for a typical Danish company*" (CEO, Partner 10)
		"*[The predefined roles] have some limitations in small companies. They are OK once you reach a certain size where it is easier to look at it from an organizational perspective and say: "You fit into this box"*" (Product Manager, Partner 6)
		"*When the consultants go out and ask: "What do you do"? "Well I am Production manager". "Then you probably need the Production Manager role". "No I don't' because I also do this, and this, and that". So you have to build some new roles because the [predefined] ones are too narrow.*" Product Manager, Partner 10)
	Industry-specific	"*The [predefined] roles are for trade companies. And it doesn't really matter which branch of trade the companies are in, as long as their business model is that receive some orders and ship some goods*" (Chief Consultant, Partner 7)

		"*[…] so will it require that we tailor the predefined role-centers to address industry verticals? Yes it will. Otherwise there is no button to press to activate the features that we have made that is vertical specific.*" (Consultant, Partner 8)
		"*The roles are very clearly defined in the retail industry. If you are working behind the counter then you do that and not much else. And if you are the manager of the store then you need the overview and want a role [user interface] that fits exactly that*"(Consultant, Partner 8)
Strategies for addressing the misfits	From cross-industry to industry-specific roles	"*It is the partner companies that have to adjust their industry vertical solutions to the new versions that Microsoft releases. They are selling the unified solution to the customers and not the standard NAV solution to the customers*." (Product Marketing Manager, Microsoft)
		"*If you look at Customer Model [the predefined persona model] there is a need for extending that to [specific] industry verticals to some degree. But that is not Microsoft's job. That is our job.*" (Consultant, Partner 8)
		"*So we said, what have added to NAV to fit it to the furniture production business […] and then looked at what information needed to be available. Which users does the information have to be available to and thereby found which [predefined] roles it has to be displayed in.*" (CEO, Partner 10)
	Fitting without tailoring	"*They receive training in in how they place things in the ribbons [part of the role-centers] and remove fields and add fields and how to place stuff in the list panes on the left side [part of the role-centers]. So you could say we train the users in making their own role-centers.*" (Unit Manager, Partner 2)

		"*We could have chosen to make a compromise with our standard practice and build some roles specifically for [the customer]. But our philosophy is that we are not too happy about that. I think [the VAR that carried out the implementation] did make one custom role for [the customer], but that was it.*" (CEO, Partner 10)
		"So we told [the customer] how to build a role-center and how to [personalize] the roles and gave them guidelines for how they should do it. And they are a level now where they are able to make new roles now based on the predefined user interfaces." (Product Manager, Partner 6)
	Fitting with tailoring	"*We did a quick fix by making a new role-center based on the 'Sales Manager' role-center and then add the tasks from the 'Purchasing Agent' role-center, so in 45 minutes […] we made a new role-center based on components from other role-centers.*" (Consultant, Partner 8).
		"*We have the 21 predefined roles. Then we add to that from [one customer] […] and from another customer so that we get a repository of perhaps 30 roles that other customers can choose from.*" (Unit Manager, Partner 2).
		"*So the point was that the partners could make their own [role-centers]*" (Usability Manager, Microsoft)

Appendix G: Paper VI

Fitting Enterprise Systems to Organizational Roles: A Customer Perspective

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Abstract

This paper presents research on role-oriented Enterprise Systems by addressing the concept of fitting user interfaces (UI) to organizational roles of the users. The research is based on a series of case studies of implementations of a specific role-oriented Enterprise System that includes multiple predefined role-fitted UIs. Findings from of the case studies are analyzed according to categories derived from previous research in organizational role theory and Information Systems in the categories of tailoring, personalization, role aggregation, role switching, and role specialization. The findings suggest that while the very idea of fitting UIs of Enterprise Systems to organizational roles of users may provide certain benefits related to role specialization, predefined role aggregation and cumbersome role switching may entail issues for users with multiple organizational roles. Furthermore, the research indicates that the possibility of further personalization of role UIs may be both beneficial and disadvantageous from a perspective of knowledge sharing about the system. Finally, the findings suggest the importance of Enterprise Systems' continuous support for back-office roles while indicating a growing need to support front-office roles.

Keywords: Enterprise Systems, User Interfaces, Organizational Roles, Role-oriented, Role-fitting

1 Introduction

In tandem with the widespread adoption of Enterprise Systems, researchers and practitioners have dedicated much attention to the fit between the systems and the organizations in which they are implemented (e.g., Rolland and Prakash 2000; Soh, Kien and Tay-Yap 2000; Wu, Shin and Heng 2007). Especially the fit between predefined *business processes* of packaged, or commercial-of-the-shelf (COTS), Enterprise Systems and the business processes of the organizations has been the center of much attention (e.g., Davenport 1998; Ng, Ip and Lee 1999; Koch 2001; Huq and

Martin 2006). While the fit of predefined business processes is undoubtedly an important research topic for the domain of Enterprise Systems, *user satisfaction* has long been recognized as another important factor for Information Systems (IS) and Enterprise Systems success (DeLone and McLean 1992; Hong and Kim 2002; Sedera and Tan 2005). However, multiple studies in both the academic and practitioner literature have pointed to poor usability in user interfaces (UIs) of Enterprise Systems (Soh et al. 2000; Aladwani 2001; Gilbert 2003; Topi, Lucas and Babaian 2005; Zrivan, Pliskin and Levin 2005), which is known to have a significant impact on user satisfaction of Enterprise Systems (Calisir and Calisir 2004).

As Enterprise Systems continue to increase their scope of organizational functions, an increasing number of users with different responsibilities, tasks, and degrees of experience interact with the systems. Previous research has suggested that *multiple user interfaces* to the same system, based on the different *organizational roles* of the users, may help to accommodate for the differences between users (Greenberg 1991; Shneiderman and Plaisant 1994). A previous literature study by this author (Holst 2009) showed that while the concept of modeling and orienting Enterprise Systems to organizational roles of users has been proposed (e.g. Worley, Chatha, Weston et al. 2005; Almeida, Guizzardi and Santos 2009; Johansson 2009), little research has addressed the potential benefits and issues of fitting user interfaces of Enterprise Systems to organizational roles (e.g., Carlsson and Hedman 2004; Worley et al. 2005). An examination of previous research in organizational role theory (Katz and Kahn 1966; Pugh, Hickson, Hinings et al. 1968; Pareek 1994) reveals that the concept of organizational roles has been extensively addressed in the organizational literature. Drawing upon findings in the field of organizational research may thus help to frame an empirical study of the concept of fitting UIs in Enterprise Systems to organizational roles of the users. This paper thus seeks to answer the question of how customer companies perceive different aspects of "role-fitted" UIs in Enterprise Systems.

The paper consists of the following parts: 1) presentation of the theoretical concepts in the literature of organizational role theory and Information System relating to orienting UIs to organizational roles of users; 2) presentation of the methodology for the research 3) presentation of the findings; 4) discussion of the findings; and 5) conclusion, practical implications, and further research.

2 Theory

Research on fitting UIs of Enterprise Systems to different organizational roles calls for an investigation of previous research into two areas. First, existing literature in the field of organizational role theory should be examined in order to establish a foundation for the very concept of an 'organizational role', to which the UIs are fitted. Second, research in the IS field should be investigated to provide insight into how previous work has addressed the concept of fitting UIs to organizational roles.

2.1 Organizational role theory

Much of our theoretical understanding of the role concept in an organizational perspective can be traced back to the seminal work of Katz and Kahn (1966) and their work in social psychology of organizations. In this work the very essence of an organization is "the patterned activities of a number of individuals" (p.17). Although not stating an exact definition of the role term, Katz and Kahn (ibid.) offer an indication of the condensed essence of a role when stating that: "In their organizational forms, roles are standardized patterns of behavior required of all persons playing part in a given functional relationship, regardless of personal wishes or interpersonal obligations irrelevant to the functional relationship" (p. 37).

Closely tied to the concept of a role is a number of related concepts, elaborating our understanding of what constitutes a role. "The notion of *office* as a relational concept defining each *position* in relation to the others and to the system as a whole" [italics added] (Katz and Kahn 1966). Pareek (1994) elaborates on the difference between the concepts of role and position by stating that a position is concerned with *hierarchical relations* and privileges, while a role is concerned with the *obligations* of that position. Worley et al. (2005) introduces the term "*actor*" as synonymous with the individual and describes the relationship as "the actor occupies a position (job description) characterised by one or several roles".

In integrating organizational roles with their related concepts, Katz and Kahn (1966) offer three concise statements in furthering the understanding of the relationship between the concepts of activities, roles, offices, and people:

- Multiple activities may be defined into a single role.
- Multiple roles may be defined into a single office.
- Multiple offices may be held by a single person.

One interpretation of the multiple relationship between roles and individuals (users) is that a single user occupies multiple roles *simultaneously*, also referred to as *role aggregation* (Almeida et al. 2009). A different interpretation could be that the user *switches* between the different roles, which we may term as *role switching* (Ellinger, Watkins and Bostrom 1999). Both interpretations require support for addressing the relationship between a single user and multiple roles but from different perspectives and the research in this paper thus applied both the perspective of role aggregation and role switching in the analysis.

Role specialization in an organization is concerned with the differentiation of activities within each role and refers to the specificity and narrowing down of the tasks assigned to any particular role (Pugh, Hickson, Hinings et al. 1963). Pugh et al. (1968) propose a total of 16 different 'activity functions' assumed to be present in all organizations and argues that the specialization of a function can be measured by investigating whether a particular activity function is performed by an organizational role with that function and no other. We may thus broadly think of the *degree* of role specialization as the number of distinctly different organizational roles. UIs fitted to organizational roles will thus need to match the degree of role specialization to which they are fitted.

Summarizing the concepts from organizational role theory, three aspects of the role concept may be applied as lenses through which to study the different aspects of tailoring UI to organizational roles:

- Role aggregation – the multiple roles occupied by a user.
- Role switching – the shift of the user from one role to another.
- Role specialization – the distribution of tasks among the users in the organization.

Armed with this basic foundation for the concept of organizational roles, we may proceed to investigate how previous literature has addressed the concept of fitting UIs to organizational roles in the field of IS in general and Enterprise Systems in particular.

2.2 Reflecting organizational roles in user interfaces

The use of the concept of roles within the field of IS has been applied to various areas (Zhu and Zhou 2008). While much of this work may be of relevance to fitting Enterprise Systems to organizational roles, some of the work within CSCW and HCI may be of special interest.

Greenberg (1991) suggests *personalizable* groupware with different UIs for different user roles to better accommodate the individual preferences of the users. Greenberg argues that personalization can lead to wider acceptance of the system among users. While yearly work on supporting multiuser applications through multiple UIs shed light on solving some of the technical challenges of developing multiple UIs to the same application, it struggles with integrating the role concept into UIs (e.g. Patterson 1991). Shneiderman and Plaisant suggest integrating roles and UIs through the concept of a 'Personal Role Manager' (PRM). The PRM is a way of "reducing distraction while working in a role, and facilitate shifting of attention from one role to another" (ibid, p. 6). The idea of the PRM is that users with multiple roles can switch between UIs depending on the role they perform at a given point in time. The suggestion of a role manager thus implies a view on multiple organizational roles of an individual user as something the user *consciously* switches between (role switching).

An extensive amount of research has addressed the issue of closing gaps between the standard functionality of COTS Enterprise Systems and business process of customer organizations (e.g., Ng et al. 1999; Koch 2001; Huq and Martin 2006). Addressing the issue of misfit between predefined business processes of the system and actual business processes of the system essentially boils down to either *tailoring* (Germonprez, Hovorka and Collopy 2007), also known as customizing (Brehm, Heinzl and Markus 2001), the system or reengineering the business processes of the organization (Davis 2005; Soffer, Golany and Dori 2005). In this paper the term *tailoring* is thus used to denote changes to the actual code of the system, while *personalization* is used to denote configuration carried out by the users.

A variant of the issue of predefined vs. tailored also applies to the fitting of UIs to organizational roles. The multiple predefined role UIs may thus reflect a "best practice" approach to the tasks and information requirements associated with the roles. These predefined roles may thus fit some user roles and organizations better than others. This aspect has been touched upon in the Enterprise System literature in the area of *Enterprise Portals*. Enterprise Portals are designed as a single point access to inter- and intra-organizational IS in order to integrate information and present users with a 'role-based' and personalized view of the information (Puschmann and Rainer 2004). Carlsson and Hedman (2004) investigate 329 preconfigured roles in SAP's enterprise portals and conclude that while the predefined roles have a strong internal and control focus they lack external focus and support for top managers.

Summarizing selected parts of the IS literature relating to fitting UIs to organizational roles, we may conclude that *personalization* and *tailoring* of predefined roles are important categories of analysis when addressing the topic.

3 Research design

3.1 The role-oriented Enterprise Systems

The system used as example of a role-oriented Enterprise System in the research presented in this paper is a COTS system. In late 2008, a new version of the system was released which included a new front-end client. Besides a general graphical update, the new front-end client also includes a total of 21 different predefined UIs targeted at different organizational roles of users in customer companies. Broadly speaking, the role-fitting of the predefined UIs influences two areas. First, tasks and information are divided between the predefined UIs according to the perceived needs of the roles of the users. Certain tasks and information are thus only available to the user if they are perceived to be relevant for the user's particular role. Second, each UI has a home page, or 'role-center as it is called by the vendor, syndicating tasks and information considered to be of most importance to a particular role.

The system allows users to personalize parts of the UI to match their personal preferences, such as hiding and showing data input fields or changing visual layout. Furthermore, if the users' needs cannot be met by the personalization options, implementation consultants have the possibility of tailoring the predefined UIs by altering the code base of the system. The new front-end client of the Enterprise System only supports association of one UI with each user login at a time, which entails that users have to close down the system, re-associate their login with a different UI, and start the system again, if they want to switch between the predefined UIs. Alternatively users can have several logins but they still need to close down the system if they want to switch between UIs.

The new version of the Enterprise System includes both the new and the old front-end client. Customer companies thus have the choice of using either the old font-end client, which includes only a single unified UI, or using the new front-end client with the multiple UIs that divides the tasks and information according to organizational roles of the users.

3.2 Methodology

The overall design of the research presented in this paper was based on an exploratory approach. The aim was thus to gain insight into which potential benefits and issues customer companies may experience from a role-oriented Enterprise System, rather than being able to generalize the findings. The research was carried out as a series of case studies of Danish companies that had implemented the role-oriented Enterprise System that was described in the previous section of the paper. The case study approach is particularly appropriate for problems and research areas that are in their early formative stages (Benbasat, Goldstein and Mead 1987). A research design of multiple case studies, as opposed to single case study, supports exploration and theory generation (Yin 2008). A total of five case studies were conducted between March 2010 and March 2011. The approach to sampling customer case studies was originally based on theoretical sampling (Eisenhardt 1989), as small companies can generally be expected to have a higher degree of role aggregation among its users, while large companies generally have a lower degree of role aggregation (cf. Mintzberg 1979). However few companies had chosen to implement the role-oriented Enterprise System by the time the research was conducted and even fewer were actually using the new front-end client with the multiple UIs. Sampling the case studies thus ended up being based on accessibility to case companies.

Data for the case studies consisted of two types of data: Semi-structured interviews (Kvale and Brinkmann 2008) with representatives from the customer organizations and data from the administration module of the Enterprise System. A semi-structured interview was carried out with a respondent in each case company who had participated in the implementation of the Enterprise System and had insight into the daily use of the system. Multiple respondents in each case company would have made findings more reliable and more generalizable for each case study. However, most of the case companies were not willing to allocate more than a single person for a single interview. Instead emphasis was put on getting access to a single individual in each case company who had actively participated in the implementation of the role-oriented Enterprise System and had insight about the daily use of the multiple UIs. All interview respondents in the research had thus participated in the implementation and were able to provide substantial insight into the general use of the system. Each interview lasted 30-45 minutes, was recorded, and was fully transcribed prior to analysis. Based on the concepts derived from previous research, presented in the theory section, the interviews focused on uncovering aspects role-fitted UIs in the areas of:

- Tailoring
- Personalization
- Role aggregation
- Role switching
- Role specialization

Table 1 provides an overview of the case companies and the interviews respondents.

Table 1. Characteristics of case companies and respondents

Company alias	**No. of employees**	**Industry**	**Interviewee title (alias)**
Company 1	800	Airport	Controller
Company 2	50 (150 worldwide)	Fashion design	System administrator

Company 3	75	Furniture manufacturing	Internal Project Manager
Company 4	90	Geographical services	Bookkeeper
Company 5	10	Packaging	Salesperson

Additionally, data from the administration module of the implementation of the Enterprise System at each case company was collected. The data consisted of information about:

- Predefined UIs used by the case companies
- Tailored UIs used by the case companies
- Number of user logins associated with predefined UIs
- Number of user logins associated with tailored UIs

The analysis of the case studies was based on data about the actual users of the Enterprise System and employees that were not using the system were thus omitted from the case study analysis. The interview data from the case studies were analyzed by means of qualitative data analysis (Miles and Huberman 1994) and compared to the data obtained from the administration module to provide some degree of triangulation between the two types of data. The data were categorized according to their relation to the five categories of: 'Tailoring', 'Personalization', 'Role aggregation', 'Role switching', and 'Role specialization'. The analysis of the 'Tailoring' category was primarily based on the data collected from the administration module. The data about the number of logins associated with the predefined and tailored role UIs were used to identify the proportion of users using predefined UIs as compared to how many that were using tailored UIs. The administration data were crosschecked and elaborated with the respondents to eliminate "test logins" and other logins that were not associated with operational use, and to gain insight into the reasons for using predefined or tailored UIs.

The category of ‘Role specialization’ was measured as a *degree* of specialization, based on a simple measure of how many different role UIs that were used in the different case companies, based on data from the administration module. This is arguably a somewhat simplified measure of ‘Role specialization’ but still provides a broad indication of the degree of specialization of the roles of the users interacting with the system. The category of ‘Role specialization’ was crosschecked and elaborated with interview data, to explore the benefits and issues related to role specialization in the UIs. Finally, analysis of the categories of ‘Role aggregation’, ‘Role switching’, and ‘Personalization’ were analyzed according to a binary scale of whether or not they occurred among the users of the Enterprise System. The analysis of these categories was primarily based on the interview data and could not be crosschecked with the login data from the administration module.

4 Findings

The following section describes the findings as related to the five categories of analysis. The summary of the findings are presented in Table 2 and discussed in detail in the following paragraphs. The analytical categories of ‘Role aggregation’ and ‘Role switching’ are described in the same section as the two categories appeared to be close related, as the analysis progressed.

Table 2. Findings from the case studies

Category	**Measure**	**Case 1**	**Case 2**	**Case 3**	**Case 4**	**Case 5**
Tailoring	No. of users on predefined / tailored UIs	10/0	2/11	15/1	10/11	1/5

Personalization	Personalization by users	Yes	Yes	Yes	Yes	Yes
Role specialization	No. of different UIs	2	8	4	7	2
Role aggregation	Role aggregation occurs among users	No	Yes	No	Yes	Yes
Role switching	Role switching occurs among users	No	No	No	Yes	No

4.1 Tailoring

The use of the predefined role UIs in the Enterprise System varied significantly across the case studies, as illustrated in Table 3 and Table 4. The two tables show the use of predefined and tailored UIs respectively. As tailored role UIs are developed for a particular implementation, a tailored role UI can by definition not be present in any other organization than the one for which it was developed, as denoted by the blank fields in Table 4.

Case Company 1 relied solely on the predefined role UIs: "As a starting point we decided to go with the standard and as little tailoring as possible […]. So we told [the implementation consultants] to tell us what the system could do as standard and then we wanted to see if we could adjust our work processes, instead of having the system tailored to our needs", said Controller, Company 1.

Contrary to the standard approach of Company 1, Company 2 had tailored six role UIs as part of the implementation of the Enterprise System: "*I made the decision about which role UIs we would develop in collaboration with the users. We sat down for a whole day and talked about what they use and then we tried to design [the UIs] to best fit that*", said System Administrator, Company 2. The System Administrator further explained that due to reasons of knowledge sharing, the basis for designing the tailored role UIs was that each organizational department should have the same role UI, while allowing the individual user to personalize some aspects of the UI.

The implementation in Company 3 was primarily based on a standard approach of using the predefined UIs. “The whole “role-thing” was not highly prioritized [during the implementation] […] but we have to go through the “role-thing”. That is the next thing we need to do”, said Internal Project Manager, Company 3. The single tailored UI in Company 3 was used in the production facilities of the company: “We have made a special role user interface for the assembly department and that is something new. Up until now we have only used PC’s [in the manufacturing] for controlling the machines. […] Those users [in the manufacturing department] are only able to see the sales orders […]”.

While Company 4 only had a single tailored UI, more than half of the users were using that interface. “We just had the entire standard role UIs thrown in and then we could try them out to see which ones we wanted. That seemed logical at the time […] The downside of this approach may have been that a lot of people haven’t tried out that many UIs and it could be that some of the other role UIs would have fitted them better”, explained the Bookkeeper, Company 4. The single tailored UI implemented in Company 4 was used by the sales department, as it was assessed that users in that department would only need a very limited set of tasks and information.

Similarly to Company 4, Company 5 also had only a single tailored role UI. However, five out of the six users of the system were using this interface. The company was a small trading company and the employees thus primarily needed to carry out tasks related to sales and purchasing. The Salesperson in Company 5 explained that they had tailored a combined “sales-and-purchasing role” which combined the tasks and information needed for both sales and purchasing. The only user who used another UI in Company 5 was the CEO, who used the predefined “Small Business Owner” role to gain an overview of the entire operation of the company and to do accounting tasks.

Only 9 of the total 21 predefined UIs offered by the Enterprise System were used by the case companies. Of the 9 predefined role UIs that were used, only the 'Bookkeeper' UI was used by more than two case companies. Case companies 2, 4, and 5 all had tailored role UIs relating to 'sale', as illustrated in Table 4 by the names they had chosen to label the tailored role UIs within the administration module of the system.

Table 3. No of users associated with predefined UIs

Name of predefined UI	Case 1	Case 2	Case 3	Case 4	Case 5
CEO and President	0	1	0	0	0
Small Business Owner	0	0	0	2	1
Bookkeeper	9	1	0	3	0
Purchasing Agent	0	0	1	1	0
IT Administrator	0	0	1	0	0
Human Resource Manager	0	0	0	1	0
Project Manager	0	0	0	2	0
Accounting Manager	1	0	0	0	0
Sales Order Processor	0	0	13	1	0
Total no of users associated with predefined UIs	10	2	15	10	1

Table 4. No of users associated with tailored UIs

Name of tailored UI	Case 1	Case 2	Case 3	Case 4	Case 5
Customer service		3			
Logistics administration		2			
PDM design		1			
Retail/finance		1			
Sales manager		1			
Sales person		3			
Production			1		
Sale				11	
Sales/procurement processor					5
Total no of users associated with tailored UIs	0	11	1	11	5

4.2 Personalization

The possibility for the individual users to personalize their UI beyond the initial fitting to organizational roles was applied by some users in all of the case companies and perceived as a clear benefit by some of the respondents: "*The sales order processor may want to be able to see some field but not some other field. She can add or remove those fields herself to her liking and I think that is really beneficial*", said Internal Project Manager, Company 3 and added: "*Some [users] want a lot of information. No problem. They can have that and they can even do it themselves. Others nearly panic and say, "I cannot cope with that". Okay, then we remove everything so they only see the product number for example. And that may even be the case for two people in the same department*".

However, the System Administrator, Company 2, pointed out that too much personalization could have negative effect: "I do not think [more personalization] would be an advantage for a company like ours where it is all about [the users] talking to each other […]. Many of the learning processes here are about talking to each other about the system and you would do more harm than good if you made the interface too personal. The Controller, Company 1, also pointed out that the possibility of personalization could be overwhelming for some users: "There are so many choices and so much flexibility. You can design the [UI] as you want. I think it can be a little overwhelming to figure out where to begin".

4.3 Role aggregation and role switching

In three out of the five case companies some users of the system had role aggregation. The respondents in company 2 and 5 explained that while some of their users needed access to information contained in different predefined UIs, they had solved the issue by tailoring UIs to users with multiple roles, and the users with role aggregation did thus not need to switch between UIs.

However, in Company 4, the Bookkeeper reported that he had to switch between different UIs. The Bookkeeper explained that part of his job also consisted of project administration but that the Enterprise System did not support aggregating his two roles into one UI without tailoring: "*It is very nice and all that you throw the things that are relevant to your specific role into the face of the user, but I find it rather stupid that you do not have access to the [other] functionality at all. It might as well be accessible but restricted in terms of how visible it was*", said the Bookkeeper and explained that he was the only person with this specific role aggregation. The costs of tailoring a UI to his specific needs were thus too high to justify tailoring and instead he had to switch between the UIs: "*It is a little frustrating. When I need to perform certain tasks, I have to switch user interface. It is not because I think that is a clever thing to do but I have* *to do it in order to get access to certain reports or information which are only available in a particular user interface. That is not very practical*".

4.4 Role specialization

The degree of role specialization in UIs implemented in the case companies varied between two and eight. Company 1 primarily used the new version for accounting and only used two different UIs: "*I think it is good that [the front-end client] is fitted to the individual user […] But right now we only use the Bookkeeper and the Accounting manager roles*", said the Controller, Company 1, but explained that they would maybe use other UIs, as other parts of the organization were scheduled to adopt the system later on.

Case company 2 used eight different UIs and thus had the highest degree of role specialization in the UIs. The System Administrator explained that the company had chosen a strategy of giving each department the same UI: "*Because of knowledge sharing, it is better that everyone in a department has the same UI, even if they are not doing the same things 100%. Then they can personalize all the small things*". The System Administrator in Company 2 further explained that the users were generally satisfied with the support for role specialization: "*It is not as confusing as in the old front-end client were everything was just lumped together in one big pile*".

Using four different UIs, Company 3 had a moderate degree of role specialization among the case companies. The Internal Project Manager in Company 3 explained that the focus on the predefined UIs had been deprioritized during the implementation in favor of getting the system "up-and-running", but that a higher degree of specialization in the UIs was to come. The Internal Project Manager also indicated that the specialization incorporated in the single tailored UI for the manufacturing department had made it easier for new users to use the system: "*That has been a huge success. We should really do that in other areas and we definitely will*".

With seven different UIs, Company 4 had chosen to introduce the system for users with various specializations: “We try to get as many users to use it as possible, as long as it makes sense […]. That was also one of the reasons for choosing a system with role UIs to get users outside the accounting department to use it”, said the Bookkeeper in Company 4.

Although Company 5 was only using two different UIs, the Salesperson in the company explained that the grouping of tasks into different UIs made the responsibilities of the individual employee clearer to the organization: “*I think [the multiple UIs] is a good way to make the different responsibilities clear to the employees*.” He further elaborated that the visualization of specialization had been one of the reasons for introducing the Enterprise System to employees who had not previously been users of the Enterprise System: “*In relation to the implementation of the new system we got two more employees hooked up to the system and they had no prior experience with ERP systems. […] It was very simple and based on the different UIs we could tell them what they should focus on so that they didn’t have to [search for the features they needed]*”, said the Salesperson, Company 5.

5 Discussion

The positive attitude of the respondents in all five case companies towards the concept of role specialization through separation of tasks and information in different UIs, suggests that the very idea of fitting UIs of Enterprise Systems to organizational roles of the users may have a positive impact on user satisfaction. This both supports previous suggestions of multiple UIs as an approach to increasing user satisfaction (Calisir and Calisir 2004) and suggestions of fitting the multiple UIs to organizational role (Shneiderman and Plaisant 1994; Holst 2009).

The positive perception of the possibility of the users further personalizing the UIs supports previous assumptions that personalization can improve acceptance among users (Greenberg 1991). However, the case studies further indicates that too much personalization may result in difficulties with knowledge sharing among the users about the system and that some users may find the prospect of personalization a bit overwhelming. Hence, striking the right balance between meeting individual requirements and keeping a certain degree of standardization across the UIs emerges as a topic of its own.

The somewhat dominant use of predefined role UIs among users in the case studies indicates some fit between the predefined UIs and the case organizations. However, the choice of using the predefined UIs may also be a part of a general approach of using the standard features, rather than tailoring the system to fit the organization, as was the case in Company 1. The Bookkeeper role UI being the only interface used by more than two of the five case companies indicates that accounting personnel are still among the primary users of Enterprise Systems, perhaps justifying the strong internal and control focus of the portal roles in SAP (Carlsson and Hedman 2004). On the other hand, the development of tailored role UIs relating to sales functionality in three of the case companies indicates a need for support of "front-office" roles that may be lacking in the predefined role UIs of the Enterprise System investigated in this research study.

The finding of case companies with users with role aggregation that required access to tasks and information spanning across different predefined UIs indicates a potential issue for predefined role-fitted UIs in Enterprise Systems. As predefined role-fitted UIs will have to be based on some variation of a best practice approach, some organizations will invariably have users with a different level of role aggregation, creating a misfit between system and users. The issue of role aggregation can especially be expected to pertain to small companies where individuals often occupy several roles simultaneously, as "it is not uncommon for the president of a small company to roll up his sleeves and fix a machine" (Mintzberg 1979). One solution to the issue of role aggregation was the tailoring approach pursued by Company 2 and 5.

However, tailoring a UI to fit the needs of a single individual, as was the case in Company 4, may induce significant costs relative to the benefit of supporting a single user. A more economical approach could thus be to facilitate an easier shift between the different UIs in the system, in line with the Personal Role Manager proposed by Shneiderman and Plaisant (1994). Another solution to the issue of role aggregation could be to support a more flexible or componentized design of the UIs, which allowed redistribution of tasks and information between the predefined UIs without the need for tailoring by implementation consultants.

5.1 Conclusion, practical implications and further research

The research presented in this paper provides emerging insight into some of the benefits and issues related to fitting Enterprise Systems to organizational roles. The research suggest that the inherent specialization of role-oriented Enterprise Systems may provide customer companies with benefits related to improved satisfaction, especially for user groups who are previously unfamiliar with Enterprise Systems. However, users with role aggregation may be put at a disadvantage if their level of role aggregation does not fit the role aggregation of the predefined roles in the system. The issue of role aggregation misfit is likely to be amplified if the system lacks support for redistributing tasks and information between the predefined UIs without resorting to tailoring. A lack of support for easily redistributing the tasks between UIs increases the importance of support for seamless switching between the UIs. The presented research further indicates that support for personalization may help to meet individual preferences of users. One the other hand, personalization also entails an emerging issue of striking the right balance between accommodating the preferences of the individual user while keeping a certain level of similarity in order to maintain knowledge sharing about the system among the users. Finally, the findings suggest that "traditional" support for users occupying back-office roles, such as bookkeepers, should still be of key concern to the design of Enterprise Systems but that support for front-office roles, such as salespersons, may be of increasing importance. Table 5 provides a summary of the conclusions.

Table 5. Summary of conclusions

Categories	Conclusions
Tailoring	Predefined UIs based on organizational roles may need tailoring to fit actual user roles.
	Support for predefined back-office roles, such as bookkeepers, is still important when designing role-oriented Enterprise Systems.
	Support for predefined front-office role, such as sales, becomes increasingly important when designing role-oriented Enterprise Systems
Role aggregation	Role aggregation may present an inherent issue in predefined UIs based on organizational roles.
	Lack of support for redistributing tasks and information between predefined role-fitted UIs, without tailoring, may increase the issue of role aggregation.
Role switching	Easy switching between role UIs becomes imperative when the predefined role aggregation in the UIs does not match the role aggregation of users.
Personalization	Personalization enables users to fit UIs to their individual preferences.
	Too much personalization prevents knowledge sharing about the system.
	The prospect of personalization can be overwhelming for some users.
Role specialization	Visualization of specialization may improve user satisfaction of users of Enterprise Systems, especially of new users.

The findings presented in this paper have a number of practical implications. First, Enterprise System vendors need to consider the issue of role aggregation when designing Enterprise Systems with UIs that are fitted to organizational roles. Vendors will either need to support a more flexible combination of multiple roles, or at least make the switching between UIs easy. Second, the multiple instances of tailored UIs for front-office roles found in the study suggest that vendors may need to increase their attention to this “new” group of Enterprise System users. Finally, consultants implementing role-oriented Enterprise Systems should make sure to identify users with role aggregation and tailor the system to meet these users’ requirements.

The five categories of analysis presented in this paper may provide researchers with a starting point for investigating other studies of role-oriented Enterprise Systems in customer organizations. However, future research needs to address further aspects of role-fitted UIs. An in depth analysis of the content of each of the predefined role UIs would improve our understanding of the fit between the predefined UIs and the organizational roles they aim to support. Such an analysis should include the relation between organizational roles of the users and the business processes related to the roles, in order to provide a more comprehensive understanding of how role-oriented Enterprise System influences alignment with business processes. Furthermore, additional case studies comparing implementations of role-oriented Enterprise Systems in small and large enterprises are needed to establish whether the different degrees of role aggregation generally associated with organizational size has a generalizable influence. Finally, different aspects of user performance, knowledge sharing, and productivity attributed to role-oriented Enterprise Systems will need to be investigated more in-depth in order to establish if role-fitting provides benefits substantial enough to warrant the effort.

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