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A MULTI-CASE ANALYSIS OF THE DEVELOPMENT OF ENTERPRISE RESOURCE PLANNING SYSTEMS (ERP) BUSINESS PRACTICES

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The PhD School of LIMAC

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A Multi-case Analysis of the Development of Enterprise Resource Planning Systems (ERP) Business Practices

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LIMAC PhD School is a cross disciplinary PhD School connected to research communities within the areas of Languages, Law, Informatics, Operations Management, Accounting, Communication and Cultural Studies.

Foreword

This project would not be possible without the grants I received from the Danish National Advanced Technology Foundation, Microsoft Development Center Copenhagen (MDCC), Copenhagen Business School (CBS) and Scandinavian Consortium for Organizational Research (SCANCOR). This thesis is developed as part of the 3gERP project, a research project funded by the Danish National Advanced Technology Foundation and Microsoft. 3gERP is a consortium comprised of Copenhagen Business School (CBS), Microsoft Development Center Copenhagen (MDCC) and Datalogisk Institut Københavns Universitat (DIKU) started in 2006 and gradually winding down with the last PhD students completing their theses. The project aims to develop a standardized, flexible and configurable ERP system for small- and medium-scale Enterprises (SME).

The shortcomings and errors of this work are mine and mine alone. To the extent that it advances the literature on ERP, much of that is due to the people who greatly supported me in my PhD journey.

Foremost, I would like to express my sincerest gratitude to my primary supervisor, Prof. Niels Bjørn-Andersen, for his guidance, wisdom and obvious genuine concern for my intellectual growth and personal

advancement. Without a doubt, I could not have finished this work without his invaluable support. He is the quintessential professor: he is avuncular but very professional; gentle but firm; sharp of mind but not edgy; extremely knowledgeable but never impatient and condescending. I will forever treasure his insights and advice on matters concerning the academic world and life in general.

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Abstract

The potential of Enterprise Resource Planning (ERP) systems to integrate the business functions of any organization has led to its proliferation since the 1990s. Arguably, ERP systems potentially enable an organization to become competitive, and their impact has since been extensively researched and debated. This thesis seeks to understand how ERP vendors have innovated and developed their business practices to ensure their own competitive advantage. The thesis consists of an overview wrapper and five articles. This work is based on a research methodology using case studies to understand the development of business practices in the ERP industry since the 1950s. As such, the thesis explores the journey of different ERP vendors that (1) were influenced by their environment, (2) participate in different structuring processes to develop their business practice; (3) adapt their business practices to produce product/service offerings potentially matching or exceeding the actions of their rivals; and (4) encounter challenges as they shift their business models.

The thesis reveals that in order to continue to outlast the competition in a hypercompetitive environment, ERP vendors (1) refine their business practices, over time, through incremental and evolutionary changes impacting the ERP industry; (2) obtain a competitive advantage through *the exploitation of core resources; (3) co-create with a partner network to maximize their resources and increase their ability to compete; and (4) realize the value proposition in terms of the business model.*

Keywords: Enterprise Systems, ERP, Business Practices, Evolution, and Business Models

Abstrakt

ERP systemers muligheder for at integrere forretningsfunktioner har ført til en omfattende udbredelse af disse i 90'erne. Der er heller ingen tvivl om, at ERP-systemer har gjort organisationer mere konkurrencedygtige, og disse systemers indflydelse er gjort til genstand for en omfattende forskning og debat.

Denne afhandling forsøger at belyse hvorledes ERP leverandører har innoveret og udviklet deres forretnings praksis for at sikre deres egne konkurrencemæssige fordele.

Afhandlingen består af en overordnet sammenfatning samt fem artikler. Der er anvendt en forskningsmetode baseret på case studier for at forstå udviklingen i forretningspraksis i ERP industrien siden 50'erne.

Afhandlingen er en udforskning af, hvorledes forskellige ERP leverandører (1) var påvirket af deres omgivelser, (2) deltog i forskellige strukturerings processer for at udvikle deres forretningspraksisser, (3) tilpassede deres forretningspraksisser til at producere produkter/service tilbud som potentielt matchede eller oversteg tilsvarende tiltag fra deres konkurrenter, og (4) løb ind i udfordringer efterhånden som de skiftede deres forretningsmodeller.

Afhandlingen belyser endvidere, at for at kunne klare konkurrencen i hyper konkurrencemæssige omgivelser, er det nødvendigt for ERP leverandører at kunne (1) redefinere deres forretningspraksisser over tid som svar på inkrementale og evolutionære påvirkninger af ERP industrien, (2) opnå en konkurrencemæssig fordel gennem udnyttelse af deres nøgle ressourcer, (3) samarbejde med et partner netværk for at maksimere udnyttelsen af deres egne ressourcer og evne til at konkurrere, og (4) realisere værdigevinster gennem deres forretningsmodel.

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Introduction

The term Enterprise Resource Planning (ERP) was coined by The Gartner Group in 1990 (Shehab *et al.*, 2004), as a modification to the name of earlier systems that were referred to as Manufacturing Resource Planning (MRP II). The term describes the phenomenon of non-manufacturing industries turning to MRP systems to perform financial transaction processing capabilities that cover the whole enterprise. Thus, the name change from “manufacturing” to “enterprise” signifies that the systems had become capable of linking major business functions regardless of industry.

The roots of the ERP industry can be traced back to the founding of several ERP vendors in the 1970s (Jacobs and Weston, 2007). While Blumenthal (1969) had already proposed an integrated architecture framework that could be used as a foundation for ERP systems, its application to non-manufacturing firms did not come to fruition until the 1990s. The mainstream adoption of ERP in the middle of the 1990s coincided with the marked increase in IT investments, which was primarily attributed to globalization and competition (McAfee and Brynjolfsson, 2008). It was during this period that the business world embraced ERP systems, and they came to play a dominant role in how corporations used information technology (Davenport, 1998). This increased demand for ERP was also linked to the Y2K problem associated with the turn of millennium in mainframe systems (Cumbie *et al.*, 2005). Hence, organizations were prompted to adopt and move to new ERP systems to fix problems with non-compliance (Davenport *et al.*, 2004; Jacobs and Weston, 2007). Additionally, they sought to make themselves more competitive by “realizing the promise of enterprise systems” (Maas, 2000) (*i.e.,* the ability to integrate functions across the enterprise).

ERP vendors focus on the development and sale of pre-packaged enterprise technology solutions. These systems are typically sold as an integrated system containing established “best business practices,” which aids in integrating the enterprise to achieve competitive advantage. The strategic value of ERP in terms of whether it can help user organizations realize benefits by achieving competitive advantage has been discussed in the literature (cf. Greis and Kasarda, 1997; He, 2004; Martinson, 2004). However, we know little about how ERP vendors ensure their own competitive advantage.

This thesis is thus motivated by the need to examine the mechanisms that enable the creation of the system from a vendors’ point of view to ensure their competitive advantage. Lam (2005) observed that due to the fast-paced progress of technologies, organizations viewed the adoption of

ERP systems as a competitive necessity and no longer as a means to achieve competitive advantage. For ERP vendors, this meant that their ability to compete is determined by their ability to keep up with the pace of technological innovation. Keeping up with technological innovation is not unique to ERP systems; it applies to many technological sectors that take advantage of the assemblage of components and subsystems used to make technological devices (Arthur, 2009).

Apart from the cursory review of the technological aspects and functions of the ERP (cf. Shehab et al., 2004; Jacobs and Weston Jr., 2006; Lorincz, 2007), little is known about the history of ERP. This thesis aims to provide a historical context for the development of the system to (1) expose how a particular vendor's environment shapes the adoption of certain business practices; and (2) determine the implications of pursuing a particular business practice to the development of an ERP system.

The thesis begins with a brief review of the history and overall development of ERP to provide a better understanding of the overall landscape and ontology of an ERP system. It provides an understanding of how a particular ERP vendor creates and develops its business practices and responds to changes in its environment in the process of offering ERP solutions to survive in a competitive market.

Rather than focusing exclusively on ERP developers, this thesis also examines the ERP vendor's ecosystem, an environment, which combines the resources of the large centralized ERP vendor with the resources of local partners to create ERP systems matching user needs. This environment provides structure and tools to various actors (*i.e.,* partner and user organizations) that not only informs future action, but also paves a way to change them. By examining an ERP vendor's ecosystem, this thesis aims to provide insights not only into the ERP industry, but also into other technological sectors that take advantage of strategic networks to maintain their competitive advantage.

The comprehensive nature of an ERP means that in order to fully understand how it is created, it is important to have an understanding of two types of systems: technical systems with elements that are joined together to create an ERP; and social systems that form the organizations and participate in the creation process.

1.1 Technical Systems: The Features and Functions of ERP

Researchers have commonly traced the roots of ERP to the late 1960s, when Materials Requirement Planning (MRP) was first developed by IBM (Rashid *et al.*, 2002; Jacobs and Weston, 2007). However, we find it more appropriate to credit the provenance of ERP to the 1950s, when the first business-oriented computer was created to manage inventory and production of goods (Mason, 2004).

An ERP system is associated with many features and functions to run the financials (*e.g.,* accounting, cash management, controlling, treasury, risk management), human resources, and operations (*e.g.,* procurement, material management, and logistics, manufacturing) of a business (Klaus *et al.*, 2000). It was later redefined as “ERP II” in the 2000s, to include possibilities for e-business. It general today, ERP refers to “an integrated suite of business applications” (Hesterman, 2011). In this study, we will use the term ERP instead of enterprise system (ES), another term often used to refer to a system that is used by an organization.

The concept of ERP as an integrated system that permeates the enterprise can be traced back to the work of Blumenthal (1969). In his book Management Information Systems: A Framework for Planning and Development (Blumenthal, 1969), he proposed that an integrated architecture framework, which he called Total Systems, can be used as organizational information systems. Blumenthal’s (1969) work was largely influenced by Jay Forrester’s information-decision action model in a closed-loop, and the “view that the information system is a network reaching into all parts of the firm” (Forrester, 1961 p. 24). A similar point of view is found in the development of manufacturing processes and closed-loop MRP documented in the key concepts: material flow control (Burbridge, 1961; Burbridge, 1963) and information feedback (Forrester, 1961). Material flow control refers to the efficient use of materials in production (Burbridge, 1961; Burbridge, 1963). Information feedback refers to the ability of industrial systems to create a reporting mechanism, which can be used to make future decisions based on the integrated knowledge from various "functional areas of management – marketing, production, accounting, research and development, and capital investment" (Forrester, 1961, p. 13). These functional areas are related to six (6) systems that represent economic activity, five (5) of which directly relate to data – namely orders, materials, money, personnel, and equipment – and one that "links the levels of the five flow systems to the rates in the same and in different flow systems" (Forrester, 1961, p. 14).

1.1 Social Systems: The formation of the ERP industry

The formation of an industry refers to the vendors who create the components and assemblages that form a particular technology (Arthur, 2009). As such, the formation of the ERP industry began with the creation of MRP systems developed by vendors in the 1970s Some of the vendors that started in this period are SAP, Baan, Lawson, JD Edwards, PeopleSoft, and Oracle. SAP was established in 1972 by five engineers in Mannheim, Germany who envisioned the development of a standard software for integrated business solutions. In 1973, SAP completed the first financial accounting system that served as the basis for the development of other software modules, which is now referred to as SAP R/1 (SAP, 2010). By 1975 SAP's system included purchasing, inventory management, and invoice verification modules. Baan Corporation (1978) was founded by John Baan in The Netherlands (Shehab *et al.*, 2004) with a focus on Financial and Administrative Consulting Services. Lawson Software (1975) had its beginnings in developing pre-packaged enterprise technology solutions. JD Edwards (1977) founded by Jack Thompson, Dan Gregory and Ed McVaney, focused on developing software and consulting services for manufacturing organizations. Oracle Corporation, founded in 1977 by Larry Ellison, offered the first SQL relational database management system in 1979.

In the 1980s, a period that focused on just-in-time (JIT) manufacturing strategies popularized by the Japanese, enterprises emphasized efficiencies and quality in several areas – process controls, closed-loop planning and capacity constraints, quality, and reduction of overhead costs (O'Neill and Sackett, 1994; Rondeau and Litteral, 2001; Jacobs and

Weston, 2007). At which time, JD Edwards, developed integrated material requirements planning systems for clients with time phased ordering capabilities. Time phased ordering capabilities include: closed loop scheduling, enhanced shop floor reporting, due date scheduling, procurement, and detailed cost reporting (Jacobs and Weston, 2007). It was also during this period that IBM's dominance became noticeable. In 1980, IBM developed Computer Integrated Manufacturing (CIM) solutions which "integrated across the enterprise" using IBM System 38 and AS400 as their enabling technology. In 1981 SAP developed its first production management module.

In the early 1990s, increased globalization triggered many vendors to expand their market base. For instance by 1991, PeopleSoft expanded to Canada, Europe, Asia, Africa, Central and South America, and the Pacific Rim. Similarly, in 1995 Baan was in 35 countries through indirect sales channels (Jacobs and Weston, 2007).

By the late 1990s, there was a marked increase in mergers and acquisitions (M&A) among ERP vendors (Mahato *et al.*, 2006; Jacobs and Weston, 2007) and some of their respective partners. This suggests that the industry had reached a certain maturity level, as shown by the ERP vendors' predatory actions in order to capture market share. The strong M&A activity in all industries during this period (2000-2007) was also significant in the ERP market mostly led by key players (*e.g.,* SAP, Oracle, Microsoft and Infor) (Wire, 1999; Jacobs and Weston, 2007; SAP, 2010).

The proliferation of ERP led to a hypercompetitive environment where competitors create or erode competitive advantage (D'Aveni and Guntger, 1994). An ERP vendor operating in such environment is burdened with the need to come up with an attractive product (*i.e.,* an ERP system) which will allow it to sustain a competitive advantage. Barnett (2008) alluded to the intensity of this competition as an “evolutionary arms race” and suggested that in order to win, an organization must either grow organically or participate in mergers and acquisitions (M&A).

1.2 Mechanisms of Change

In order to provide a better understanding of how an ERP vendor responds to changes in its environment, the literature was reviewed to understand the nature of change (*i.e.,* incremental vs. revolutionary). Incremental change can involve a step-by-step improvement by relying on the incremental nature of human learning, knowledge and their applicability (Nelson and Winter, 1982; Ettlie et al., 1984 ; Dewar and Dutton, 1986; Tushman and Anderson, 1986). Incremental changes are typically made to an existing product in order to increase efficiency (Daft and Becker, 1978; Lyytinen and Rose, 2003). In contrast, revolutionary change involves a radical improvement in the product. Similarly, the Schumpeterian view explains the idea of “disruptive technologies” for sustaining a firm’s competitiveness by constantly adapting and incorporating new technologies and knowledge to existing systems of production (Schumpeter, 1934; Schumpeter, 1942; Christensen and Overdorf, 2000). Under this view, the creation of artifacts is a balance between the exploration of new ideas and the exploitation of others (March, 1991). On one hand the exploration of new ideas transforms industries through innovation (Dosi, 1982; Teece, 1986; March, 1991; Christensen, 1992). On the other hand, exploitation looks into the recombination of elements in order to establish new markets (Dess and Donald, 1984; Dewar and Dutton, 1986; Henderson and Clark, 1990). This process of “creative destruction” enables the firm to break out of an existing architecture in order to adapt to a new one (Henderson and Clark, 1990). This exploitation and recombination of elements from other markets makes it expensive for competing firms to replicate products, thus creating a challenge for others (Cooper and Schendel, 1976; Mauborgne and Kim, 2005).

An alternate view sees change as resulting from a problem-seeking mindset, based on a maximization strategy (Penrose, 1959). This type of change assumes limited availability of resources (*e.g.,* RBV). Using this view, organizations identify problems with respect to their competitiveness and allocate resources to innovate using “organizational slack” to maintain competitive advantage. This results in an incremental change in functions, systems, or frameworks for better utilization of existing resources.

Despite the numerous studies on ERP, very few focus on the ERP vendors’ ability to maintain its competitive advantage. Among the very few who focused on the ERP vendor, Liang and Xue (2004) suggested that vendors should create systems that could be localized, customized, and implemented in increments, to alleviate the implementation problems that occur as part of the business process reengineering (BPR) at the user organization.

The rise in demand for ERP systems in the 1990s led to a corresponding increase in the use of partners to implement ERP systems. In this way, ERP vendors increasingly rely on inter-organizational relationships to create advances in phases of incremental and evolutionary changes triggered by important innovation (Shapiro and Varian, 1999). The strategic potential of co-creation with partners to enhance innovation capabilities has also been emphasized as an emerging stream of research (Fox and Wareham, 2009; Kude, 2009; Han *et al.*, 2012; Sarker *et al.*, 2012). In this research, partner networks have been studied and referred to in various ways: value chain (Johansson and Newman, 2010); value networks (Christensen, 2002); hub and spoke (Kude, 2009); and ecosystems (Adner, 2006; Fox and Wareham, 2009). It is especially interesting for our work that Kude (2009) looked at the lock-in effects in terms of organizational coupling (tight vs. loose) to the spoke (*i.e.,* partners in the 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 (*i.e.,* product and channel development) and its partners (*i.e.,* sales and implementation) and identified particular platform infrastructure elements, processes, and toolkits that need to be in place. While these studies have contributed greatly in understanding the benefits of utilizing strategic alliances to provide additional resources, little is known about how these complex relationships impact an organization's ability to evolve in a hypercompetitive industry, and the impact of evolving strategies to the relationships between the allies. Lee, et al. (2010) also found that while software alliances play a role in co-creation, complementarity contributes to hypercompetition. Studies have suggested that in hypercompetitive markets, simply being the most innovative firm or obtaining competitive advantage is not enough to outperform rivals, (D'Aveni and Guntger, 1994), thus making it necessary to co-evolve and constantly change.

In spite of the substantial amount of literature mentioned above, and the many studies of the impact of ERP on user organizations, there is a lack of literature pertaining to the business models and strategy of ERP vendors. This thesis aims to fill the gap by providing a historical study of the evolution of ERP business practices and exploring a particular business practice that uses partner networks. It further attempts to investigate the impact of ERP vendors' introduction of new business strategies in order to keep up with the hypercompetitive environment, where the stakes for survival are high. Furthermore, it explores the implications of such strategic change in terms of the tension between an ERP vendor and their partners as they co-create ERP systems.

Following this introductory section, Section 2 explains the overall research question. Section 3 provides the study's overall research approach and the philosophical underpinnings. Section 4 explains the three distinct theoretical frameworks used in the study. Section 5 presents the five articles eventually included in the final thesis as well as the abstracts of these papers. Section 6 pinpoints the key contributions of the study. Section 7 provides a discussion of the limitations of the study and areas for future research. Finally, Section 8 concludes with a summary of the study.

2 Research Question

This thesis attempts to answer two key research questions: (1) How does an organization, such as an ERP vendor, respond to changes in its environment in the process of offering ERP solutions? and (2) Does the ERP vendor's decision to adopt a particular business practice contribute to its ability to survive in a competitive market?

This thesis aims to contribute to three main research areas:

- First, it contributes to the ERP literature by providing an ERP vendor perspective rather than the typical ERP user perspective. This thesis focuses on the business practices of six (6) vendors to describe how each vendor is influenced by its social context to develop a particular standardized ERP system. This thesis also aims to provide an understanding of the past, present, and future business practices of the ERP industry. To achieve this, it begins by tracing the history of the ERP industry to explore how ERP vendors have been able to replicate various practices that extend over time and space and affect their ability to compete. The thesis explains the overall development of ERP in terms of how various types of ERP evolved from the vendor's adoption of a particular business practice to obtain competitive advantage. In this way, the thesis contributes to the research stream that evaluates “organizational and human trade-offs” (Kallinikos, 2004). Using multiple case studies, the thesis illustrates how vendors develop distinct social practices as shaped by their respective contexts and localized practices. While norms within the industry are established through the adoption of similar business practices, the adoption of a unique business practice ensures competitive advantage for a particular ERP vendor to survive a hypercompetitive environment.

- Second, it contributes to the study of co-creation literature (Fox and Wareham, 2009; Kude, 2009; Sarker et al., 2012). This thesis examines the dynamics between the ERP vendor and its partners, as the ERP vendor strives to align strategies to augment the resources of the value network. In this way, the thesis contributes to the research stream that examines the ERP vendor and its role in co-creation using partner networks. The case studies reveal how an ERP ecosystem (i.e. an ERP vendor firm and its network of partners) can work together to co-create value and come up with a product/service offering that allows them to obtain a sustainable competitive advantage by understanding the different capabilities that each partner provides.

- Third, it contributes to the study of strategy formulation in Information Systems (IS), by uncovering some of the challenges faced by an ERP vendor as it adopts a new strategy. This thesis looks at existing strategies, and it explicitly contributes to knowledge about how a change in strategy can have an impact on an ERP vendor's ecosystem. It also proposes the use of an evolutionary business model (EBM) framework to help practitioners enhance the value proposition of the ERP system to various groups as an ERP vendor adopts a change. In this way, the thesis illustrates how the adoption of various value formations can precipitate a change in the future business models for the ERP vendor.

3 Research Approach

3.1 Philosophical Underpinning

Philosophy of science looks at the philosophical underpinnings of a particular study and guides the way the researcher examines a particular domain, evaluates any assumptions, and expresses the implications. Further, the application of the philosophy of science helps explain how we know what we know, and how we acquire knowledge in the first place (Hirschheim, 1992).

The philosophical assumptions used in a research influence (1) ontological assumptions (beliefs about the nature of the world around us); (2) epistemological assumptions (beliefs about how knowledge is acquired); (3) methodological assumptions (beliefs about appropriate mechanisms for acquiring knowledge); and (4) axiological assumptions (beliefs about the role of values in research) (Hirschheim and Klein, 1989). By recognizing the philosophical underpinnings of the study, and the impact on the epistemological, ontological, methodological, and axiological assumptions, the researcher is able to (1) contextualize the research with respect to the role of the researcher and the appropriate contributions to the field of IS; and (2) apply appropriate methodological tools so that claims of knowledge about a particular domain can be tested and validated against a particular theory.

The epistemological assumptions about knowledge acquisition (subjective-objective dimensions) and the ontological assumptions (order-conflict view of the world) were originally suggested by Burrell and Morgan to create four paradigms (Burrel and Morgan, 1979;). Burrell and Morgan's framework was then redefined by Hirschheim and Klein (1989) and subsequently applied to the field of IS as follows: functionalism (objective-order), social relativism (subjective-order), radical structuralism (objective-conflict), and neo-humanism (subjective-conflict) (Hirschheim and Klein, 1989).

However, the underlying philosophies of functionalism (positivist) and social-relativism (interpretivist) have been extensively critiqued and often deemed incommensurable (Mingers, 2002). On one hand, positivists have a tendency to unduly expect regularities in events and explain them in terms of universal laws. On the other hand, interpretivists have unduly relativist implications in terms of human perception, with emphasis on social context. Thus, Mingers (2002) proposed the use of critical realism to the study of IS to establish what he called the realist ontological view while accepting the relativist epistemological domain. Critical realists acknowledge the existence of reality, independent from people's perception of it (Goles and Hirschheim, 2000). Unlike the social-constructivists, who view reality as constructed through social interactions and a particular IS phenomenon (*e.g.,* language, shared meanings, documents, tools) (Hirschheim and Klein, 1989; Klein and Myers, 1999), critical realists believe that the world can be understood through descriptions and discourses "(Sayer, 2000). They take on a fallibillist philosophy, recognizing that knowledge about the world may be uncertain (Sayer, 2000). In a critical realist study, axiological assumptions are also influenced. For instance, the research questions asked are also recognized to be "value-laden" (Dobson, 2002) based on the influences of the literature reviewed as well as the researcher's own experiences.

In conducting this research, the researcher adopted a critical realist philosophical assumption (Bhaskar, 1975; Sayer, 2000; Mingers, 2002). This permitted the researcher to contextualize the actual research with respect to her axiological assumptions. By establishing that the researcher has the requisite management experience in all aspects of a software development life cycle and various areas of consulting, the interviewees were comfortable with using industry-specific lingo and would frequently use analogies that helped explain a particular topic. Thus the researcher was able to take full advantage of being a professionally qualified doctoral student (Klein and Rowe, 2008) with more than 12 years' experience in the

IS industry, and was treated as an insider during the interviews. The researcher spent a significant portion of her career as a consultant in the communications and high tech (CHT) industry and has extensive systems development experience in mainframe, client server, Internet, and Internet Protocol television technologies. The researcher also spent a number of years managing vendors, contractors (both onshore and offshore) and development teams that implemented both customized and commercially off the shelf (COTS) applications for CHT organizations in the Silicon Valley and across the United States.

The critical realist philosophical assumption influences the methodological assumptions as well as the manner in which the data is interpreted and analyzed in case studies (Lee, 1991; Orlikowski and Baroudi, 1991). Sayer (2010) noted that critical realist studies have a tendency to put less weight on quantitative studies that attempt to explain causation, in favor of qualitative approaches that propose mechanisms that can explain a cause. Thus the researcher also opted for a qualitative study to provide rich descriptions of the events and look for possible explanations to explain the phenomenon.

Consistent with the critical realist view (Bhaskar, 1975), the researcher acknowledges that there is a natural order of events (*actual* domain), mechanisms (*real* domain) and experiences (*empirical* domain). In order to understand changes that occur, it is necessary to identify structures and mechanisms that may not be directly observed, but may only be explained or arrived at by inferences. In each of the studies for this thesis, the researcher first collected the data necessary to answer a particular research question, before selecting a theoretical framework that could explain the particular domain of study in terms of structures and mechanisms. This approach provides the ability to “explain *why* things are and hypothesize the structures and mechanisms that shape observable events” (Mingers, 2002). This approach is considered to have greater explanatory power (Smith, 2006).

3.2 Systematic Review of Literature

In order to study the strategic changes within the ERP industry and understand the various areas of focus for an ERP system, the research began with a systematic review (Boland *et al.*, 2014) of literature on ERP. This review of literature was aimed at (1) evaluating the current ERP research for gaps in the academic- and practitioner-oriented literature; (2) identifying future research directions; (3) understanding how research was conducted including how the themes changed over time; and (4) contributing to the development of specific theories.

The systematic review began with a scope search of the academic papers beginning 1990, when Gartner coined the phrase “enterprise resource planning (ERP)”. The review began by reviewing the “Senior Scholar’s Basket of Journals” as defined by the Association for Information Systems (AIS), which includes the following eight (8) academic journals: European Journal of Information Systems (EJIS); Information Systems Journal (ISJ); Information Systems Research (ISR); Journal of Strategic Information Systems (JSIS); Journal of Information Technology (JIT); Journal of the Association for Information Systems (JAIS); Journal of Management of Information Systems (JMIS); and MIS Quarterly (MISQ). The researcher expanded the list to include Information and Management Journal (IMJ).

After selecting the journals to be studied, the researcher executed a search for “ERP” and “Enterprise Systems” using EbscoHost Databases (*i.e.,* Business Source Complete, Academic Search Elite, Socindex with Full Text and Communication and Mass Media Complete). Subsequently, the researcher read the abstracts for all the articles, and later decided that some of the articles had to be excluded since the search parameter term ‘ERP’ or ‘Enterprise System’ returned articles that were not really related to the study (*e.g.,*“free enterprise systems”). Once all the articles were screened, the references were pulled into EndNote and subsequently added into Excel.

Full-text papers were then reviewed and discarded to provide a general understanding of how ERP has been studied in terms of themes and philosophical underpinnings. This literature study aimed to identify the themes involving ERP research that dominated both academic- and practitioner-oriented journals during the period 1990-2013. This process was further expedited by using other researchers' review of existing literature on ERP (summarized in Table 1 below).

Title	Author(s), Year	Time Frame	Categorization Focus
Enterprise Resource Planning: An integrative review	(Shehab *et al.*, 2004)	1990-2003	Selection criteria used for adoption/implementation decisions
Enterprise Resource Planning Systems Research: An Annotated Bibliography	(Esteves and Pastor, 2001)	1997-2001	ERP life cycle framework and General directions
An Updated ERP Systems Annotated Bibliography: 2001-2005	(Esteves, 2007)	2001-2005	ERP life cycle-based framework: General, Adoption, Acquisition, Implementation, Usage, Evolution, Retirement and Education
A comprehensive literature review of the ERP research field over a decade	(Schlichter and Kraemmergaard, 2010)	2000-2009	Research disciplines: Information Systems; Accounting; Organization and Management; Operations Management; Computer Science; and Other. Research trends based on Botta-Genoulaz (2005)categories
Enterprise Resource Planning Research: Where Are We Now and Where Should We Go From Here?	(Cumbie *et al.*, 2005)	1999-2004	Research strategies and focus: ERP Implementation, ERP Operations, and ERP Benefits.
Survey paper: A survey on the recent research literature on ERP systems	(Botta-Genoulaz *et al.*, 2005)	2003-2004	Research trends: Implementation of ERP; Optimisation of ERP; Management and ERP; ERP tools; ERP and Supply Chain Management (SCM)
Popular Concepts beyond Organizations: Exploring New Dimensions of Information Technology Innovations	(Wang, 2009)	1991-2002	Business Problems and Innovation Concepts

Table 1. Previous literature studies on ERP

Previous literature studies created their own categorization schemes for analyzing data covering a wide range of years and topics. While Botta-Genoulaz (2005) and Shehab et al. (2004) took a broad search on multiple research streams to do their literature review, others focused their search on select research streams. Schlicter & Kraemmergaard (2010) suggested that studies in ERP are being published in six (6) research disciplines: IS; accounting; organization management; operations management; computer science; and what they termed 'others.' Of these six (6) disciplines, a substantial portion of the research was found in IS journals (31%) and operations management (OM) journals (24%). This is consistent with the approach by Cumbie et al. (2005), who narrowed down their literature review to those two main fields – *i.e.,* IS and OM– primarily to identify gaps in the literature in these two areas covering the period 1999-2004. For their part, Esteves & Pastor (2001) narrowed down the review of literature to cover only IS research literature, which included ten (10) IS conferences and twenty three (23) journals covering the period 1997-2000, although this would later be updated by Esteves et al. (2007) to include 2001-2005. It is noteworthy that with the exception of the study by Schlicter & Kraemmergaard (2010), which adopted a categorization method proposed by Botta-Genoulaz (2005), researchers who have previously done literature reviews came up with their own categories. For instance, Wang

(2009) took a quantitative approach to categorize journals based on the potential correlation of ERP adoption to solve business problems and innovation concept and reviewed the period 1991-2002. Given that these reviews have already provided an annotated bibliography and useful categorization of literature, the categories defined by Esteves & Pastor (2001) and Botta-Genoulaz (2005) were used as a starting point since they focus on IS research spanning a wider range of years (1990-2011), albeit on a narrower list of IS and practitioner journals.

Constant comparison between the papers enabled a detailed analysis of various elements and relationships to find common themes (Corbin and Strauss, 1996; Dey, 2007; Urquhart *et al.*, 2010). These categories were later refined using a theoretical sampling to analyze additional 'slices of data' and to ensure that no relevant categories were overlooked (Urquhart *et al.*, 2010). In order to do so, the following practitioner oriented journals, which also cover a broader range of disciplines were added: Communications of the ACM (CACM); Information Systems Management Journal (ISMJ); MIS Quarterly Executive (MISQE); Communications of the AIS (CAIS); Harvard Business Review (HBR); MIT Sloan Management Review (MSMR); California Management Review (CMR); and Academy of Management Executive (AME).

The researcher focused on literature specific to the IS studies, and although the thesis encompasses a wider range of years (1990-2011), the researcher reviewed a narrower list of seventeen (17) journals and focused on looking for gaps between academic- and practitioner-oriented journals (see Table 2). The review also covered journals that Esteves et al. (2001; Esteves, 2007) did not look into, namely: Journal of the Association for Information Systems, MIS Quarterly Executive, California Management Review and Academy of Management Executive.

Academic-oriented IS Journals	Practitioner-oriented Journals
European Journal of Information Systems (EJIS)	Communications of the ACM (CACM)
Information Systems Journal (ISJ)	Information Systems Management Journal (ISMJ)
Information Systems Research (ISR)	MIS Quarterly Executive (MISQE)
Journal of the Association for Information Systems (JAIS)	Communications of the AIS (CAIS)
Journal of Management of Information Systems (JMIS)	Harvard Business Review (HBR)
MIS Quarterly (MISQ)	MIT Sloan Management Review (MSMR)
Journal of Strategic Information Systems (JSIS)	California Management Review (CMR)
Journal of Information Technology (JIT)	Academy of Management Executive (AME)
Information & Management Journal (IMJ)	

Table 2. Journal categories

Once all the papers were categorized based on their abstracts, these papers were read and analyzed to see if there were other research patterns in the literature. More specifically, the purpose of this second round of analysis was twofold: first, to get a deeper understanding of the research themes and area of study; and second, to understand current and future research directions.

The systematic review of literature on ERP was only the beginning of the research process, but it allowed the researcher to develop new theories (Boland *et al.*, 2014) that can be applied to the field of IS research. The categorization of existing literature aided in positioning contributions to the growing body of knowledge. After identifying research areas for this thesis, a subsequent literature search was conducted using the keywords “ERP” and the selected theoretical underpinning as part of the literature review of each paper. This review helped frame the case studies in terms of the theoretical framework that will be applied to writing a particular case.

3.3 Current and Future Research Directions

The initial review of the abstracts from the academic journals revealed that much of the available literature on ERP research can generally be categorized into four main areas: (1) design; (2) impact; (3) implementation; and (4) management (see Table 3).

Category	Description
Design	Papers that report on studies related to how ERP systems should be designed.
Impact	Papers that analyze the benefits of adopting and/or using ERP systems. This also includes studies that analyze the impact to the academic community.
Implementation	Papers that discuss various implementation of ERP, including the challenges, critical success factors and failures.
Management	Papers that discuss how management makes decisions on ERP, strategies that include ERP and roles of management with respect to ERP.

Table 3. Areas of Study on ERP

Much of the previous research on ERP systems studied the design and development of information systems from a user organization's point of view, to highlight the processes which enable a particular organization to adopt a new system (Copeland et al., 1995; Mason, 2004; Porra et al., 2005). These studies showed how information-based processes are used to develop systems, as illustrated by Copeland et al. (1995)'s study of the development of the SABRE passenger reservation system for American Airlines; Mason (2004)'s investigation of LEO; and Porra et al. (2005)'s examination of Texaco's systems. Most were interested in exploring how companies used these systems (Bagchi *et al.*, 2003; Lyytinen *et al.*, 2009) and their impact to both practice and academia (Stefanou, 2001; Gefen, 2004; El Amrani *et al.*, 2006; Hatzakis *et al.*, 2007; Karimi *et al.*, 2007; Fryling, 2010). Others looked at the design of ERP systems using business process models (BPM) (Scheer, 1988; Scheer and Habermann, 2000; Roberts et al., 2003) and componentizing of the ERP applications (Sprott, 2000).

Other studies provide an understanding of the impact of adopting ERP systems in organizations to reap (Burn and Ash, 2005) and quantify the benefits of implementing large enterprise systems (Ayal and Seidmann, 2009) across organizations. For instance, the adoption of ERP has been examined in terms of how globally dispersed communities benefitted from the integration of ERP systems, as seen in Roberts *et al.* (2003)'s review of Motorola's adoption of ERP. Some researchers looked at the rationale for adopting ERP and proposed that the selection of ERP is typically based on the technological features and functions required by management (Howcroft and Light, 2010). This rationale is consistent with the functional view of business processes that comprise the individual modules that ERP vendors sell.

Between 1990-2011, the vast majority of the available literature on ERP focused on implementation (Cliffe, 1999; Adam and O'Doherty, 2000; Krumbholz *et al.*, 2000; Lee and Lee, 2000; Soh *et al.*, 2000; Al-Mudimigh *et al.*, 2001; Krumbholz and Maiden, 2001; Soffer *et al.*, 2003; Lee and Myers, 2004; Soh and Sia, 2004; Gattiker and Goodhue, 2005; Ko *et al.*, 2005; Nandhakumar *et al.*, 2005; Wei *et al.*, 2005; Elbanna, 2006;

Nordheim and Paivarinta, 2006; Shepherd *et al.*, 2009; Klaus and Blanton, 2010; Koch and Mitlohner, 2010; Meissonier and Houze, 2010). Between 2000 and 2002, there was a rise in implementation studies in both academic- and practitioner-oriented journals (*e.g.,*Genovese *et al.*, 2001; McNurlin, 2001; James and Wolf, 2002) that corresponded with the rise of ERP adoption in the late 1990s. This increased interest in examining how ERP was being implemented in organizations to increase their chances of success (Markus et al., 2000; Sarker and Lee, 2003; Lam, 2005; Remus and Wiener, 2010), and mitigate failure (Krumbholz et al., 2000; Markus et al., 2000; Soh et al., 2000; Lee, 2004; Soh and Sia, 2004; Sia and Soh, 2007; Meissonier and Houze, 2010).

Previous research also explored the issues associated with managing an ERP implementation (*e.g.,*Avital and Vandenbosch, 2000; Gosain *et al.*, 2005; Hwang, 2005; Osei-Bryson *et al.*, 2008; Elbanna, 2010). Avital and Vandenbosch (2000) demonstrated in their theatrical case study the dilemmas faced by the project management and implementation team members during a SAP implementation. Gosain *et al.* (2005) examined various ways to manage the interdependencies between multiple groups. Osei-Bryson *et al.* (2008) looked into the effectiveness of management techniques to improve the implementation of ERP projects.

The review of literature also revealed that interest in ERP articles across various journals has varied over the years. The increase in ERP publications continued between 2001-2006, but despite this being the period immediately after the ERP II concept was coined, there was only one article on ERP II, which was authored by Beatty, R. and Williams, C. (2006) and published in CACM. This suggests that the name ERP II may not have taken off neither in the academic- nor in the practitioner-oriented journals.

The researcher also investigated the extent to which practitioner-oriented journals discussed the issues around ERP systems earlier than scientific contributions. However, in the years 2002, 2004, and 2005, when the majority of the studies were published, there were similar and parallel patterns of activity in both types of journals. This could perhaps be explained in part by the fact that the journals selected for this study were also written by mostly academic authors rather than industry practitioners.

Between 2007-2010, there was a decline in interest in publishing on ERP, following an apparent shift in the interest of practitioner-oriented journals (*i.e.,* MISQE, MSMR, CACM) toward enterprise application integration (EAI), enterprise architecture, service-oriented architecture, and web-based architecture. This general research direction seems to be in line with the industry's growing interest in cloud computing (*e.g.,* Software-as-a-Service (SaaS), with shining examples like Salesforce.com).

The review revealed a dearth of literature that looks at the history and overall evolution of the ERP system, how the playing field for the vendors has changed through the years, and how ERP vendors are able to innovate and evolve their products to keep up with the changing business needs. One exception is the study by (Pollock and Williams, 2008), which attempted to look into the development of the ERP systems of a single ERP vendor. In fact, the only extended historical study of ERP, which includes inter-organizational structures and relations, is the one by Koch (2007). While these two studies have extended the view of ERP to a complex assemblage of heterogeneous actors, they still cover a rather limited period. In contrast, our study is a longitudinal study covering over 60 years, spanning multiple projects by tracing the roots of ERP back to when the first IS system was built. It provides a historical account of the creation of ERP systems from the perspective of multiple vendors, and goes beyond other studies that only consider a single organization (typically a user organization).

3.4 Case Studies

After identifying the gap in the literature, a case-oriented approach was selected for the five articles included in this thesis. The researcher looked at various ERP vendors and conducted a case study of their history and business practices. The researcher also collaborated with other authors to write different articles that deal with different cases.

Each case study explores how one or more ERP-vendors developed their offerings relative to the needs in the market in the particular social context. It further identifies the challenges that each vendor faced as it adopted a particular business strategy in a competitive market. This approach was designed to look for similarities and compare different cases in order to form general explanations (Miles and Huberman, 1994).

The case studies adopt two complementary approaches to conduct the research: a longitudinal approach and in-situ case study approach.

The longitudinal approach is used extensively in three articles. In article A, a longitudinal study covering 60 years provides a historical account of the ERP industry to get a better grasp on the various influences that shape the action of a particular vendor. It explores how a vendor draws upon its social context and established social practices to reinforce existing practices or create new ones. It also examines how business practices became institutionalized and legitimized in the process of developing an

ERP system. This allows us to look at the overall landscape of the development of ERP, a system that has evolved with changing functions and features over time. Article B compares two vendors which adopted two different partner strategies and shows the impact of adapting a particular business practice (*i.e.,* use of partners) to the business model of a vendor. Article E proposes a business model framework based on a literature review of existing theoretical models that seeks to explain the mechanisms that enable an ERP vendor to survive competition. Business model is a concept typically used by practitioners to explain their businesses in terms of creating value. Applying the proposed business model framework to a case study, it illustrates the mechanisms that can cause change. More specifically, it looks at an ERP vendor's business model over time to see how it evolved.

The in-situ case study was applied in Articles C and D, which look at the network of partners that collaborate toward co-creating value. Since in an ERP setting, a vendor's ability to deliver customer value depends in large part on how the market views its products vis-à-vis the products of its competition, both articles investigate the business strategies that a vendor adopted to gain a competitive edge. Article C analyzes the added values that the network of partners provided to an ERP vendor that led to a competitive advantage. It looks into each player's resources – *i.e.,* assets and capabilities – and how these resources were tapped to create a unique product/service offering. Article D probes into the dilemma, from the perspective of the ERP vendor, of co-creating but also co-destructing value, as it shifted its business strategies to evolve and adapt to its environment. It explains the complexities which arose from the shifting business context and the need to create new organizational routines to institutionalize a new business practice.

The longitudinal approach used in Articles A, B, and E contributed to an explanatory study, which can be traced over time. It was used to explain motivations for creating the ERP, pursue why firms adopted a specific business strategy in the user company, and describe the process through which an ERP system can evolve. Meanwhile, the use of in-situ case studies for articles C and D enabled a deeper look into the practice of using partners for a particular ERP vendor, and it allowed for a detailed examination of the roles and relationships of the different actors and organizations involved in creating the ERP system.

3.4.1 Case Selection Criteria

Using theoretical sampling, the case studies were selected using various criteria based on the nature of the research. For Article A, the cases selected represented a particular way of developing solutions. Additionally, the cases were based on the typical characteristic of the system that was developed (*i.e.,* MRP, MRP II, ERP and ERP II). The vendors of the type of systems selected followed the traditional view of the history of ERP in terms of its technological architecture (*i.e.,* mainframe, client server, internet). LEO, while not deemed as a vendor, was selected since it was the first electronic system developed with several MRP systems features as identified by Mason (2004). The inclusion of LEO was primarily used in the longitudinal study of various ERP vendors, which is aimed at investigating, understanding, and learning from the overall historical development of ERP. SAP was selected based on its established record in developing MRP II solutions in the 70s. Navision was selected based on its track record of developing ERP solutions that targeted small- and medium- enterprises. Salesforce.com was selected based on its dominance in offering cloud-based solutions in the market. Strictly speaking, many would classify Salesforce.com as a Customer Relationship Management (CRM) system only; however it is an example of an integrated business application, which includes functionality (*e.g.,* cloud computing, subscription-based, ease of use) that became a standard feature of future ERP systems.

For Article B, Maconomy and Navision were chosen based on the contrasting business models in going to market with their ERP solutions. Both companies were established around the same time, and they targeted the same clients. But one sold directly to the customers, while the other used a partner channel. This allowed for a direct comparison of the business benefit of a partner channel.

For Articles C and D, the cases selected built on prior work of members who were part of the 3gERP project. One of the researchers in the group began his analytical work with identifying the types of partners in a particular vendor's ecosystem and the relevant background of the network relationships. Based on this categorization, which is also included in the publications submitted herein, future interviews were selected. Additionally, for Article D, cases were chosen from market leaders in the ERP industry as noted by industry specialists (*e.g.,* Panorama, 2010; Hesterman *et al.*, 2011; Panorama, 2012). As such, four vendors were selected from Gartner's magic quadrant (*e.g.,* Hesterman *et al.*, 2011) along with some of its partners from various industry verticals.

For Article E, the Evolutionary Business Model (EBM) framework was applied to SAP, which is the same case selected in Article A. By using SAP, this study was able to investigate how SAP responded to the conditions in the market place to come up with new business models. It builds on Article A by illustrating how particular environmental and technological conditions triggered a change in SAP's business models, but extends the analysis in this article to a detailed analysis of the context in which the business model is adapted.

One of the advantages of using a case study is that it defines a clear boundary for conducting analysis and provides insights into what is happening in the real world. While the cases provide insights that are generalizable to theory, they do not claim to have statistical significance, and they are not intended for use to generalize to probabilistic estimates. Nonetheless, the cases were selected based on the possibility to lend themselves to three levels of analysis which reflect the macro-, meso-, and micro-contexts of business practices. This sampling theory suggests that cases should be selected based on commonalities and differences that will allow researchers to trace patterns, and this research has done just that. Additionally, by using multiple cases in the study, the phenomenon can be explained in an iterative process that operationally links theory to the empirical data collected. The cross-case analysis enhances the generalizability of the qualitative study because it provides the possibility to find similarities and differences across cases and help find related conditions (Miles and Huberman, 1994). The reader can find an account of the data collection for each of the five articles in the appendices. Here we provide an overview of the total empirical basis for the thesis.

3.4.2 Data Collection

Because the creation of an ERP is a complex phenomenon, which is highly influenced by the context in which it is created, this thesis used multiple types of archival and qualitative data. We collected data from sixteen (16) organizations that have been involved in the creation of ERP. Data was primarily collected through semi-structured interviews (Kvale, 2008) and document analysis of corporate documents and websites from both ERPCorp and the partners in the ecosystem. Additional archival data was gathered from corporate documents; news articles; video interviews; books, academic and practitioner articles; and information from websites of the participating companies and their rivals. This data was combined with qualitative interview data to conduct a qualitative study of how multiple ERP vendors developed their ERP systems.

Qualitative data was collected from multiple perspectives from those working within the ERP ecosystem, *i.e.,* the ERP vendor organization and its partner network. Collecting data from multiple perspectives enabled the researcher to reach a saturation point at time where no new data was found in spite of the interviewees' differences (Corbin and Strauss, 1996). ERP vendors were selected based on the whether their respective employers were regarded as leaders in their particular market segment. The choice of ERP vendors were vetted out from industry reports (*e.g.,* Panorama, 2010; Hesterman *et al.*, 2011; Panorama, 2012). The ERP vendor partners were solicited from multiple geographic regions through personal industry contacts, cold-calling from a partner list, and referrals from the vendor or its partners, in order to get a variety of partner types in terms of industry focus and product offerings. The participants interviewed were typically engaged in strategic formation activities, making decisions that impact the direction of the product focus and partner alliances. We believe that a qualitative interview method is particularly useful for a professionally qualified doctoral student (PQDS) who has an established track record of management expertise and has the capability to "decide from their knowledge of the operational conditions they know better than any academics if theory could be applicable" (Klein and Rowe, 2008, p. 682).

Qualitative interview data was collected in two stages. The first set of interview data was collected between November 2009 and November 2010[1]. The second set of interview data was collected between October 2011 and April 2012 through face-to-face and phone interviews (typically lasting 1 hour to 2 1/2 hours), with participants located in sites across Asia, Europe, and continental US. Prior to each visit, systematic searches were

[1] The data in Article 4 was collected in Danish and analyzed by the co-author.

done about the organization and position of the interviewee in order to tailor the questions according to the role of the individual in the organizations. This allowed the researcher to gather practitioner insights on certain business practices and organizational routines that were specific to the organization. Questions pertaining to specific events listed on websites, news articles or industry reports were incorporated in the interview to gather additional data on the event and the importance of such event to the organization. Specific information regarding the strategy from the point of view of a vendor, its competitor or its partners was also collected.

Data was collected from five (5) senior executives from the ERP vendor to gain insights on both historical and future strategic plans of the ERP vendor, as well as how they developed their product and partner strategy. Contrasting data was gathered from six (6) senior executives from ERP vendor competitors and four (4) of their respective partners, to gather information on how these organizations also developed their product offerings and various partner strategies. Complementary data was obtained from different ERP vendors' partners to understand how they developed their respective product offerings and their subsequent response to various changes in a particular ERP vendor's partner strategy.

Some of the interviewees from ERPCorp and ERP Corp's partners were interviewed in both the first and second round of interviews which provided continuity in the discussions. Twenty six (26) one-on-one semi-structured interviews were held using a questionnaire. Contextual meaning for the interviews was obtained from various corporate websites, strategy and marketing material, and industry interviews that were available about the corporation and the interviewee.

Table 4 below shows the list of participants in the second round of interviews, their roles within their respective companies, and how the interviews were conducted. The participants were assured that confidentiality would be maintained in both the use of their and their firm's identities; thus, all proper names have been anonymized for this publication.

	Position	Company Name	Region	Interview Type
1	Director	ERPCorp	US	Face-to-face
2	Director	ERPCorp	US	Face-to-face
3	Director	ERPCorp	US	Phone
4	General Manager Research & Development	ERPCorp	Europe	Face-to-face
5	Vice President, Partner Management	ERPCorp	US	Face-to-face
6	Founder/Business Development Manager	Rival ERP Vendor Alpha	Europe	Face-to-face
7	Founder/Director of Business Development	Rival ERP Vendor Alpha	Europe	Face-to-face
8	Executive Vice President	Rival ERP Vendor Beta	US	Phone
9	Senior Vice President	Rival ERP Vendor Beta	US	Face-to-face
10	Vice President, Product Strategy	Rival ERP Vendor Beta	US	Face-to-face
11	Head of Community Experience	Rival ERP Vendor Beta	US	Face-to-face
12	CEO	Independent Software Vendor, Non-Selling Alpha	Europe	Face-to-face

13	CEO, Partner Management	Independent Software Vendor Selling Beta	Europe	Face-to-face
14	CTO	Independent Software Vendor Selling Beta	Europe	Face-to-face
15	Board Member	Independent Software Vendor Non-Selling Charlie	Europe	Face-to-face
16	General Manager/Founder	Independent Software Vendor Selling Delta	Europe	Face-to-face
17	Senior Consultant	Independent Software Vendor Selling Delta	Europe	Face-to-face
18	Senior Manager	Systems Integrator Alpha	Asia	Face-to-face
19	Team Lead/Senior Consultant	Value Added Reseller Alpha	Europe	Face-to-face
20	Department Head	Value Added Reseller Beta	Europe	Face-to-face
21	Department Head	Value Added Reseller Charlie	Europe	Face-to-face
22	CEO	Value Added Reseller Delta	Europe	Face-to-face
23	CEO and Founder	Rival ERP Vendor Partner Alpha	US	Face-to-face
24	Vice President Product Marketing and Business Development	Rival ERP Vendor Partner Alpha	US	Face-to-face
25	Senior Consultant	Rival ERP Vendor Partner Beta	US	Face-to-face
26	Financial Executive	Rival ERP Vendor Partner Charlie	US	Face-to-face

Table 4. List of Interview Participants

Prior to each interview, permission was asked to record and transcribe the data collected for the study, as required by the Stanford IRB. Except for two interviewees who declined the recording, all interviews were recorded and stored on both on the iPhone and LiveScribe. After the interview, the excel spreadsheet was updated to keep track of the key information about the interviewee (*e.g.,* role in the company, industry vertical, type of ERP vendor) and information related to the interview protocols was stored (e.g. date of interview, approval consent for recording, how the data was collected). Because the primary analysis was on ERP vendors, only the interviews with the focal vendor and its competitors were fully transcribed. Interviews with the partners were only partially transcribed. The pencast capability of LiveScribe, and the ability to listen to the audio when tapping anywhere in the LiveScibe notebook, sped up the process of finding quotes. Additionally, the notebook – which was automatically converted to searchable text when synced with a computer – facilitated data coding because of the search function. The iPhone was used as a backup recording device that was used for transcribing and replaying the recordings. To establish validity and reliability in the data, the interviews were triangulated with archival data (*e.g.,* organizational charts, reports), secondary data (*e.g.,* news articles, industry reports, webcasts), previous interviews, and in some instances observations from tours of various innovation labs to establish converging lines.

Typically, in a case oriented strategy, a theoretical lens is selected to explain the case study, and then later it is applied to other cases to see if patterns emerge. For instance, relevant quotes from interviewees were used to identify an organization’s strategy or change in direction. Subsequently, the relevance of the research studies vis-à-vis the timing of significant events as identified by historical studies on ERP (cf. Shehab *et al.*, 2004; Jacobs and Weston, 2007) and significant events as noted by ERP vendor company websites, were also assessed. The patterns were then presented in a matrix that synthesized the data (Miles and Huberman, 1994). For example, the data from the interviews about technological architecture and product offerings across multiple vendors were consolidated in a table. Such cross-case analysis showed whether the logic surrounding one case could be replicated to provide theoretical, industry-wide insights (Eisenhardt, 1991).

Subsequently, the findings from each case study were illustrated and analyzed in different articles using a particular theoretical lens. This is consistent with the critical realist perspective (Bhaskar, 1975) that suggests that a social scientist needs to come up with better models to explain reality employing various theoretical models. Thus, the application of multiple theoretical lenses provided explanations for both the motivation that influences individuals to act, and the process of creating a complex system that crossed both inter-organizational and social-technical boundaries.

3.5 Institutional Review Board (IRB)

The research was subjected to the IRB guidelines at Stanford, since part of the research was conducted while the researcher was a visiting scholar at Stanford University. Accordingly, the study was submitted to and approved by the Stanford IRB as an expedited non-medical research (Protocol # 23690). Excerpt of the approval as follows:

This email is to notify you that the protocol listed below has been approved by the IRB.

Protocol: 23690 (NEW)
Review Type: EXEMPT
Protocol Director: Michelle Carol Antero
Department: School of Education
Protocol Title: Managing Inter-Organizational Innovations
Approval Period: 02/23/2012 - 12/31/2999

The protocol title in the IRB request was a broad description of the research effort, rather than one that is associated with the titles of any of the articles. Selecting a broad title allowed the researcher to explore multiple angles of research involving multiple organizations that create and innovate within a software ecosystem.

4 Theoretical Frameworks

The different case studies also applied interdisciplinary theories from IS, sociology, and management for a holistic view. This thesis uses different theoretical views to explain the evolution of ERP business practices. The use of multiple theories aids in the understanding of the ambiguous nature of organizational phenomena, where an organization can be many things at the same time. The first article applies an evolutionary framework (*i.e.,* Structuration Theory) grounded in sociology. The next four articles apply three strategic management frameworks (*i.e.,* Resource Based View, Red Queen Theory, Business Model) to explain how an ERP vendor adopts a particular business practice in order to compete, evolve, and survive in the ERP industry. The application of multiple theories provides different frameworks to explain the same phenomenon, which is consistent with the critical realist view. The use of multiple theoretical lenses also helps in providing an explanation for the complexity of creating a system that crosses not only inter-organizational boundaries but also social-technical boundaries.

In looking for theoretical frameworks, the researcher looked at historical studies in the field of IS (Mason, 2004; Porra *et al.*, 2005; Jacobs and Weston, 2007) that have been conducted to illustrate the changes in an organization. In this thesis, structuration theory was applied in the first article to account for institutional and temporal dimensions. It focuses on understanding how organizational structures are replicated over time, an approach referred to as organizational systematics (Baum and Singh, 1994). The use of structuration theory enables us to look at localized practices at the micro-level. This means that focus is placed on the actions of individuals at a particular point in time to illustrate how they established and institutionalized organizational routines.

Organizational routines refer to the formulation of processes and practices that enable people to get their work done (Jarzabkowski, 2004; Spee and Jarzabkowski, 2009). Organization routines are repeatable patterns of actions based on the participation of multiple actors (Pentland and Feldman, 2005; Pentland and Feldman, 2007). Organizational routines provide the ability to be agile by contributing to both stability and change. Routines serve as a benchmark for accessing change (Orlikowski, 2002), such that when organizational routines are analyzed, emphasis is placed on the routines that are formed in situated and localized activities, rather than change (Jarzabkowski, 2004; Spee and Jarzabkowski, 2009). Using structuration theory, we can see that established structures enable routines to be formed, but when changes to existing structures are introduced, established routines are challenged. This creates a dilemma on how to reconcile the tension between stability and change (Mintzberg, 1987).

Drawing on strategic management literature enables the analysis to probe into how firms manage changes in order to remain competitive. Under the resource-based view (RBV), firms are able to obtain competitive advantage if they manage to optimally assess their resources and processes, as well as create new capabilities (Barney, 1991; Wade and Hulland, 2004). Critics of RBV have pointed out that the theory does not fully explain the connection between the firm and its environment or industry (Eisenhardt and Schoonhoven, 1996; Das and Teng, 2000). Because RBV is limited to analyzing the firm attributes internally, other theoretical frameworks that look at the vendor's environment and the competition were included. Accordingly, in order to account for the influence of inter-organizational networks in achieving competitive advantage, the study is supplemented by network theories to aid in the analysis of the partner network as a resource. From a network perspective, firms achieve competitive advantage when they are able to identify intrinsic and extrinsic resources (Gulati *et al.*, 2000; Greve, 2009). The analysis is presented from the vendor's point of view, and it looks at the resources of the vendor and the partner ecosystem to determine how the vendor can compete. The inclusion of network theories enriched the analysis to extend the understanding in terms of resource exchanges across organizations.

The inclusion of the Red Queen theory (Barnett, 2008) in this thesis allows competition to be viewed in terms of simultaneous actions, where competing firms co-evolve. The Red Queen theory suggests that in order for firms to compete, they can either: (1) match or exceed its rivals; or (2) kill the Red Queen (Barnett, 2008; Derfus *et al.*, 2008), its rival. In other words, a firm must not only try to develop new capabilities, it must also search for innovative solutions locally, in some instances linked with social references to others (Levitt and March, 1988; Barnett, 2008). Solutions tend to be based on “competitive hysteresis” (Barnett, 2008), an include elements of reflexivity from having experienced competition. RQT suggests that the response to competition is informed by the organization’s past experiences, similar to Giddens’ (1984) idea of bounded knowledgeability. On one hand, a firm becomes a stronger competitor when it encounters the same problem and develops competitive hysteresis. This means that over time, organizations respond to certain types of problems based on their previous experiences (Cooper, 1992). On the other hand, having established routines to solve similar problems limits options when circumstances change, thus increasing the likelihood of falling into a competency trap (Levitt and March, 1988; Barnett, 2008).

This theory builds on the evolutionary perspective of strategies (Barnett and Bugelman, 1996). By applying the Red Queen Theory, the study is able to provide a dynamic view based on the notion of co-evolution to explain how organizations evolve with respect to the number, size, and fitness of its rivals. This contrasts with the static view of competitive advantage by suggesting that competitive advantage can be sustained (cf. Porter, 1987; Barney, 1991). RQT provides a lens to understand how organizations co-evolve and compete by combining behavioral aspects that take into account organizational learning and economic rationalities – i.e., to increase market share and profitability (Barnett, 2008). RQT falls under evolutionary theories which provide the ability to focus on entities (*e.g.*, organizations, routines), processes and events in the histories of organizations (Baum and Singh, 1994). Its inclusion in the thesis allow us to explain the history of the organizations that create ERP systems as they relate to particular events (*e.g,* birth, death) of organizations and the mutual interaction of entities within ecosystems. This study is also in line with organizational ecology that puts emphasis on studying organizations within ecosystems to understand the mechanisms that contribute to their growth or demise (Baum and Singh, 1994).

The use of different strategic management theories provides the ability to look at an organization's ability to compete. One of the limitations of

RBV is that it only looks at organizations from an economic perspective with finite resources. Additional theories became necessary to explain the network ties that organizations formed in the process of creating an ERP system. The inclusion of RQT enabled the researcher to explain an organization's history and ability to compete in relation to its ecosystem, which included its competitors and partners. The insights from using RBV would only be substantially different from the insights in RQT in that RBV assumes that all the resources are internal.

Additionally, by incorporating theories from sociology and strategic management literature, the study illustrates how individuals are guided by norms that become institutionalized through socialization. This thesis contributes to theory by proposing an evolutionary business model (EBM) framework as a tool to communicate business strategies within an organization and allow it to change. The framework includes Stabell and Fjeldstad (1998)'s value configurations to explain how an organization can evolve its business model so that it can adapt to its market. This proposed EBM framework is illustrated in a longitudinal case study to explain the various mechanisms through which businesses are able to adapt to their environment. This extends the work of Burgelman (1991) that looked at intraorganizational ecological processes within SAP to explain the survival of the organization.

Using patterns of action from the data, the study is able to accomplish a multi-level analysis from macro, meso, and micro contexts. In order to understand institutionalized practices, the researcher looked for patterns forming “best practices”, based on the idea that organizational routines can be replicated to obtain competitive advantage from a macro-context of competitive advantage. In this thesis, best practices refer to the actual practices that organizations do, rather than the best practice that is encapsulated in an ERP product. Organizational routines are then analyzed from the firm perspective. Finally, localized practices are investigated on the individual level. Table 5 below summarizes the three levels of analysis as they relate to the various theories.

Level of Analysis	**Patterns of Action found in Empirical Study**	**Theories**
Macro-context: competitive and institutional forces	Institutionalized practices (*e.g.,* “communities of practices”) Broad commonalities of action	Structuration Red Queen
Within-firm: meso-level	Organizational Routines	Structuration Resource-Based View Business Model
Individual: micro-level	Localized Practices (*e.g.,* Technology in Use, Adaptation)	Structuration Resource-Based View Business Model

Table 5. Theoretical Frameworks and Level of Analysis

5 Article Abstracts and Publication Status

Articles	Selection of Cases	Theoretical Lens	Research Approach	Level of Analysis
A. A Historical Analysis of Enterprise Systems Using Structuration Theory	LEO, SAP, Navision, Salesforce.com	Applies Structuration Theory	Longitudinal	Industry Firm Individual
B. Why a Partner Ecosystem Results in Superior Value: A Comparative Analysis of the Business Models of Two ERP Vendors	Maconomy Navision	Applies RBV	Longitudinal	Firm
C. Strategic Management of Network Resources: A Case Study of an ERP Ecosystem.	ERPCorp	Applies RBV	In-Situ	Firm Individual
D. Hypercompetition in the ERP: It takes all the running to stay in Place	ERPCorp, ERP Corp Rivals	Applies Red Queen Theory	In-Situ	Industry Firm
E. Evolution of Business Models: A Case Study of SAP	SAP	Proposes Evolutionary Business Model Framework	Longitudinal	Firm

Table 6. Selection of Cases with appropriate Theoretical Lens

The thesis includes five articles, which have been published or submitted to a conference or journal. Table 6 summarizes the articles, selection of cases, theoretical lenses, corresponding research approach, and level of analysis.

Individual articles were motivated by a gap between academic and practitioner-oriented literature and was written to find not only theory-development contributions for academics but also relevant recommendations to practitioners. The balance between rigor and relevance was addressed by proposing a framework (Article E), which goes beyond just documenting the past, and makes a practical contribution.

This section presents the abstracts, publication status and review process of the individual papers included in this thesis. The full papers are included in the appendix. The papers are organized in terms of the theoretical framework applied (*i.e.,* structuration theory, RBV, Red Queen and EBF).

5.1 Article A. A Historical Analysis of Enterprise Systems Using Structuration Theory

The paper conducts a historical analysis of the modes of developing Enterprise Resource Planning (ERP) systems, using structuration theory as a lens to illustrate how these systems evolve through a process of structuration — *i.e.,* where structures influence human agents and human agents shape or change structures in a recursive process. The lens is applied to four case studies representing four generations of ERP: (1)

individualized; (2) customized; (3) standardized; and (4) commoditized IT Systems. The analysis reveals that over time, ERP industry structures (*i.e.,* technological and business practices) are institutionalized and transformed in the structuration process, through (1) mobilizing allocative and authoritative resources, (2) changing procedural and normative rules within and across organizations, and/or (3) forming new network structures between vendor, partner, and user organizations.

This paper will be submitted to JSIS as Antero, M. C., Bjørn-Andersen, N., and Sarker, S. (TBD). A Historical Analysis of Enterprise Systems Using Structuration Theory. It will be updated based on the encouraging comments received from the senior editor of JSIS. It will also be revised based on reviewers' feedback from JMIS and JAIS.

5.2 Article B. Why a Partner Ecosystem Results in Superior Value: A Comparative Analysis of the Business Models of Two ERP Vendors

The paper carries out a historical analysis of business conducted over 25 years by two enterprise resource planning (ERP) software vendors in

Denmark, Maconomy and Navision employing two different business models. On one hand, Maconomy adopted a business model where the company itself would develop, sell and implement ERP packages directly to its customers because the company's key executives believed that they would be best at it and that they would obtain valuable information about customer requirements in the process. Navision, on the other hand, adopted a business model which relied on an ecosystem of partners consisting of value added resellers (VAR) and independent software vendors (ISV) in order to sell, implement and further develop add-ons for their software.

Using the Resource Based View (RBV), the paper compares and contrasts the capabilities and resources of the two companies. The key finding is that Navision provided superior customer value and, consequently, collected superior rent, as shown by its selling price of as much as 16 times the selling price of Maconomy. This occurred despite the fact that the two companies started at roughly the same enterprise values and at almost the same time. The analysis shows that the main reason for this huge difference is the value of Navision's ecosystem, which had enabled the company to achieve substantial economies of scale.

We believe that this finding has implications far beyond the ERP field. During the heyday of e-commerce/e-business, it was generally believed that the technology would disintermediate the value chain and further direct sales to customers. The results of our study point to the opposite direction: Technology will lead to more intermediation and the inclusion of more economic units in the traditional value chain or value network due to lower transaction costs and increased focus on core competences.

This paper was published as Antero, M. C., & Bjørn-Andersen, N. (2012). Why a Partner Ecosystem Results in Superior Value: A Comparative Analysis of the Business Models of Two ERP Vendors. Information Resources Management Journal (IRMJ), 26(1), 12-24. doi:10.4018/irmj.2013010102.

5.3 Article C. Strategic Management of Network Resources: A Case Study of an ERP Ecosystem.

This paper applies the resource-based view (RBV) theory to a case study aimed at identifying the complementary resources among partners in the ERPCorp ecosystem of development and implementation of Enterprise Resource Planning (ERP) for small and medium enterprises (SME) in Denmark. The paper analyzes these resources in terms of being valuable, rare, inimitable, immobile and non-substitutable in the ERP solutions market. The study finds four complementary resources that contribute to key competitive advantage, namely: (1) ERP core product, (2) horizontal add-on; (3) vertical add-ons; and (4) customer-specific add-ons. The paper 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 partner certification requirements to be part of the ecosystem. The evidence suggests that the strategy, if implemented successfully, maintains the competitive advantage for ERPCorp ecosystem by effectively combining resources and leveraging lock-on and network effects.

This paper was published as Antero M., & P. Riis-Holst (2011), International Journal of Enterprise Information Systems (IJEIS), Volume 7 Issue 2.

5.3.1 Article D. Hypercompetition in the ERP: It takes all the running to stay in Place

Applying the Red Queen Theory (RQT), the study posits that an enterprise resource planning (ERP) software vendor counters the Red Queen Effect (RQE) in the hypercompetitive ERP industry by strategically aligning itself with multiple partners to form an ecosystem that can be leveraged for growth, provides multiple opportunities for innovation, and produces and delivers a product to its customers. By carrying out a cross-case analysis of ERPCorp, its partners and rivals based on multiple qualitative interviews, the paper shows that ERPCorp was able to survive the entry process as well as adapt and avoid the competency trap by using a partner network to sell, implement and develop complementary offerings. The key finding is that in order to survive the “race”, ERPCorp must adopt new strategies to match or exceed the actions of its rivals. However, this creates various tensions with partners, thus requiring the ability to effectively manage an inter-organizational network.

This paper was double-blind reviewed and published in Antero, M. (2012). Hypercompetition in the ERP Industry: It takes all the running to stay in place. AMCIS: Association for Information Systems. ISBN: 978-0-615-66346-3.

5.4 Article E. Evolution of Business Models: A Case Study of SAP.

The ERP industry has undergone dramatic changes over the past decades due to changing market demands, creating new challenges and opportunities, which have to be managed by ERP vendors. This paper inquires into the necessary evolution of business models in a technology-intensive industry (*e.g.,* develop new offerings, engage in partnerships, and utilize new sales channels). This paper draws from the strategy process perspective to develop an evolutionary business model (EBM) framework that explains the components and processes involved. The framework is then applied to a longitudinal case study of SAP to explain how its success in a technology-intensive industry hinges on its ability to reconfigure its business model. The paper contributes to the extant literature on business models in two ways: first, by identifying and explaining the need for an evolutionary perspective; and second, by adopting different value configurations to reflect the convergence of customers, suppliers and vendors.

This paper was double-blind reviewed and published as Antero, M. C., Hedman, J., & Henningsson, S. (2013). Evolution of Business Models: A Case Study of SAP. In ECIS 2013 Proceedings. AIS Electronic Library (AISeL). (Proceedings / European Conference on Information Systems (ECIS)). http://aisel.aisnet.org/ecis2013/204. Subsequent versions of this paper have been presented in an EJIS Author's workshop at the ECIS 2013 conference and will be submitted as a journal paper in the future.

6 Contributions

This thesis contributes to the field of IS and accounts for the relationship between technology, organizations, and social systems. The comprehensive nature of an ERP system requires an analysis of the full socio-technical system, which is socially constructed in the process of creation and use by the actions of human agents that create structures (Barley, 1986; Orlikowski, 1992; Walsham, 1993; DeSanctis and Poole, 1994). This perspective looks at frames of reference that can be used to enable individuals to work together. This will then be constituted by social practices and traditions (Scherer, 2003). The following subsections summarize the theoretical contributions of the thesis.

6.1 The development of the ERP Industry as an evolutionary change

The history of ERP systems reflects the tremendous changes in the development of business applications over five decades. Most studies (c.f.Kumar and Van Hillegersberg, 2000; Koch, 2007) have presented the development of ERP from a technological perspective or the functionality of the system by application areas. This was critiqued by Hirschheim and Smithson (1998), who suggested that IS are often viewed as technical systems, thus the organizational and social aspects are understudied. In order to address this, we used structuration theory as a lens to decouple the development of ERP from the narrow technological aspect or the features that are embedded in the ERP systems, and looked at how various structures were formed. This allowed a closer look at how various social structures and new practices were formed. In this way, the thesis responds to the call of Koch (2007) who said that ERP should be seen as both local and institutional. It also complements the work of Pollock and Williams (2008) who suggested that the development of ERP was not only due to technological discontinuities but also the prescriptive changes of vendors who wanted to convince their users to purchase their software. It also presents an alternative to the Biography of Artifacts framework (Pollock and Williams, 2009) who integrates historical and contemporary information from multiple sites and timeframes. Moreover, this thesis also used Baum and Singh (1994)'s organizational systematics approach to understand the evolution of ERP in order to illustrate how organizational structures extend over time through the conservation of hereditary information. The study identified and classified divergent business practices, and traced the genealogical roots of ERP to LEO in the late 1940'ies through the utilization of particular competencies.

This study explains how an organization responded to changes in its environment by exploring the localized practices of ERP vendors. It shows that through localized practices of four ERP vendors, four institutionalized business practices dominated the way ERP vendors created systems (as in Table 7): individualized, customized, standardized, and commoditized. This 2x2 matrix illustrates that the evolution of technology from individualized systems to commoditized systems in a matter that has not been shown in the IS field.

		Vendor/Partner Involvement	
		Low	**High**
Implementation Effort	High Effort	Individualized (Lyons) 1	Customized (SAP) 2
	Low Effort	Commoditized (Salesforce.com) 4	Standardized (Microsoft) 3

Table 7. Four Generations of Enterprise Resource Planning System

It all began with the immense effort of an individual company, Lyons, to develop an individualized IT system that would satisfy its needs (i.e., material planning and accounting). Lyon built an individualized system (Type 1) that can be used to solve a particular business problem from the recombination of resources based on the idea of using an “electronic brain.” This is viewed as a revolutionary change, in line with the ideas of exploitation which recombine elements from other products in order to establish new markets (Dess and Donald, 1984; Dewar and Dutton, 1986; Henderson and Clark, 1990).

Next, the replication of software across multiple companies, as illustrated by the SAP case, resulted in the development of customized ERP systems. This change was an incremental change in terms of developing common modules and selling them as pre-packaged software. The rise of this customized ERP system (Type 2) enabled vendors to further customize existing software to meet the requirements of a specific business. Utilizing terms from evolutionary theories, the replication process enables an organization to perpetuate a particular practice over time (Baum and Singh, 1994).

It was not until the introduction of the personal computers (PCs) in the 1980s that another revolutionary change enabled a new type of system to be developed. During this period, Navision (and many other ERP vendors) began creating standardized ERP systems that require minimal customization to each customer through localization (local market conditions) and verticalization (specific conditions in that particular part of an industry vertical). This standardized type of ERP system (Type 3) allowed ERP vendors to sell software that incorporated additional features based on standard country-specific (localized) and industry (verticalized) needs, thus reducing the effort to modify the system when implemented by the user organization. Navision also adopted the use of partner vendors specialized in a smaller segment of the industry, in order to be able to come up with a specific application that could be adapted with little or no costly customization at a customer site.

Finally, the expansion into new markets through scaling up of operations fostered the need for commoditized ERP systems, as illustrated by Salesforce.com, using the cloud-based solution typically referred to as Software as a Service (SaaS). This type of ERP system (Type 4) refers to an ERP package that might not be an exact match to the requirements of the user organizations, but is close enough to allow them to take a software package and make minor modifications to suit their needs. This was coupled with a revolutionary shift in terms of the underlying technological components of the ERP system. The changes in the business practices created a paradigm shift and influenced the way different organizations adopted their respective systems.

This thesis also explains the vendor's decision to adopt a particular business practice to ensure its ability to survive in a competitive market. Viewed within the framework of structuration theory, the evolution of ERP systems (in Article A) is revealed through the incremental and revolutionary changes in the technological platforms and the strength of ties between multiple organizations that formed social systems through the structuration process. This is consistent with the findings of Sundbo (2001), who found that organizations combined organizational business practices with market developments in order to make changes and create new products. Each case shows the influence of organizational routines, ---which are repetitive patterns of actions---on the institutionalization of certain business practices, thus forming new structures. The cases in Article A exemplify how actors from each organization drew on particular rules and resources in the process of creating an ERP system. This process contributed to the evolution of ERP business practices in the ERP industry and at the same time guided the process of establishing organizational routines. Article A also illustrates how different actions led to the development of the ERP industry practice over time and formed four generations of ERP systems.

Article A further reveals that organizations develop strong organizational and social structures through various interactions and communicative actions. This formation of social relationships with other organizations enables vendors to not only mobilize the ERP system from one organization to another, but also influence each other's organizational routines. Various organizational activities between and among the ERP vendors led to the reformulation of the existing rules that guide their actions in the process of creating new organizational routines. The case studies demonstrate that ERP vendors are able to manage the process of changing structures through communicative actions and the prescription of norms to sanction how participants should behave. Article A emphasizes the social structures that are created between various organizations and shows how these alliances have been leveraged for growth. It further provides insight on how ERP vendors need the dynamic capability to change strategies and mobilize resources that are not part of the organization, especially when alternative technologies become available. Ultimately, they are able to mobilize the resources (both material and allocative) in the ERP ecosystem to create new structures (*e.g.,* ERP system). Article A also confirms that structures facilitate the ability to replicate and serve as an administrative system, in the absence of traditional mechanisms of control (Lovas and Ghosal, 2000). This was seen when routines were replicated across organizations, forming a certain generation of technology (Arthur, 2009), and allowing our research to highlight the four types of ERP systems.

The application of structuration theory responds to Smith's (2006) call for methodologies that are consistent with the critical realist objective to trace the interaction of structure and agency. This allowed a closer examination of the mechanisms for change using structuration theory, to illustrate how various structures have shaped the actions of human agents in the process of creating an ERP system. Some attention is also placed on agency (*i.e.,* ability for human to choose) and how shared systems of meanings can be developed in the process of (re)producing structures. Article A also addresses the need to have a qualitative study that investigates the relationship of technology and society in multiple levels, similar to the work of Pollock and Williams (2008); Pollock and Williams (2009).

6.2 Maximizing Resources through Strategic Partnerships

Studies suggest that the strength of the partners in implementing ERP systems directly relates to the subsequent success of an ERP implementation (Holland and Light, 1999; Adam and O'Doherty, 2000;

Ross and Vitale, 2000; Nah and Lau, 2001; Somers and Nelson, 2001). This study confirms that the strength of the partners is important not only in achieving successful implementation, but also in obtaining market share for the vendor. Through multiple case studies, the interactions between various actors that have contributed to each vendor's ability to capture a particular market successfully were explored. Navision (in Article B) and the ERPCorp vendor (in Articles C, D) were able to obtain sustainable competitive advantage as they maximized the resources within an ecosystem to come up with a product/service offering. This was achieved by combining the resources and capabilities of an ERP ecosystem (comprising primarily of an ERP vendor firm and its network of partners). By recognizing that the evolution of ERP systems is based on these systems' ability to form organizational routines that aid their development, Articles B, C and D build on the findings in Article A by investigating a particular business practice to obtain a competitive advantage. They also explore how organizations transform organizational strategies beyond intraorganizational ecologies (Burgelman, 1991; Baum and Singh, 1994). The application of the RBV theory, using case studies in Articles B and C, explain the impact of developing localized practices to help vendors obtain a competitive advantage using strategic alliances. These two articles build on the idea that in order to change, organizations should focus on a maximization strategy that takes advantage of available resources. RBV also allowed us to explain how a particular vendor can identify resources across the partner network, and maximize its strategic alliances to strengthen its practices. This complements the work of Rebstock and Selig (2000) which evaluated different strategies of implementing localized solutions in response to globalization. RBV also aided in a comparative analysis of two vendors to highlight the impact of a strategic alliance to their respective business models, as illustrated in Article B. By combining resources across multiple organizations, competitive advantage provides the motivation for co-creation.

Articles C and D further investigate the impact on the partner network when a new business practice (*i.e.,* change in strategy) is introduced, and confirm the view that the interactions related to resource exchanges across organizations have an effect on the organizational evolution (Baum and Singh, 1994). While the core ERP product is replicated because it is passed on to the partners directly, the interactions with the customer cause some variances in the offering of each partner. The impact of the variations in the product offerings has a significant impact on the partner network when the ERP vendor changes its strategy. Articles C and D reveal that both the ERP vendor and its partners make choices to change their respective strategies to keep up with the competitive market in terms of the maximizing their strategy. For the ERP vendor, this decision may mean cutting out partners that are not capable of changing their technological solutions to fit its long-term vision. For the partners, they have to consider the cost of switching to another partner because of the lock-in effects of building on one particular vendor's technological architecture.

In Article A, various relationships between multiple organizations showed varying social structures, which were analyzed in terms of power, control, and strength of ties. The power and control were analyzed in terms of which organization (*i.e.,* vendor, partner, user) controlled the overall development of the ERP system. It was found that from these different types of relationships, four different types of ERP systems were subsequently developed. First, user organizations that developed individualized systems controlled the overall development of the ERP by pulling the necessary resources into its organization. Second, vendor organizations that developed customized systems incorporated best practices by working closely with user organizations, who influenced the way the ERP system was tailored to suit their needs. Third, vendor organizations that built standardized systems selected industry-specific partners to implement and make modifications to the ERP system and these partners were the ones who had control over the relationship with the customer. The vendor organization anticipated the generic, overall business needs and accordingly built a platform architecture that enabled the partner to build applications. Fourth, vendor organizations that built commoditized systems allowed their users to simply pull the necessary components that they needed to configure the application. This suggests that the power of control in this type of organization was moved back to the user organization, which was more knowledgeable of its own internal business practices and was capable of selecting a system that would work for its business needs.

The strength of ties was analyzed in terms of how quickly a firm can innovate and scale. For individualized systems, user organizations sought the assistance of a vendor to develop a system for them based on their requirements. Further, for individualized as well as customized systems, vendors built strong relationships with the customers. On the other hand, for standardized and commoditized systems, vendors built multiple weak relationships with multiple customers: standardized systems were mobilized by partners, whereas commoditized systems were mobilized using the internet. This finding is consistent with Burt’s (1992) study that suggested that weak ties with multiple actors enable a firm to have access to more information and adapt accordingly. By understanding the dynamics of the relationships between multiple organizations, which interact to create an ERP, we can see how an ERP vendor can position itself so that it can adopt various business practices that are suitable to the environment. It further contributes to the work by Kude & Dibbern (2009) by showing that, as the focal firm tightens the control of the partnership, partners tighten the relationship with their customers (Article C).

6.3 Managing Constant Change and Co-evolution

The dynamics of introducing a new business practice to not only a vendor and its partner ecosystems, but also the competitive environment is examined using the Red Queen theory. Through the actions and decisions of human agents, an organization's adaptability and selection of innovation strategies was analyzed. By applying an evolutionary theory (*i.e.,* RQT) that has not been widely applied in IS, Article D focused on the complexities that an ERP vendor is faced with as it evolves relative to its competition. According to RQT, a firm's survival in a competitive market is dependent on its ability to simultaneously analyze the actions of market participants and then react adeptly. For an ERP vendor in a hypercompetitive industry, its survival hinges on its ability to match or exceed the actions of its rivals. For an ERP vendor that uses partners, this also entails the ability to manage the tensions that arise from the ERP ecosystem. Here we confirm that the maximization view to obtain a competitive advantage is insufficient in a hypercompetitive market. It also corresponds to the findings of March (1991) who suggested the need to explore and exploit in order to keep up with the competition.

The case study in Articles C and D illustrates how a particular vendor adapted to its environment by making changes to its business practices, and uncovers the challenges that arise as institutionalized practices are changed. Article D reveals that the firm's viability in the market is also linked to the value proposition that it offers not only to its customers but also to its business partners. As the industry continually evolves to produce dominant market solutions, more companies are bound to experience the Red Queen effect. The Red Queen effect refers to the inability to survive the competition when a firm only reproduces similar routines, thus contributing to a firm's inability to adapt. Such effect has also been widely studied by others (Kauffman, 1995; Voelpel *et al.*, 2005; Derfus *et al.*, 2008; Love *et al.*, 2009). By viewing competitive advantage as something that is temporary, ERP vendors must be able to constantly evolve with rivals who also innovate. This means that in order to maintain the stability of the ERP ecosystem, a vendor needs to be adept at managing strategic changes (*e.g.,* markets, technologies, and relationships between various organizations). However, this poses a problem in terms of reconciling the dilemma of change and stability, which Jarzabkowski (2004) referred to as the strategist's dilemma.

6.4 Managing the Value Formations in the Business Model to Compete with Constant Change

Article D highlights the need to continually provide value to both customers and partners. Building on the findings of Article D, Article E extends the existing business model framework by incorporating an evolutionary view through the inclusion of different value configurations (Stabell and Fjeldstad, 1998). By linking value configurations to the evolutionary business model (EBM) framework in Article E, an evolutionary component was added to the business model concept that was missing in prior models. This framework builds on the ideas of intra-organizational evolution. It extends the work of Burgelman (1991) that looked into the effect of changing strategies from an intra-organizational ecological perspective by exploring the impact of changing strategies across organizations. By looking at the changes in the value formation, we uncover how organizations adapt to their environment as a consequence of a strategic change. The study also provides a historical account of how an ERP vendor evolved and is in line with Baum and Singh (1994)'s organizational ecology approach.

The thesis also contributed to the 3gERP project area research E Organizational Implementation and Partnerships as outlined in http://www.3gERP.org. In this project area, research focused on the ERP vendor's partnerships and business models. In particular, by developing an evolutionary business model framework, it can shed light on how the business models should be designed. In response to the underlying criticism that academics are more concerned with models that do not have any relevance to practice, this business model framework can be useful to practitioners so that they can assess the potential impact of a change. As noted by Pollock and Williams (2008) the terminology "ERP" was something that came from the practitioners and was only introduced in the academic world through the concept of Business Process Reengineering (Hammer and Champy, 1993). As such, it is advantageous to come up with a business model framework that can be applied by practitioners and academics alike to help identify mechanisms that trigger change.

This business model framework was utilized in a longitudinal study to show that as business practices evolve, an ERP vendor adopts new value configurations or business processes to deliver its product and/or services to the market. By looking at localized practices of SAP over time, we are able to illustrate the durability of a particular strategy, and identify the conditions that prompted and required the vendor to change its business models. This thesis complements the work of Zook and Allen (2012) who explored how great business models can be replicated in changing times. Through an illustrative case study, Article E focused on a particular ERP vendor, SAP, to show how it adopted various business models since its inception in the 1970s to keep up with its competition. It shows how SAP developed various technological platforms as part of its exploration efforts. It also navigated the change through modifying their value formations to support the complementary activities that were brought in by both their partners and customers. The study of SAP's history demonstrates the process of evolution as a path that is linked to the environment by showing how SAP has kept up with the demands of the hypercompetitive environment. This confirms the ideas of March (1994), who suggested that history is a process wherein changes, whether great or small, can make a significant impact to the course of history.

7 Limitations and implications for future research

The first article is a historical case study based on a literature review of four different ERP vendors as they relate to their environment and how they signify fundamental changes over time. One of the limitations of this research is that vendors were primarily selected because they belong to the group of leading vendors whose products are included in Gartner's Magic Quadrant. This was done since it is assumed that successful vendors would be the ones directing the development of the market. To complement the picture and provide an alternate viewpoint, the second phase of the study purposely selected some of the vendors and partners that are not viewed as dominant players in the market. Additionally, because of the inherent nature of a historical study to produce a vast amount of data, choosing the events that made a historical impact was a challenge. To aid in this analysis, the researcher relied on the vendors' historical accounts, as written in their respective websites, to select the important events that were included in the narrative. However, the data produced several hours of recorded interviews that were stored both on the iPhone and LiveScribe. While the interviews with the focal vendor were fully transcribed, interviews with the other vendors were only partially transcribed. To compensate for this, the researcher relied on detailed notes taken from the interviews, which were coded to find common themes which were transcribed for future reference.

This research has provided a unique opportunity to document a change in strategy and assess the potential impact. As the research was conducted at the beginning of the ERPCorps' transition to a new strategy, it may not have fully identified consequences from the strategy. For instance, while ERPCorp hopes that its partners will be motivated to 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 after the implementation of the strategy to determine the full impact. While Article E illustrated how the Red Queen theory can be used in IS, further research can also benefit from using the Red Queen theory as a strategic management theory for IS. Moreover, because of the similarities in many high tech industries that also use strategic partners in producing their products, future work can be done to apply the proposed business model framework and other theoretical models (*i.e.,* Red Queen, Structuration theory) to other empirical data to illustrate and explain a change.

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. Article D addressed the limitation of national boundaries where we presented the ERPCorps' ecosystem in conjunction with other vendors. It further contributes to the research stream of co-creation of value (Fox and Wareham, 2009; Sarker *et al.*, 2012). However, this study is still limited to the ERP industry. Future work can look into other technological firms as well, because the nature of technology is something produced from components and assemblages (Arthur, 2009). Moreover, because the outcomes of history are not only defined by the environmental context (March, 1994), future work can also explore other ERP vendors to understand the impact of environmental conditions similar to that of SAP's.

8 Conclusion

This study sought to answer two research questions: *"How does an organization, such as an ERP vendor, respond to changes in its environment in the process of offering ERP solutions?"* and *"Does the ERP vendor's decision to adopt a particular business practice contribute to its ability to survive in a competitive market?"*

In order to answer the first question, it used multiple theoretical frameworks (*i.e.,* Red Queen, Structuration) to explain the history of ERP in terms of both organizational ecology and organizational systematics (Baum and Singh, 1994). Applying structuration theory to the study of the evolution of business practices was useful in understanding the interaction between actors and structures. This study allowed us to trace various changes in ERP business practices that have led to the four generations of ERP. Unlike other studies that link the evolution of ERP to technological innovations, we link the progression of these different eras to various business practices that became institutionalized. It also provides an alternative lens to study the history of IS. This is done not only to explain the history in terms of the technological path dependence, but also in terms of how the structures were formed and aid in the process of replication, and in terms of how organizational routines were developed to interact with other organizations within the same industry. Such studies extend the knowledge on how administrative systems are formed and affect the development of organizations that eventually form a generation of technologies. By applying a longitudinal approach, this thesis provided insights into how the adoption of certain practices became institutionalized in the industry. It also allowed us to explore the process in which organizations are able to adapt to their environment in order to obtain a competitive advantage.

In order to answer the second question, the interactions of an ERP vendor were analyzed using a qualitative approach to understand how a particular ERP vendor managed its co-creation process. This was in response to a call of Johansson and Newman (2010) to include inter-firm strategic alliances. In this study, we incorporated studies on the creation of ERP with respect to the social systems that participate in the creation process. This thesis also looked at the social practices of ERP vendors as they carry on their work toward creating ERP systems. Using multiple case studies, the thesis probes into the social practices of an ERP ecosystem (ERP vendor and its network of partners) to describe how they co-create value and come up with a product/service offering. Each case study focuses on explaining how a particular ERP vendor developed localized practices that are communicated through a strategy in order to take action against its competitors. Additionally, each case study looked at market conditions (such as technological trends and business strategies) that inform future business models for the ERP vendor.

By applying RBV to answer the second research question, we revealed that the vendor, ERPCorp, was able to co-create with its partners and mobilize them toward a goal of sustaining its competitive advantage. This meant that each player performed in a particular function in order to leverage resources that are valuable, rare, imperfectly mobile, inimitable, and non-substitutable for competitive advantage. It presented the key complementary resources across ERP ecosystem and illustrated how these firms can collectively leverage resources to obtain competitive advantage. However, when competing in a hypercompetitive environment, the ERP vendor and its partners need to be adept at managing strategic changes (*e.g.,* markets, technologies and relationships between various organizations) in order to maintain the stability of the ERP ecosystem. Since RBV was not able to sufficiently address the dilemmas brought about by a change, it required another lens---the Red Queen theory---to help explain the impact of change to the ecosystem.

This thesis highlighted the tensions between stability and change, as well as the organizational and human tradeoffs in the process of evolving. We accomplished this through multiple case studies that traced the process in which organizations managed to develop a product offering that is dependent on its ability to come up with technological changes, as well as support it by forming strategic alliances with a partner network to create an ERP system. We looked closely at how an ERP vendor is able to continue to create new systems, and in the process obtain competitive advantage. RBV theory proved to be a useful framework to analyze the changes in ERPCorp's business development strategy from the maximizing strategy. It aided in the identification of key complementary resources and their distribution within the ecosystem that enables the firm to maintain a global competitive edge in the ERP solutions market. 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. This is consistent with other studies, which claim that firms are more agile and able to innovate in a network ecosystem (Srivastava *et al.*, 2001; Adner, 2006; Van Heck and Vervest, 2007). However, due to "lock in" effects, the firm is also susceptible to unproductive relationships (Shapiro and Varian, 1999). In the case of ERPCorp, it has created a large and vertically integrated hierarchy that has specialized structures both upstream and downstream. One of the disadvantages of the approach, is that mode of governance may indeed impede ability to adapt to change, as discovered by Achrol and Kotler (1999).

In the study that applied the Red Queen theory, we found that ERPCorp is willing to take on risk, and the case illustrates the “organizational and human trade-offs”, as earlier presented by Kallinikos (2004). In the case of ERPCorp, maximizing its rent requires a tradeoff wherein organizational structures are broken down in order to survive the hypercompetitive environment. It also prompts a partner to decide whether it will continue to participate in the network based on the potential to maximize its relational rents for the entire ERP ecosystem. This finding confirms that both vendors and partners make choices that enable them to outlast its competition. It also provides a motivation for looking at various opportunities for generating rent, and finding mechanisms that enable organizations to adapt to changing business strategies as explored in Paper 4 and 5 (Appendix D and E, respectively).

Analyzing changes in the strategy of ERP vendors as the market continues to consolidate and become hypercompetitive allowed us to also see how technological firms employ various strategies and business models to compete in the market place. Through our case study using RQT, we provided a practical understanding of the impact of changes in strategy through the dissenting opinion of some partners, and how they reacted to the change. Likewise, we showed how some aligned their strategies in order to stay in the business. These in-situ studies also contribute to the rigor vs. relevance debate by taking the perspective of “technê and phronêsis of IS professionals, managers, executives, and consultants (‘natives’) themselves” (Lee 2010, p.346).

The challenge for ERP vendors is how to stay as a focal player in the ecosystem, especially at a time when industries begin to converge. Using the RQT, we showed the possibility of falling into the competency trap because of the tendency to search for solutions locally. Using ERP vendors as case studies allowed us to look at the ecosystem that forms a particular technology used in a value network in competition with other vendors and their value network. While the lessons highlighted in this thesis are specific to this group of vendors, we can also generalize the same can be applied to other technological organizations, because of the nature of technology is comprised of an assemblage of components (Arthur, 2009). Future work can look into other technological organizations, which can also experience the same hypercompetitive environment and need to come up with survival strategies. One way to survive is to continually challenge themselves with both exploration and exploitation techniques (March, 1991) and come up with radical changes in the environment to keep up with the market. But there could be other strategies. Further research can be done to expand on this study by either looking from the perspective of other vendors or by covering a longer time-period.

Just like Caroll's (1871) character the Red Queen said, in a hypercompetitive environment, "it takes all the running you can do to keep in the same place." To remain competitive, there is a constant need to evolve and adapt to the environment, because others are co-evolving at the same time. Thus, organizations have to deal with the challenges of adaptability in a world of constant change and come up with an appropriate business model (Zook and Allen, 2012). Practitioners in the field have typically understood competition in terms of the business model. In this study, we proposed a new business model framework to incorporate various theories from strategic management and illustrated it using a case study of SAP. It has presented several areas where change can occur. By adopting this business model framework, an organization can look at not only its resources and capabilities (c.f. RBV), but also its competitive environment (c.f. Red Queen) to come up with new business practices and value configurations (Stabell and Fjeldstad, 1998).

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Appendix

Appendix A: A Structuration Approach to a Historical Analysis of Enterprise Resource Planning Systems

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Abstract

The paper conducts a historical analysis of the modes of developing Enterprise Resource Planning (ERP) systems, using structuration theory as a lens to illustrate how these systems evolve through a process of structuration — i.e., where structures influence human agents and human agents shape or change structures in a recursive process. The lens is applied to four case studies representing four generations of ERP: (1) individualized; (2) customized; (3) standardized; and (4) commoditized IT Systems. The analysis reveals that over time, ERP industry structures (i.e., *technological and business practices) are institutionalized and transformed in the structuration process, through (1) mobilizing allocative and authoritative resources, (2) changing procedural and normative rules within and across organizations, and/or (3) forming new network structures between vendor, partner, and user organizations.*

Keywords: Enterprise Resource Planning, History, Structuration, Enterprise Systems

Introduction

Although scholars acknowledge the benefits that can be gained from understanding the history of Information Systems (IS), historical analysis in the IS discipline is not well established and is often a missed opportunity (Land, 2010). Many continue to focus on adoption and diffusion, the contemporary uses of IS, improvements to the design and architecture of such artifact, and ways to develop technologies cheaper, better and faster, without consciously considering the past. One particular kind of systems that can gain from such a study is Enterprise Resource Planning (ERP) systems. ERP systems are pre-packaged software applications designed to "support all business functions of an enterprise, especially procurement, material management, production, logistics, maintenance, sales, distribution, financial accounting, asset management, cash management, controlling, strategic planning, and quality management” (Klaus et al., 2000, p. 143). Because of the potential benefits of ERP, both practitioners and academics deem ERP systems as the “price of running a business” (Kumar and Van Hillegersberg, 2000; Shehab et al., 2004).

Existing studies on ERP have mainly focused on the user organization, highlighting the challenges associated with implementation (Soh et al., 2000; Robey et al., 2002; Wang et al., 2006), acceptance (Gefen and Ridings, 2002; Gefen, 2004), and benefits of adopting the system (Pollock and Williams, 2008). Few studies have attempted to trace the history of ERP from a chronological and evolutionary perspective, going back to the addition of new business functions — *i.e.,* inventory, manufacturing, accounting, and human resource (Rashid et al., 2002; Martinek and Szikora, 2005; Jacobs and Weston, 2007). The existing chronologies have focused on the expansion of the features and functions of ERP, suggesting that change is cumulative, as indicated by the terms used to refer to it (*i.e.,* MRP, MRP II, ERP, ERP II).

This paper aims contribute to the historical study of ERP by applying an evolutionary perspective using structuration theory. Rather than viewing the changes in ERP as cumulative, we posit that the history of ERP can be viewed in terms of the (re)production of structures. It examines the various organizational activities of ERP vendors to explain the relationships between and among human agent's actions, organizations, and the ERP industry as a whole. It contextualizes certain events (*e.g.,* the latest advances in technology and industry's best practices) to explain the transformative influences that caused ERP to evolve. This approach helps explain the limitations inherent in a particular industry and expound on the complexities in the creation of an ERP. It shows how historic actions have led to the transformation of ERP systems, in the hope that "[s]eeing the past can help one envision the future" (Neustadt and May, 1986). More specifically, we analzye four cases to address the following research question*: How do ERP vendors develop business practices to create ERP systems and subsequently influence the evolution of the industry?* By looking at the interactions across organizations, the study can reveal how particular actions lead to the formation of an industry.

The paper begins with a description of the methodology used to carry out this study. It proceeds with a brief overview of the historical methods in IS, a description of structuration theory, and how it is used in the IS discipline to lay the analytical foundation. It subsequently applies a structuration perspective to analyze and discuss the four cases. A final section concludes and summarizes implications for future research.

Methodology

The first phase of the study commenced with a broad search of articles in the Web of Science (Social Science), using the search term "Enterprise Research Planning." The search retrieved 1,062 peer-reviewed articles covering the period 1990-2012. 1990 was the year Gartner Group coined the term, "Enterprise Resource Planning". We subsequently categorized research themes by selecting a subset of academic papers from the eight "Senior Scholar's Basket of Journals", in addition to Communications of the ACM (CACM), Information Systems Management Journal (ISM), Information and Management Journal (I&M), and the practitioner journals Harvard Business Review, Sloan Management Review, and California Management Review. Consistent with the findings of previous studies (Esteves and Pastor, 2001; Esteves, 2007; Koch, 2007; Schlichter and Kraemmergaard, 2010), our categorization revealed that the study of ERP over the last 60 years has lacked a solid historical perspective.

The second phase of our search was undertaken using the parameters "history" and "Information Systems," to scan for historical traditions and methods for a historical study. Previous research in this area have taken a chronological approach to study patterns (Mason, 2004; Jacobs and Weston, 2007) and understand simultaneous discontinuous paradigms

(Porra et al., 2005), with a tendency to study a limited time period or a single institution (Mitev and De Vaujany, 2012). In this study, we applied an integrationist historical perspective that accounts for institutional and temporal dimensions typically applied in a longitudinal case study (Mitev and De Vaujany, 2012). To do this, we chose structuration theory as a theoretical lens to construct history within the boundaries of "time-space" relations (Giddens, 1984). It explains how ERP systems evolve using a longue durée historiographical account, wherein long-term perspectives are integrated (Mitev and De Vaujany, 2012, p. 118).

The third phase of review was a search using keywords: "ERP" and "structuration"; "enterprise resource planning history"; "Enterprise Resource Planning Evolution"; and "ERP" and "history". This was done to (1) achieve an understanding of how structuration theory or history has been studied in ERP; and (2) identify key players, events, and common threads that could guide the historical analysis. We found that none of the nine articles that applied structuration theory have used it in a historical discourse.

The fourth phase of our literature review focused on assembling pieces of the past into a coherent account of events for each of the four selected cases based on a purposive sample (Miles and Huberman, 1994). These exemplars were selected from market leaders, as determined by industry reports such as Gartner's Magic Quadrant (Hesterman et al., 2011) and Panorama's Clash of the Titans (Panorama, 2012). Each organization pursued its own business model and represents a dominant business practice in a particular period. More importantly, these ERP vendors changed the playing field by bringing new ideas into the industry, thereby causing the ERP product to evolve. Over time, other vendors followed suit by changing their own business practices. The discussion of each case will be limited to a particular period where a particular vendor executed a dominant business model.

In order to provide a multi-level analysis, we looked for empirical referents for each of the case narratives. A historical account of ERP was then created from key events, to show how organizations were established using that particular narrative. Because we attempt to account for the history of ERP over a period of over 50 years, this study is broad in nature and focuses only on major events. These were selected by identifying business practices and technological innovations that stimulated the major transformations in the ERP industry. To ensure historical rigor, we analyzed recorded events from books, journals, autobiographies, Internet archives, and popular media using the criteria set by Mitev and De Vaujany (2012). This longitudinal case study approach (*i.e.,* integrationist historical perspective approach) enabled the focus on longue durée or long-term evolving structures instead of events (Mitev and De Vaujany, 2012).

The fifth phase of our research comprised of detailed analysis of separate, single cases, followed by a cross-case analysis using our chosen theoretical lens. This phase specifically analyzed the business practices of various organizations formed in different times and places, in order to develop our taxonomy of ERP. This multiple case study approach allowed us to illustrate a theoretical construct in one case and apply it to another case, increasing both the internal and external validity. It also enabled us to verify whether the logic applicable in the analysis of one vendor could be replicated to provide theoretical, industry-wide insights (Eisenhardt, 1991).

Historical Research

There has recently been a renewed interest in conducting historiographies to identify research trends in IS in general (Hirschheim and Klein, 2012), in Decision Support Systems (Hosack *et al.*, 2012) and in e-government (Bélanger and Carter, 2012). Historical methods have traditionally been used in IS to understand the processes which enable a particular organization to adopt or transition into a new system. For instance, Copeland et al. (1995) investigated the information-based processes to develop the SABRE passenger reservation system for American Airlines. Mitev (1996) used a historical study to explain IS implementation failures at the French Railway system by relating social (micro) and organizational (macro) level interactions. Finally Porra et al. (2005) explored the history of Texaco to reveal the processes of implementing a system. But few studies have attempted to relate the creation of an IS and its contributions to the IS field, along the lines pursued by Mason (2004) in his historical analysis of LEO.

In the study of ERP, previous attempts to heed these calls have done so by conducting a longitudinal study over a few years. For example, Burn & Ash (2005) conducted a 4-year longitudinal study to understand the benefits of ERP across multiple organizations, while Sarker & Lee (2003) conducted a 4-year study which looked at social enablers of ERP success. However, both studies lack the historical perspective beyond the implementation period. Recent attempts have looked beyond implementation to quantify the benefits of implementing large enterprise systems (Ayal and Seidmann, 2009). Others have extended the historical study of ERP to include inter-organizational structures and relations (Koch, 2007; Antero and Bjørn-Andersen, 2011). While these studies have extended the view of ERP to a complex assemblage of heterogeneous actors, they still cover a rather limited period. One study attempted to look at a longer time period but focused on a single ERP vendor (Pollock and Williams, 2008). In contrast, our study is a longitudinal study over 60 years, spanning multiple projects by tracing the roots of ERP back to when the first IS system was built. It provides a historical account of the creation of ERP systems from the perspective of multiple vendors, and goes beyond other studies that only consider a single organization (typically a user organization). Moreover, such study allows us to trace the genealogy of the ERP to understand how an particular industry was formed.

Structuration Theory

Structuration theory (1984) is grounded in sociology and emphasizes the actions of human agent (Adams and Sydie, 2002). Structuration refers to the recursive human ability to create or (re)produce structures, which are a set of rules and resources which "mediate human action" (Orlikowski, 1992, p. 404). Structures can take one of the following forms: (1) procedural rules (*e.g.,* how a certain practice is performed); (2) moral rules of appropriate enactment such as laws; or (3) allocative resources (*i.e.,* material or object) and authoritative resources (*e.g.,* persons) (Cohen, 2000).

Structures

In structuration theory, structures are created based on patterns of interactions between actors (Giddens, 1984; Cohen, 1989). These patterns can be analyzed using the modalities of structuration in three dimensions — *i.e.,* domination, legitimation and signification — each of which corresponds to various dimensions of interaction — *i.e.,* power, sanction and meaning (Jones and Karsten, 2008). Structures are drawn upon and then translated into action through various modalities — *i.e.,* facility, norms and interpretative schemes.

In this study, we focus on two levels of structures: ERP industry structures and organizational structures (as illustrated in Figure 1). The decisions made in an organization may lead to actions that either reinforce or change existing organizational structures. For instance, human agents can draw upon firm strategies to guide and shape the firm's internal processes (Eisenhardt and Sull, 2001). Thus, developing an ERP system can be associated with the ability to inscribe industry "best practices" based on its collective understanding of multiple business processes. ERP industry and organizational structures are applicable to various types of organizations (*e.g.,* vendors, partners and users). In other words, human agents or institutions draw upon structures in daily interaction; in the process, these structures become reified features of social systems.

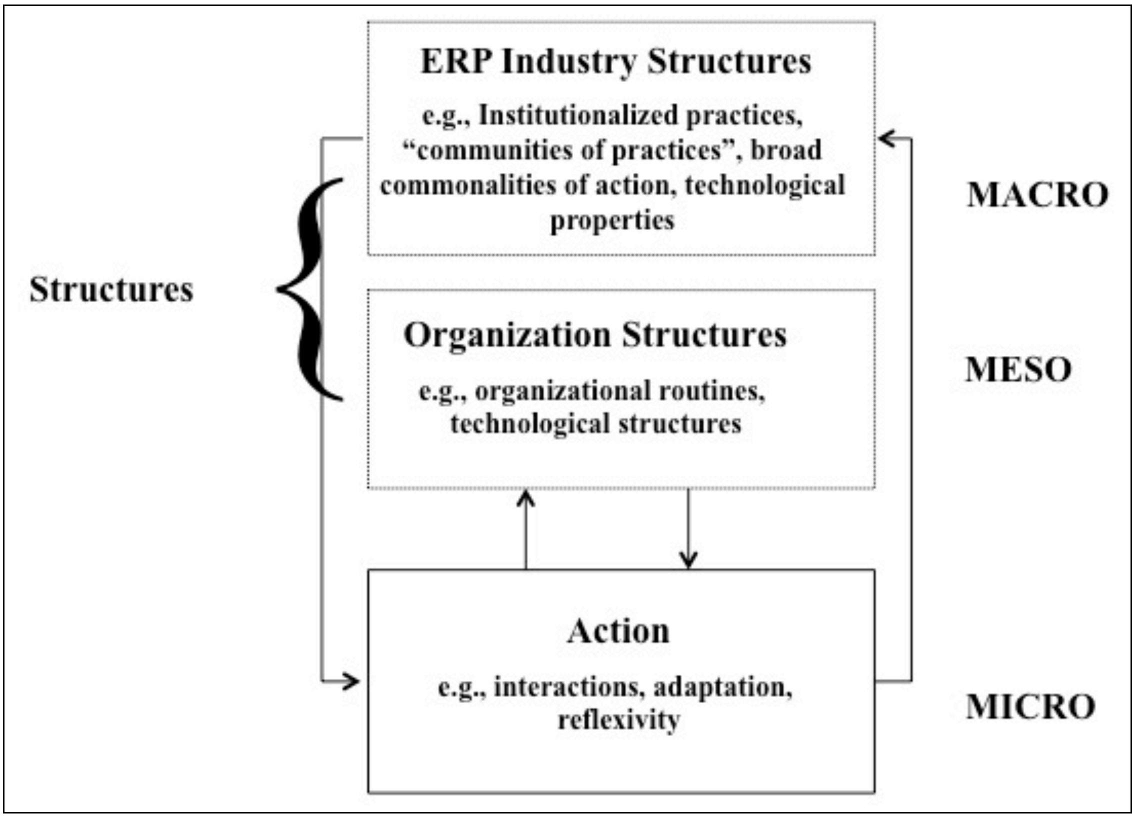

Figure 1. Structuration Theory of ERP Industry

Actions

The third box in Figure 1 illustrates actions. Through the action or interaction of human agents, the status quo of the structure can be both reaffirmed and transformed (Giddens, 1984; Barley, 1986; Orlikowski, 1992). Interactions are activities instantiated by a human agent acting within a social system which are dependent upon the "positioning of individuals within time-space contexts" (Giddens, 1984, p. 89).

Human agents also have the capability to create their own social structures using human agency (Orlikowski, 1992; Chung and Parker, 2008) and strategically filtering information in order to control regulations, either to keep the status quo or to change it (Giddens, 1984). Decisions of human agents are thus guided by practical consciousness to act in a knowledgeable way (Walsham, 1993). However, because humans are reflexive and have bounded knowledgeability, they understand that their actions produce consequences, intended or otherwise, that require acknowledgement in the form of feedback (Giddens, 1984).

We use the term “IT system”— with IT standing for “information technology” to refer to a (new) technology which provides the ability to *process large amounts of information using statistical and mathematical programming methods on computers* (Leavitt and Whisler, 1958). IT systems are used in lieu of the term “technology” to refer to an IT artifact, as used in the structuration model of technology (Orlikowski, 1992). This view allows us to understand the creation of ERP as a socio-technical system, constructed by the actions of human agents (Barley, 1986; Orlikowski, 1992; Walsham, 1993; DeSanctis and Poole, 1994). Therefore, the interactions that occur within an organization can be represented (1) between or among human agents; or (2) between a human agent and the IT system.

Duality of Structure

Using structuration theory, we can analyze the linkages between structures and actions in a recursive loop. There is said to be a duality of structure, because structures "specify parameters of acceptable conduct, but structures are also modified by the actions they inform" (Barley, 1986, p. 80). This duality enables structure to be viewed as a process — being part of the social practices that comprise social systems — as well as an outcome (Willmott, 1981; Giddens, 1984; Barley, 1986). Figure 1 illustrates the reciprocal relationship between ERP industry structures, organizational structures, and human actions.

Table 1 below provides an overview of the key concepts used in this study.

Key Concepts	Definition
Structure	Set of rules and resources which mediate human action. Examples: Procedural Rules (*e.g.,* How a certain practice is performed); Moral Rules of appropriate enactment (*e.g.,* Laws, Norms); Allocative Resource (*e.g.,* Material or objects such as technology and capital); Authoritative (*e.g.,*Persons)
Action	Enactment or interaction of actors (*i.e.,* human agents)
Structure of Domination	Structures of domination convey messages of power – the intent, will and ability of actors to secure outcomes.
Structure of Legitimation	Structures of legitimation are formed when human agents are able to sanction interactions through the development of norms (Willmott, 1981).
Structure of Signification	Structures of signification inform the understanding of various actions through the communication of meaning in verbal expressions or other forms of discursive practices
Duality of Structure	Interaction between human actors and structures are reciprocal – *i.e.,* actions can be both enabled and constrained by these structures (Giddens, 1984; Orlikowski, 1992)
Organizational Structures	Organizational structures refer to rules and resources that are established within an organization. Examples: structural arrangements, business strategies, ideology, culture, control mechanisms, standard operating procedures (SOPs), division of labor (Orlikowski, 1992).
ERP Industry Structures	ERP Industry structures are traces in the human mind of industry practices. ERP industry structures are features of the industry formed based on the routinization of habitualized actions that become accepted norms. Examples: institutionalization of business practices or technological features which have become accepted in the industry. It includes business processes for certain industry functions (*e.g.,* accounting, human resource management, customer relations management).

Table 1. Key Concepts

In this paper, we focus on empirical referents for three types of structures: technological structures, business practice structures, and network structures. Technological structures are properties of an IT artifact (*e.g.,* hardware and software), which can be attributed to a new piece of technology, or the standardization or specialization of an existing technology. The addition of new pieces of technology may act as an enabler and constraint due to inherent incompatibilities. According to structuration theory, social practices should be used as the primary unit of analysis to explain the relationships that form society (Giddens, 1984; Cohen, 2000; Jones and Karsten, 2008). In this paper, we look at business practices which refer to the procedural rules for work as inscribed by organizations. By analyzing the business practices of multiple cases, we can understand the processes that were institutionalized around the development of an ERP. Network structures refer to patterns of relations that connect multiple human agents in a network (2007).

Structuration Theory in IS Research

Structuration theory has been adopted in IS research by incorporating technology to explain the "relationship between IS and organizations" (Barley, 1986; Orlikowski, 1992; Walsham, 1993; DeSanctis and Poole, 1994; Barrett and Walsham, 1999; Jones and Karsten, 2008; Nan, 2011).

While Barley (1986) did not always assume that technologies have to play a role in changing structures, he points out that “[t]echnologies do influence organizational structures in orderly ways, but their influence depends on the specific historical process in which they are embedded” (Barley, 1986). Orlikowski (1992) extended Barley’s earlier work to explain the relationships between three components (*i.e.,* technology, human agents, and institutional properties) through the Structural Model of Technology. Moreover, she put forward the duality of technology concept to explain the reciprocal influence of technology to human agents — *i.e.,* technology enables and constrains the execution of tasks or activities as specified by social practices, and at the same time changes or reinforces institutional properties by facilitating human action (Orlikowski, 1992; Orlikowski, 1996).

Walsham (1993) used structuration theory to explain organizational changes associated with the adoption of IS. He further suggested that change can be traced to structuring processes related to the content (organization and IS), social context, and social processes (culture and politics) through various modalities of structuration found in the context/process linkages. Barrett and Walsham (1999) likewise looked at IS as a disembedding mechanism that facilitates interaction in dispersed geographical areas and its impact to work transformation in inter-organizational settings.

Structuration Theory in ERP Research

In the field of ERP, structuration theory has mainly been applied at an organizational level to explain (1) the structural differences between organizational (macro) and human agent (micro) structures (Avison and Malaurent, 2008); or (2) the link between organizational structures and actions to make sense of an ERP implementation (Rose and Kraemmergaard, 2003). Majority of the studies focused on interactions between actors and the institutional structures in particular settings. Insufficient emphasis has been given to the development of ERP in a broader context. Few have considered the inter-relationships between human agents across various organizations, that also arise in the process of changing structures. Such a study would explain the recursive influence of industry (macro) and organizational (meso) structures which guide actions, allow relationships to form organizational (meso) structures, and create technological structures and business practices that reify or change an industry.

Case Studies

The cases selected for this study — *i.e.,* (1) J. Lyon's & Co. enterprise system – Lyon's Electronic Office (LEO); (2) SAP's prepackaged software; (3) Navision's platform enabled system; and (4) Saleforce.com's cloud software — exemplify each of the four generations representing the dominant business practices of producing an ERP. In each case study, we pay particular attention to how ERP was developed and used to change the way in which (1) information is stored, retrieved and used; (2) work is redistributed across multiple organizations; or (3) work is changed to increase the scale and scope of operations. While some of these organizations have since changed their systems over time, we limit the discussion to a particular type of system in a specific period.

Lyons: The Development of the First Enterprise System

In 1947, news from the U.S. about an "electronic brain" reached an Assistant Controller, Oliver Standingford, who imagined the possibility of using it to solve the business problems of J. Lyons & Co., a UK-based tea company (Ferry, 2003). He broached the idea to John Simmons, then a management trainee, who relayed the news to the company Secretary, George William Booth. Recognizing the idea's potential, Booth sent Simmons and Chief Assistant Controller Thomas Thompson to the U.S. to learn about this new development as well as new business processes and business information systems (Land, 2000; Mason, 2004).

After Thompson and Simmons recognized that the present state of the computer industry in the U.S. was inadequate to meet their needs, they approached Prof. Douglas Hartree of Cambridge University, who was then working with Dr. Maurice Wilkes, head of the university's Mathematical Laboratory. At that time, Wilkes was leading the efforts to develop the Electronic Delay Storage Automatic Computer (EDSAC), which had the capability to execute a stored program (Mason, 2004; Campbell-Kelly, 2009). While Wilkes and Hartree had not originally considered using EDSAC for business applications, they were intrigued by the prospect of using a machine for clerical tasks and agreed to collaborate with Lyons. For their part, Lyons provided aid to Cambridge to support and expedite the completion of EDSAC (Shurkin, 1996), including their own technician, Ernest Lenaerts, to work on EDSAC (Ferry, 2003; Mason, 2004).

The successful completion of EDSAC and the Lyons board's historic decision in May 1949 to forge ahead with the Lyons Electronic Office (LEO), Lyons subsequently forming a project team to take on the task of developing its own machine (Shurkin, 1996; Ferry, 2003). With Thompson heading the LEO project, he sought the advice of Cambridge and Harvard experts on various technical and programming approaches (Ferry, 2003). The requirements of the system were drawn up by David Caminer and Derek Hemy on a flow chart, which meticulously laid out the business processes (Ferry, 2003). The flow chart served as a tool to interpret user processes and verify the code in the program. The LEO team also developed a manual exception process to adjust a standard baseline order and execute changes to orders. The process involved telephone operators modifying punch cards to handle inventory changes. Instead of paper-based copies, they used a microfilm copy, which served as order, packing note, delivery note, and invoice.

In 1951, LEO launched and ran its first inventory application, making Lyons the first company in the world to develop a bespoke solution in response to a business need: to “process a higher volume of transactions at higher speed and greater precision” as well as have “better management control of data” (Mason, 2004, p. 189). Since LEO was a scarce resource and only one of three computers in Britain, Lyons soon got requests from other companies for using the machine (Ferry, 2003). By 1951, with Cadby Hall Bakeries as their first client, Lyons expanded the use of LEO to make sales valuations using raw data on quantities and products for other companies. The LEO project team developed a payroll system in 1953, and later that year, Lyons also ran payroll calculations for other companies such as Ford Motor Co. UK (Aris *et al.*, 1997). In comparison, UNIVAC I was first used for payroll by the Appliance Division of General Electric (GE) and by US Steel in Pittsburgh in 1954, and IBM did not develop a business-oriented machine until 1955.

By 1956, LEO was updated to include sales invoicing functions which automatically produced instructions for each order, calculated the assembly for packers and loaders, and checked carriage free of charge thresholds. One of the unintended but welcome consequences of the new function was that salesmen were also provided with a cash collection list which incorporated unpaid amounts from the previous weeks — a feature which proved very useful for Lyons (Mason, 2004, p. 189).

By the 1960s, the focus on inventory control, with an emphasis on product manufacturing strategies that minimized costs, became prevalent in management philosophies (Rondeau and Litteral, 2001; Jacobs and Weston, 2007). In the late 1960s, Material Requirements Planning (MRP) was developed through the partnership of IBM and J.I. Case (manufacturer of tractors and construction machinery) under the direction of Dr. Joseph Orlicky (Jacobs and Weston, 2007). The term MRP became a shared term used across the industry, focusing on bill of material (BOM) and Material requirement calculations (Møller, 2005). During the latter part of the decade, the concept of closed-loop MRP emerged, and industry focused on priority and capacity planning to allow due dates to be synchronized.

By 1963, Lyons was competing head to head with IBM in the development of business applications for other companies. In 1964, IBM launched IBM's System/360 with the OS/360 operating system ,which supposedly "allowed users to begin with a low range system and migrate upward as their needs grew without rewriting their applications programs" (Mason, 2004, p. 213). This marked the beginning of the market dominance of IBM in developing customized business software applications to automate some of the MRP functions. Eventually, IBM's development of faster higher capacity disk storage and the availability of random access storage completely changed the game.

Case Analysis: The Creation of Individualized Systems

Figure 2 below illustrates the linkages that formed from the time Lyons conceptualized the idea to build its own IT system to automate business processes, until the time Lyons decided to use LEO to build a new business model by selling (Jacobs and Weston, 2007) services to other clients to aid in their day-to-day operations.

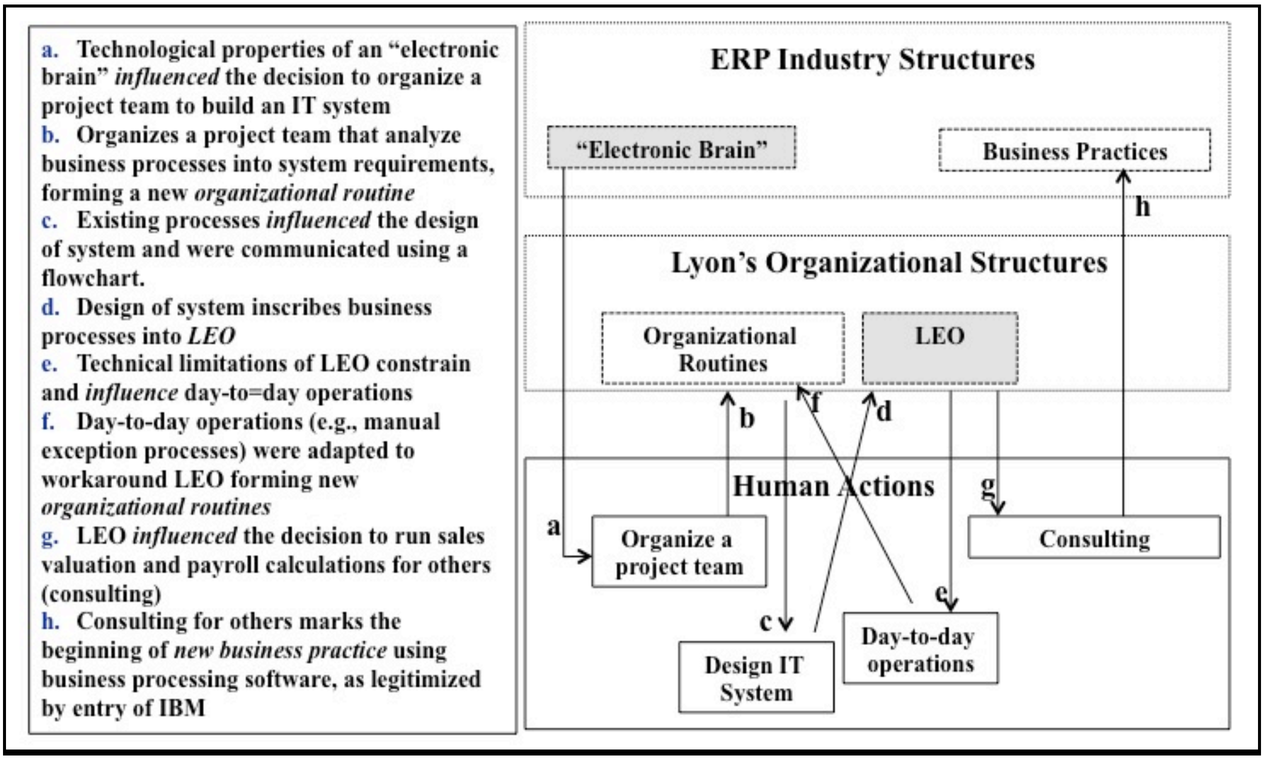

Figure 2. Illustrative analysis of individualized ERP Systems

The general technological advancements available — *i.e.,* "electronic brain", *influenced* Lyon's decision to organize a project team that would explore the possibility of using an IT system (arrow a). The project team developed an *organizational routine* around translating existing business processes in system requirements (arrow b). Existing business processes were translated and communicated through signs and symbols in a flowchart which *influenced* the design of the system (arrow c). The design of the IT system inscribed the processes into LEO, which formed a new *technological structure* (arrow d).

The resulting IT system called LEO was the outcome of several organizational activities and consisted of multiple parts: an inventory application; a payroll application; a purchasing function using a baseline for orders; and a sales invoicing function. The creation of LEO reveals how new technological structures are formed in an iterative process. The project team's development of organizational routines allowed them to manage a huge systems development project which became institutionalized, similar to "many 'best practices' approaches that evolved around the same time and later in the United States" (Mason, 2004, p. 190).

Furthermore, the inscription of routines and technological constraints *influenced* how Lyon's personnel performed their day-to-day operations (arrow f). Their operations developed a manual exception process to handle order changes, thus producing an organizational routine (arrow g). This shows how humans were reflexive and were able to adapt to the systems, consistent with studies of technology in use (Orlikowski, 1992). The development of new routines through habitualized actions shows how a new structure of legitimation was formed. Moreover, the creation of LEO *influenced* the possibility for Lyons to make the system available to others (arrow g). Over time, Lyons developed a consulting practice around sales valuations and payroll calculations. By 1963, LEO legitimized its consulting competency and was reputed to have “the practical experience of a proven business processing software” (Mason, 2004, p. 213). IBM’s entry in the British market not only legitimized Lyon’s service, but also marked the beginning of an industry practice of creating individualized ES.

SAP: The Development of Prepackaged Software Solutions

While the first in-house integrated tailor-made systems were developed from scratch in various organizations, the first-generation ERP pre-packaged software was developed by Systemanalyse Programmentwickung (SAP) (Kumar and Van Hillegersberg, 2000; Meissner, 2000). SAP was established in April 1972 in Weinheim, Germany by five former IBM engineers — Dietmar Hopp, Klaus Tschira, Hasso Plattner, Claus Wellenreuther, and Hans-Werner Hector — who envisioned that they could develop standard software for integrated business solutions (Meissner, 2000). In exchange for stocks in the company, IBM gave these former employees the SAPE software, which IBM originally developed for Xerox and subsequently acquired (Kumar and Van Hillegersberg, 2000).

In 1973, SAP completed its first pre-packaged financial accounting system using International Chemical Industry’s (ICI) IBM mainframes

(Meissner, 2000). Initially they called it System R, and it served as the basis for the development of other software modules. System R later came to be known as SAP R/1; where R stood for real-time processing (Neumann and Srinivasan, 2009; SAP). By positioning its financial accounting system RF ("real time financial accounting") as technically superior to batch programs, SAP secured two additional contracts with Roth-Händle, a cigarette manufacturer, and Knoll, a pharmaceutical manufacturer (Meissner, 2000). Two years later, in 1975, SAP built an RM system, which included purchasing, inventory management, and invoice verification modules. In 1976, the company changed its name to SAP GmbH Systeme, Anwendungen, Produkte in the Datenverarbeitung (Systems, Applications, and Products for Data Processing) (Meissner, 2000). In 1978, SAP completed the Asset Accounting module (SAP). Later that year, SAP launched SAP R/2 that was also developed on the mainframe but with interactivity between modules that provided additional capabilities on a two-tier architecture (Jacobs and Weston, 2007). One of SAP's first users to adapt SAP R/2 was ICI (SAP), but it did not take long for SAP to be adopted by other manufacturing organizations such as Boeing, Mercedez-Benz, and BMW. (Kumar and Van Hillegersberg, 2000).

The international presence of SAP began in 1978 when John Deer, a manufacturer of agricultural machinery, translated its software into French and exported its financial accounting system to its subsidiaries in Europe and Africa. By 1984, SAP International AG was established in Biel, Switzerland (Meissner, 2000). The competitive pressures in the 1970s played a big role in the development of systems (Shehab *et al.*, 2004). As business needs matured and MRP vendors developed solutions with an expanded focus to include marketing and later accounting practices, the 'M' in 'MRP', likewise evolved to encompass the manufacturing process, *i.e.,* Manufacturing Requirements Planning (Rondeau and Litteral, 2001; Jacobs and Weston, 2007). The system was later referred to as MRP II, to distinguish it from Material Requirements Planning and reflect the additional functionality (Wallace and Kremzar, 2001). MRP II likewise evolved to include Sales & Operations Planning, Financial Interface and Simulation (Wallace and Kremzar, 2001).

By 1992, SAP completed developing R/3. R/3 was programmed both on C and its own fourth-generation programming language, ABAP/4, and developed for both UNIX and AS400 client-server architectures (Meissner, 2000; Jacobs and Weston, 2007). The client-server architecture utilized the relational database management system (RDBMS), a technology first developed by Oracle in 1979 and considered as the gold standard for database technology (Oracle, 2007). Another key business process modeling improvement at SAP was developed by August-Wilhelm Scheer

(Meissner, 2000). Scheer is widely cited and known for his work on ARIS, a business process modeling tool. ARIS is used in implementing SAP projects to help organizations develop clearly defined goals, process interfaces and the define organizational responsibilities of inter-organizational cooperation (Scheer and Habermann, 2000).

Case Analysis: The Creation of Customized Systems

Figure 3 below illustrates the actions of human agents in and among organizations to explain how existing technological and ERP industry structures influenced the creation of new organizations and new business practices — *i.e.,* pre-packaged software that could be customized to a wide range of customers.

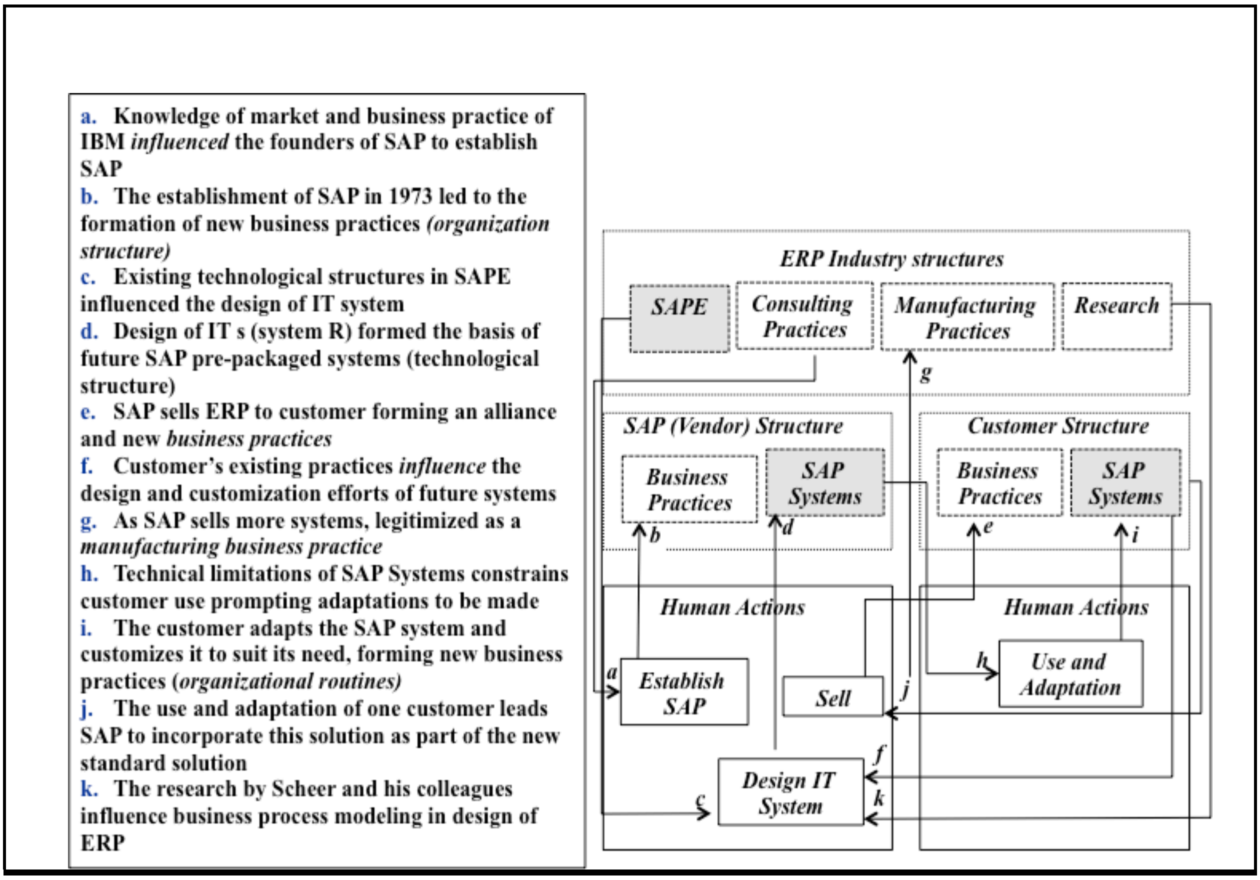

Figure 3. Illustrative analysis of customized ERP Systems

The decision to establish SAP was *influenced* by existing consulting practices (i.e. prevailing ERP industry practices which incorporated MRP logic), as well as the organizational structures at IBM (arrow a). The establishment of a company with a vision of developing pre-packaged software led to the formation of new business practices and new organizational structures (arrow b). Existing technological structures — the SAPE software from IBM — influenced and constrained the design of the new IT system (arrow c). Subsequently, the design of system R, formed the basis of future SAP systems (arrow d). However, before the new IT system could be launched as the first pre-packaged financial accounting system, it took more than just replicating the old design in order to incorporate accounting rules.

In an effort to sell System R, communicative action aided the formation of alliances between SAP's personnel and those from user organizations such as ICI (arrow e). Existing business processes at the customer (e.g. ICI) influenced the customization efforts for the pre-packaged ERP system (arrow f). Structures of signification are reinforced when the user requirements are communicated based on the customer's knowledge of organizational structures. SAP's ability to sell its financial accounting system to ICI and later to other manufacturing corporations shows how SAP mobilized its software package to secure an outcome, *i.e.,* profit through establishing a structure of domination over its users to use MRP. Additionally, the adoption of SAP into manufacturing industry (arrow g) shows how a structure of legitimation was facilitated through norms.

Customers were constrained by the technical limitations of SAP software (arrow h). Thus, they were prompting the modification to SAP's software, establishing a new business practice at the customer (arrow i). For instance, John Deer translated SAP's software in French for use in its Asian and European operations. This modification influenced SAP's ability to incorporate these changes as a standardized solution (arrow j).

Additionally, Scheer and his colleagues' research influenced and eventually institutionalized the use of business process modeling in future designs of SAP (arrow k).

Navision: The Development of a Platform-based ERP

In 1984, three graduates of Denmark Technical University (DTU) (Jesper Balser, Torben Wind, and Peter Bang) founded Personal Computing and Consulting (PC&C), later renamed as Navision. They developed a single-user accounting software called PCPlus, which targeted the small/home office market in Denmark. In the course of enhancing their software to develop a multi-user solution, Navision approached René Stockner, also an alumni of DTU and an employee of IBM Denmark, to broach the idea of developing their product using IBM's PS/2 hardware. René had recognized the potential of the PCPlus software (Post, 1997) enabling the partnership between the two organizations. By 1987, PC&C had released one of the industry's first client-server application: Navigator 1. With the ability to run on Local Area Network (LAN) and IBM acting as a major distributor, IBM Navigator became a commercial success.

Shortly after, Navision began contracting dealers to become certified resellers of their products. This was considered a novelty at that time and provided several benefits to Navision. First, it allowed Navision to realize economies of scale by providing certified resellers — the so-called Value Added Resellers (VAR) as well as Independent Software vendors (ISV) — with the ability to tailor-fit Navision packages to the user's needs in multiple horizontal (geographical) as well as vertical (industry) markets. Second, it created a new business model that enabled profit sharing from a license fee structure agreement. Third, it allowed Navision to spread development costs over a larger number of systems, such that the marginal cost of producing "one more system" became negligible. Finally, increasing certification created greater brand awareness for Navision's products.

In 1989, Navision recognized the opportunity to enter the German market and overcome the limitations of expanding in the Danish market. Navision partnered with a German company in Hamburg that would oversee and carry out localization (*i.e.,* customizing the product to accommodate the language, legal and other requirements). Navision then adopted a design philosophy to develop a flexible architecture that enabled it to (a) sell internationally; and (b) make modifications that would cater to various industry verticals. Accordingly, Navision came up with a three-layered architecture: a kernel architecture layer, a verticalization layer, and a localization layer. The kernel architecture provided generic functionalities applicable to multiple countries/markets and industries; the verticalization layer allowed partners to make industry-specific modifications; and the localization layer allowed the partners to adhere to local requirements (typically involving legal requirements, standard practices, or reporting requirements). This setup also meant that customizations would not be done in the base code. In order to allow partners to make the necessary localizations and develop verticals easier, Navision also developed a tool for its partners. Soon the development, sales, and implementation of the Navision's ERP system formed an ecosystem around it. By 1990, Navision had expanded into Iceland, Spain and UK. In 1995, it also expanded its solutions to include accounting and business management solutions (Antero and Bjørn-Andersen, 2011).

Case Analysis: The Creation of Standardized Systems

Figure 4 below illustrates the linkages when a firm mobilizes its IT System through alliances, allowing more partners to standardize solutions to specific industries and reach more user organizations.

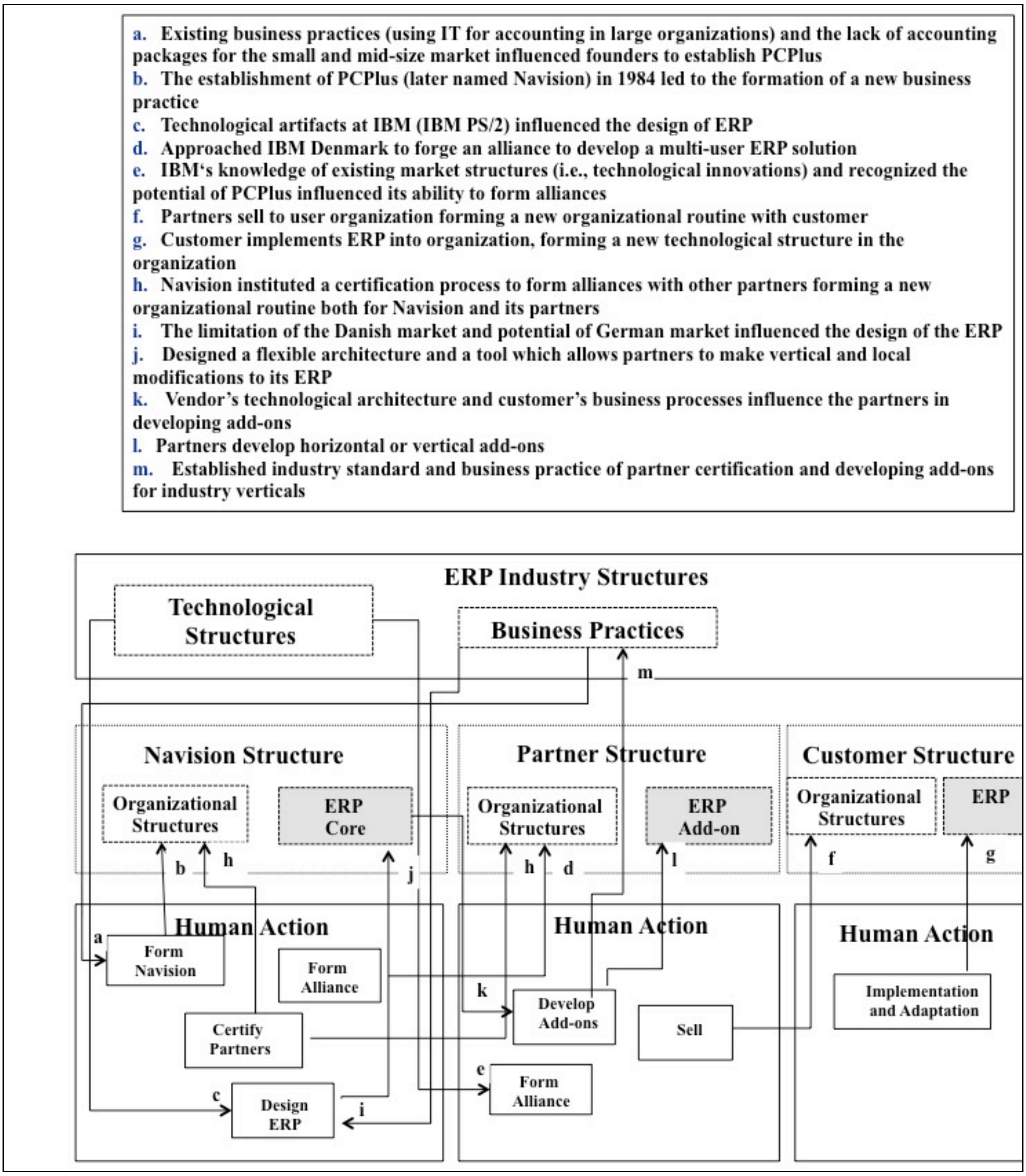

Figure 4. Illustrative analysis of standardized ERP Systems

Existing ERP industry structures (use of pre-packaged software solutions) and the lack of IT solutions for the small and mid-size market led the founders of PC&C to form a new organization (arrow a). PC&C, later renamed Navision, was established in 1984 and led to the formation of a new business practice (arrow b). Technological structures available at IBM influenced the design of a software package to automate accounting functions for SMEs (arrow c). The founders of Navision approached IBM to form an alliance and develop a multi-user software package (arrow d). IBM's decision to partner with Navision was also influenced by knowledge of existing ERP industry practices and technological innovations (arrow e).

Navision affiliated itself with multiple partners who were given access to its core products to sell to multiple user organizations, forming a new organizational routine(arrow f). The formation of new linkages between a vendor and a partner allowed a partner organization to secure new users by selling pre-packaged standard software through the communication of their expertise, an attempt at creating a structure of domination. The customer implemented ERP, formed a new technological structure in the organization (arrow g). Over time, Navision instituted a certification process (arrow h) to allow it to form other alliances with multiple partners, thus providing the ability to dispel uncertainty and legitimize the practice. The limitations of the Danish market coupled with the understanding of the potential of the German market, influenced its decision (arrow i) to create a flexible architecture and development tools (arrow j).

Vendor’s architectural standards and user organizations’ business processes influenced the ability of partners to create ERP add-ons (arrow k). Over time, human agents in partner organizations developed new routines that could be built into horizontal or vertical add-ons (arrow l). The creation of norms of using strategic alliances enabled a structure of legitimacy to be formed among its partner network, setting an industry standard in developing vertical solutions (arrow m).

Salesforce.com: The Development of Cloud-based System

In the 1990s, there was a notable increase in ERP adoption due to several reasons. First, small- and medium-enterprises were prompted to adopt pre-packaged ERP solutions to fix problems of non-compliance (Davenport *et al.*, 2004; Jacobs and Weston, 2007). Second, Y2K, a problem associated with the turn of millennium in mainframe systems, increased the adoption of client/server solutions (Wang, 2009). By the late 1990s, the industry had reached a certain maturity level, as shown by the commoditization of ERP and the marked increase in mergers and acquisitions (M&A) among ERP vendors (Mahato *et al.*, 2006; Jacobs and Weston, 2007) and some of their respective partners. ERP vendors entered a period of software vendor consolidation to capture market share.

The strong M&A activity in all industries in this period (2000-2007) was also significant in the ERP market mostly led by key players (*e.g.,* SAP, Oracle, Microsoft and Infor)(Wire, 1999; Jacobs and Weston, 2007; SAP, 2010).

The Internet was seen as an enabling technology to access information in real time, and ERP vendors modified their software solutions (Jacobs and Weston, 2007). The widespread diffusion of ERP systems with extended capabilities — *e.g.,* enabling e-businesses and increasing focus on inter-organizational collaboration — was signified and legitimized in 2000, when the Gartner Group came up with the term “ERP II” or “ERP/2” (Davenport *et al.*, 2004; Møller, 2005). Subsequently, the increased interest in cloud computing was reflected in the architectural trends and innovation generation forums. For instance, cloud service offerings have been noted to have one of the following architectural forms, each reflecting one of the three basic service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) (Durkee, 2010; Hugos and Hulitzky, 2011).

One of the early adopters of SaaS was a company known as Salesforce.com, based in San Francisco, California. In 1999, its founder Marc Benioff took a sabbatical from Oracle to start a business built on the premise that users would pay monthly access to software on the web. This was at a time when most software companies were charging a sizable amount in upfront license fees. Benioff was well positioned to understand the customer relationship management (CRM) market after having worked with Tom Siebel, CEO of Siebel Systems. Benioff and Siebel had worked on the Oracle Automatic Sales and Information Systems (OASIS), a product geared toward salespeople. Siebel Systems, a major player in the CRM space, was also based on OASIS. Benioff was therefore well aware of the product's features and shortcomings, allowing him to envision how he could revolutionize the way this particular application can be delivered (Benioff and Adler, 2009). He initially broached his ideas with Tom Siebel, but a difference in views prompted Benioff to start his own company (Benioff and Adler, 2009). Salesforce.com was founded on a vision that software purchases could be democratized, free from the "complexities of installation, maintenance, and constant upgrades"(Benioff and Adler, 2009). The company's logo and customer support number (1-800-NO-SOFTWARE) were chosen to represent this absence of software.

By April 1999, Salesforce.com had a working prototype of the CRM application, using the web as a delivery platform. The software included a portal for mobile users to access sales leads, company profiles, and other services (Kirby, 2002). In August 1999, Benioff was able to secure its first customer, Blue Martini Software; he implemented the service in two weeks.

By September that year, the company had managed to sign on five pilot customers. Shortly after, it was able to launch a self-service model, initially offering its services for free, thus enabling the expansion of its market share (Benioff and Adler, 2009). Unlike traditional models where software vendors sought out user organizations, Salesforce.com often didn't talk to them until after they had signed up for service.

To promote sales, Salesforce.com branched into different strategies. In 2000, Rob Acker, a former Oracle sales manager, recognized that they had better success with businesses with less than thirty employees. He convinced Benioff to build and lead an account management team to focus on and pursue this segment. Carl Schachter led a separate strategy, which included face-to-face meetings that pitched both the practicality and vision of salesforce.com to capture enterprise clients. Shortly after, Jim Steel and David Rudnitsky were brought in to expand sales and distribution efforts worldwide, as well as target Fortune 1000 companies. By 2001, Salesforce.com expanded its features and built vertical markets (Benioff and Adler, 2009).

In 2003, Benioff pitched the benefits of SaaS to user organizations (Salesforce.com, 2011). In the same year, its main competitor Siebel launched similar on-demand service, and later acquired another on-demand software company called UpShot, thus legitimizing

Salesforce.com’s SaaS model (Benioff and Adler, 2009). Although not strictly an ERP system, Salesforce.com was trailblazing the development of cloud-based ERP systems. In 2010, Gartner named two companies as leaders in developing SaaS technology for ERP’s lower mid-market level: Epicor, a California-based corporation that develops an ERP solution on a .NET platform, and Dutch-based corporation Exact software. By 2013, other companies such as e-conomic.com and Microsoft Dynamics NAV followed suit.

Salesforce.com also developed the capability to integrate with other applications by providing an application programming interface (API). Eventually, Salesforce.com operated a PaaS and allowed everyone to create its own complementary online services (Benioff and Adler, 2009). Salesforce.com has since broadened its services to provide a “development environment, infrastructure services and social media platforms as more diverse cloud computing options that capitalize on markets well beyond the sales automation tools at the core of its historical business” (Hugos and Hulitzky, 2011).

Case Analysis: The Commoditization of Systems

Figure 5 below illustrates the case of Salesforce.com which successfully commoditized an IT system, using the Internet as a delivery vehicle to forge alliances with users.

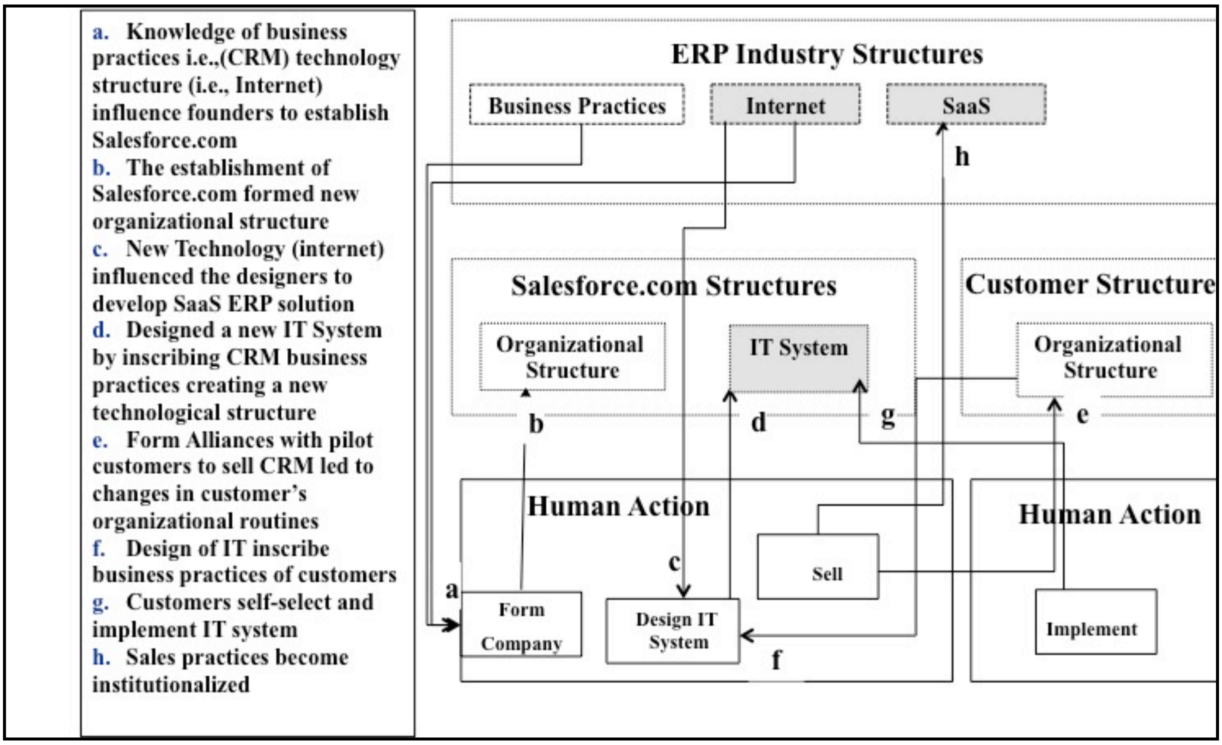

Figure 5. Illustrative analysis of commoditized Enterprise Resource Planning Systems

Knowledge of Siebel, a vendor specializing in developing CRM, influenced the founder to form a new company (arrow a). The establishment of Saleforce.com formed new organizational structure (arrow b). Influenced by the internet, a new technological structure (arrow c), designers developed a new SaaS ERP solution by inscribing CRM business practices, thus creating a new technological structure (arrow d). Salesforce.com formed an alliance with pilot users which led to changes in customer's organizational routines (arrow e). User organizations self-select ed and implemented the IT system (arrow g). Over time, SaaS became an accepted business practice (arrow h) and other companies followed suit, forming a structure of legitimacy.

Cross-Case Analysis and Discussion

A cross-case analysis of the four cases enables us to analyze human action to see how changes in the ERP industry evolve when new business practices and technological and network structures are formed. Using a structuration perspective, the history of ERP can be explained through human actions to reify or change existing structures by drawing upon a set of procedural or normative rules, and by mobilizing allocative and authoritative resources.

Business practices

The cross-case analyses reveal that vendor organizations were guided by existing ERP industry, and through their actions reinforced or changed their organizational structures. By identifying material and allocative resources, certain business practices were established to support a chosen business model and leverage certain technological, organizational, and network structures that could be combined to produce the ERP system. Human agents from ERP vendor organizations acted in multiple ways: (1) by incorporating a change in technological structure (*e.g.,* electronic brain influenced Lyon's to come up with LEO); (2) by looking at existing business practices in other markets (*e.g.,* in the 1970s, SAP was inspired by IBM to come up with pre-packaged S/W); and (3) by looking at both the business practices and a technological structures (*e.g.,* Saleforce.com looked at Sieble and the Internet to create a new marketplace).

In the case of LEO, organizational structures built around business processes already existed for the manual calculation of sales and inventory for its teashops. By creating LEO, they were able to create a new organizational structure to automate inventory control. Later, they were able to automate other areas of the company. Eventually LEO sold machine time to other organizations, thereby creating a new business practice that was institutionalized.

In the case of SAP, the existing business practice involved consulting to large enterprises to help automate various business functions; SAP changed the process of creating these systems by making the process repeatable. Over time, through the routinization and inscription of various business practices based on patterns of actions into its ERP, SAP established an organizational structure and a structure of dominance for user organizations.

Navision challenged the existing business practices of creating applications for various business functions, and introduced a process in which such applications were delivered to customers through a platform-based system and using a partner ecosystem. This approach allowed Navision to capture a new market (*i.e.,* SMEs), while also constraining its future actions because of its dependency on partners to reach user organizations.

Finally, Salesforce.com focused on creating an application for a specific business process for an under-served market. It changed the delivery mechanism by making its system directly available to the users in the cloud, lowering the organizational decision making from the top management to middle management.

When existing rules are followed, existing ERP industry structures are reinforced. For instance, an IT system could be developed to incorporate features that were comparable to IT systems available in the market. Alternatively, the formation of new business practices paves the way for the production of new structures: first, the automation of business processes triggers the possibility of creating individualized ERP; second, the ability to create a pre-packaged software that can be customized for multiple companies; third, the proficiency to standardize an IT system to different client organizations' needs; and fourth, the capacity to scale up and expand into new markets.

Technological Structures

Industry analysts such as Gartner Group have labeled IT systems with different terms, to communicate the extensions to the scope and functionality covered by these systems. These terms are structures of significations, formed by patterns of actions seen in various organizations. Analysts initially called the IT system "MRP," to emphasize the handling of materials. In the 1970s, MRP was renamed "MRP II" to encompass other parts of the manufacturing industry. In the 1990s, the term "ERP" emerged to cover the whole enterprise, and in the 2000s the term "ERP II" was coined to include possibilities for e-business. While on the surface, these can be viewed as cumulative functions of the ES, they actually correspond to the creation of new business practices. At the heart of all this is a movement away from the traditional approach of automating a business function by building computers, to a new approach which views the computer as a system that is taken-for-granted, ubiquitous, more like a necessary component of the business. This shift in views can be explained by changes in procedural rules that have influenced the creation of new technological structures. In the earlier years, ERP was sold as a product, but over time it evolved to became more and more like as a service — *i.e.,* Product (1950s-1970s), Product + Service (1980s-1990s), Service (2000s).

Over the 60 years of ERP history, different rules and resources were used to form new technological structures, or reinforce existing structures based on the availability of allocative resources. Table 2 explains the different ways in which the four case studies created new technological structures. In the case of LEO, the ERP was developed internally, from a vision inspired by the "electronic brain" to automate business functions. It mobilized an allocative resource in the form of a mainframe system to come up with a tailor-made, highly customizable ERP as a product. SAP leveraged both its mainframe and relational databases to come up with a pre-packaged software that was sold together with customization services to suit the users' needs. Navision developed a software platform that allowed multiple partners to develop add-ons, creating a system that could scale up to multiple countries and industry verticals. It utilized a new IT architecture based on the Client/Server and PCs, and incorporated an allocative resource in the form of its partners so that it could scale up the operations of customizing solutions. In this case, Navision produced a standardized platform-based system which was complemented by additional services provided by its partners. Influence by the Internet frenzy, Salesforce.com built a cloud solution based on the knowledge of CRM, and came up with a commoditized infrastructure that delivered a service to user organizations, using the Internet to scale up and reach new markets.

	Lyon's	**SAP**	**Navision**	**Salesforce.com**
Old Business Practice	Manual process of inventory control	Individualized software that is tailored to a particular customer	Customized software that is tailored to a particular customer	Standardized software that is sold by a partner organization
Allocative resource	Mainframe	Mainframe + Relational Database	Client/Server + PC	Internet
Outcome: New Business Practice (IT System)	Individualized (Tailor-made ES)	Customized (Pre-packaged ERP)	Standardized (Pre-packaged ERP with industry-specific and localized modifications)	Commoditized (Pre-packaged ERP requiring minimal modifications)

Table 2. Technological Structures that formed the ERP

These technological influences have often been used to explain the revolutionary shifts in ERP (Jacobs and Weston, 2007; Lorincz, 2007).

Alternatively, a structuration perspective reveals how the actions of the human agents are informed by the macro- and meso-level structures, and how these actions in turn are able to reify or change structures. By treating the development of ERP both as part of a process that addresses a business need, and as an outcome that is adopted by a user organization, ERP can be viewed in terms of the change in technological structure that becomes part of the ERP industry structure — *i.e.,* the new standard against which new innovations are compared. When activities have extended over time and space, they become institutionalized industry practices. Over time, the industry evolves in a recursive loop through changes in the business practices and technological and network structures.

Network Structures

By analyzing social relations, we can show that in the process of creating the ERP, new network structures (see Table 3) were formed across organizations. Partnerships were formed to increase geographical scale and acquire new users. M&As became necessary to access new resources.

	LEO	SAP	Navision	Salesforce.com
Authoritative Resource: Members in Relationship	User Organization + Consultant	Vendor + User Organization	Vendor + Partner Ecosystem + User Organization	Vendor + User organization
Procedural Rule: Nature of Relationship	Strong Relationship with Consultants (Industry Experts)	Strong Relationship with Large User organization	Weak Relationship with SME user organizations	Weak relationships with SME user organizations
Procedural Rule: Type of Relationship to User Organization	N/A	Direct Relationship with User organization	Indirect Relationship with User organization	Direct Relationship with User organization

Table 3. Network structures that formed within the ERP organization

The cross-case analysis reveals that the evolution of ERP is reflected in the formation of four distinct business practices. Using interpretative flexibility to give shape to their practices, various actors were involved as authoritative resources and engaged in specific actions to create four types of ERP. A user organization built a type 1 (Individualized) ERP based on existing organizational structures, as communicated in specific requirements to automate a particular business function. A vendor organization built a type 2 (Customized) ERP system, where common business processes ("best practices") were inscribed into a pre-packaged software. Some vendors developed their own interpretative schemes (cf. Scheer and Habermann, 2000) to facilitate the customization efforts with the user organization, thereby reducing the effort to modify the system. A vendor organization built Type 3 (Standardized) ERP systems with the capability to add features as informed by country-specific (localized) and industry (verticalized) structures. Some partners of ERP vendors specialized in a niche or industry, to come up with specialized applications for a user organization. Finally vendors and user organizations developed Type 4 (Commoditized) ERP packages for a specific business function (e.g., accounting, inventory control), with configuration tools to make minor modifications.

The individual case studies illustrate how human action led to the formation of various routines around the design, implementation and use of ERP. Through interpretative schemes, an ERP has become a resource mobilized by human agents in the process of designing, implementing, and using it across organizations. Building on Barrett & Walsham's (1999) work, these findings support the notion of Information Systems (IS) as a type of disembedding mechanism which facilitates work across organizations in multiple times and spaces. This disembedding process enables the sanctioning of norms or exercise of power over organizations. As seen in Figure 6, the control of these actions changes from one type of organization to another in different generations. Type 1 user organizations control the overall development of the ERP and pool the resources (*i.e.,* consultants) as needed. Individualized ERP are developed by the user organization: the user organization designs, implements, and uses the system based on a human agent's capability to acquire knowledge, develop the idea, and forge alliances to form an organizational entity of agents that can collectively design and implement the system themselves. Type 2 vendor organizations work closely with user organizations to customize a solution to suit their needs. They have a substantial influence over the development process of the systems, but they rely on the users to inscribe organizational routines. Customized ERP are created when a vendor is able to work directly with user organizations and form deep relationships to share the same vision which enable them to make modifications to the system together. Type 3 vendor organizations implement products in collaboration with selected industry-specific partners that have a direct relationship with the user organization. The vendor anticipates the business needs and co-creates with the partner by providing them with a platform architecture that empowers a partner to make modifications to the ERP. A vendor is thus able to expand its reach to more user organizations with weaker ties, using a standardized ERP. Finally, Type 4 vendor organizations empower the user organizations to self-select an application. A vendor inscribes business practices in the system that is sufficient to address the user organizations' needs, and the system is commoditized when it has ability to scale up through existing technological structures (*e.g.,* the internet). By empowering user organizations to control the implementation, Type 4 vendor organizations are able to develop multiple weak ties with users.

As the ERP industry practice developed over time, we can see how both the network structures (even across different types) and the nature of relationships between multiple organizations have changed. The network structures can be analyzed further in terms of structures of domination *i.e.,* the strength of ties and control over project development. In the push approach to developing ERP (Types 2 and 3) a vendor and/or partner controls the process of inscribing best practices into an ERP function. In contrast, the pull approach (Types 1 and 4) relies on the user organization to bring in a vendor or consultant who can help build the ERP. We can also illustrate these by referring back to Figures 2, 3, 4 and 5 in each of the case studies. The strength of the ties between organizations and the direction of power is illustrated using different arrows (in Figure 6).

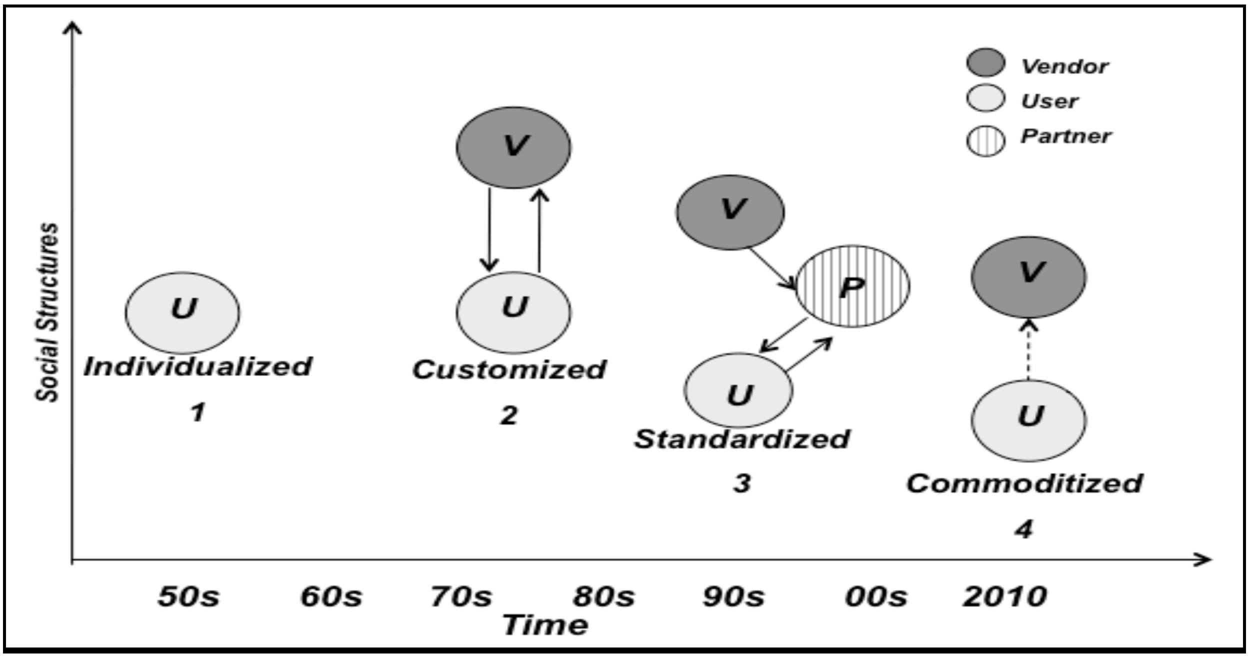

Figure 6. Organizational and Network structure of ERP development

Moreover, the implementation effort for the vendor changes with each type of network structure. When this dimension is combined with the network structures created from the cross-case analysis, the four generations can be reclassified in the following 2x2 (as shown in Table 4). Looking at the level of involvement and implementation effort, we see that the distinction between vendor organizations and partner organizations as separate organizations becomes blurred, since a user organization can only work with one of them directly. This matrix is useful for practitioners to understand various generations of ERP along these dimensions, in order to explain the complexities in the implementation projects as revealed by other researchers (cf. Soh *et al.*, 2000; Soh and Sia, 2004; Wang *et al.*, 2006; Sia and Soh, 2007).

		Vendor/Partner Involvement	
		Low	High
Implementation Effort	High Effort	Individualized (Lyons) 1	Customized (SAP) 2
	Low Effort	Commoditized (Salesforce.com) 4	Standardized (Microsoft) 3

Table 4. Four Generations of Enterprise Resource Planning Systems

Changes in the organizational, technological, and network structures reduce the amount of effort and the cost of developing a system at the user organization over time. This can be illustrated (as in Figure 7) in terms of the effort to customize and develop a repeatable piece of application, where the scope of customization diminishes over time.

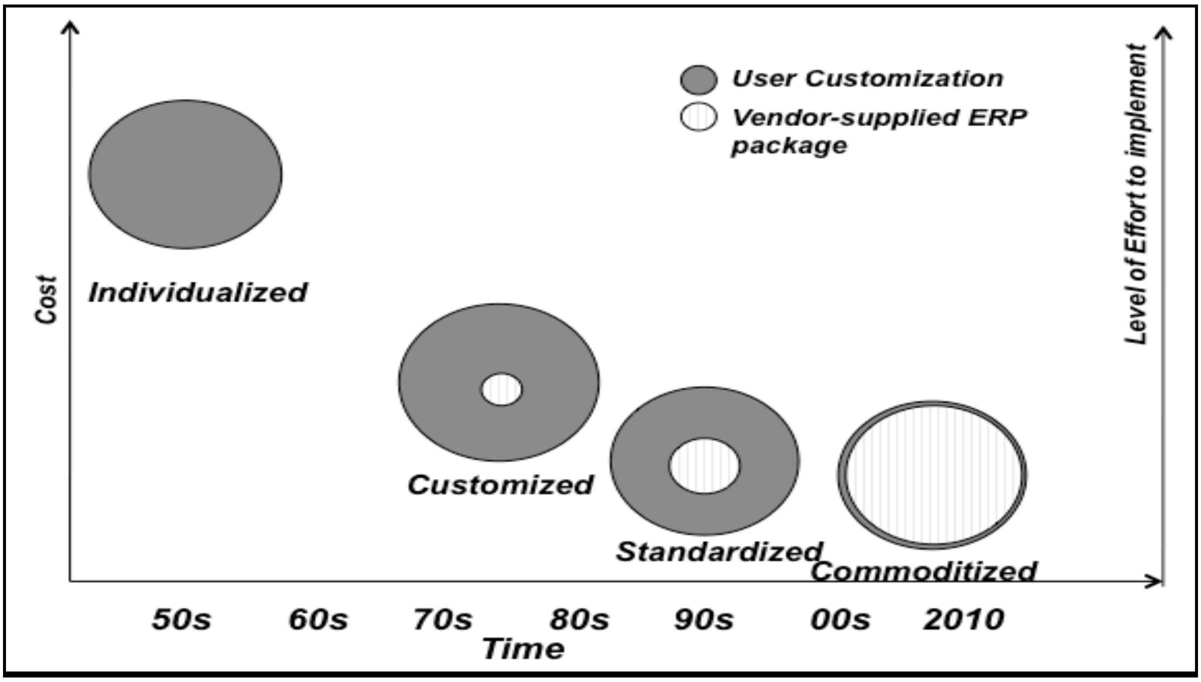

Figure 7. Generations of ERP development

Limitations of the Study

While the use of structuration theory allows for interpretative flexibility in examining a phenomenon in multiple ways, it is also important to recognize that interpretative flexibility compounds the complexity of the phenomenon, thus necessitating boundaries for analytical discussions. In this study, we limited the discussion to the creation of organizational structures, industry practices, and technological structures. We simplified the cross-case analysis by classifying actors as belonging to certain types of organizations (*i.e.,* user, vendor, partner) instead of individuals, and only discussed individuals in the narratives. We also limited the choice of cases. Although we have deliberately chosen what we believe are the most exemplary cases of ERP-systems to represent the four ‘eras’, others might disagree; the fact that there are probably more than 15,000 ERP vendors globally illustrate the complexity of selecting ‘the best ones’.

Conclusion and Implications for Future Research

The paper contributes to the integrationist historical perspective in Information Systems (IS) by illustrating the evolution of business practices that represent dominant modes of developing ERP. Rather than focusing on the additive nature of the business process functions, our research focused on illustrating the development of ERP business practices. It differs from earlier studies which commonly trace the modern roots of ERP back to the late 1960s, when Materials Requirement Planning (MRP) was developed through the partnership of International Business Machines (IBM) and J.I. Case (Jacobs and Weston, 2007). Instead, we traced the use of ERP systems back to J. Lyons & Co. in 1951, which introduced ERP as an institutionalized business practice for automating the management of inventory and production of goods, This is consistent with the claims of Bird (2002) and Mason (2004). The influence of Lyons Electronic Office (LEO) to the development of ERP systems cannot be understated, because it performed several functions that are currently closely associated with ERP systems. Inspired by the early-stage developments in the U.S. computer industry, LEO addressed the information-processing needs of Lyon's tea shop business — *e.g.,* payroll, distribution and sales invoicing (Mason, 2004). Thus, LEO is noted to be the first business-oriented computer system which performed several business functions (Shurkin; Mason, 2004; Williams, 2011).

By having a historical account of a key concept that is central in IS, we have shown how ERP has developed. By showing how ERP systems transformed from an individually build monolithic system to a commoditized service readily available, we revealed the need for business practices to be adapted, drawing on existing structures and creating new ones. This dynamic view of knowledge allowed us to link up technology, industry, and the importance of changing with the environment. In doing so, we have hopefully documented the need to understand the context in which a system was developed, and by the same token caution against more simplistic view of ERP systems.

By applying a structuration perspective, we explained the relationship between structure and actions to analyze a complex phenomenon from a multi-level perspective. That is, individual (micro) actions that shape the creation of new organizations; organizational structures (meso) that enable or constrain future actions; and the formation and influence of industry standards (macro-structure) as institutionalized by multiple organizations that participate in the ERP industry. It heeds the call to explore multi-levels of analysis to provide a better understanding of the complexities of ERP (Grabski *et al.*, 2011). It extends beyond existing research that has looked at the influence of organizational structures to individuals within the organizations in the process of creating and using an IT system (Orlikowski, 1992; Barrett and Walsham, 1999; Ke *et al.*, 2013).

The use of structuration theory also enabled the analysis of the influences of “plural institutional structures while never losing sight of the individual actors” (Yates, 1997). This allowed both human agents and institutions to be incorporated into a coherent historical account (Yates, 1997). By considering the inter-relationships between human agents across various organizations, we revealed how these relationships formed network structures that evolved to adapt to its competitive environment, by utilizing both ERP industry level and organizational structures to inform their actions. We also highlighted how various actions changed the network structures and the interaction between multiple entities in terms of power and norms. Future research can look at the political motives and power relations of various organizations to see how these affect the design of the ES. For example, one can look into the role of communicative actions (*e.g.,* press releases and internal communication of firm strategy) to see how various actors attempt introduce change. In LEO's case, the LEO project team came up with its own systems analysis managerial approach, using detailed diagrams of the data flow to communicate business practices.

Structuration theory also offered an ability to analyze business strategies because of the empowered frameworks inherent in the theory (Pozzebon, 2004). While the theory does not have a robust ability to predict future actions because of agency, it enabled us to understand and explain how certain actions that pertain to a particular business strategy reify or change existing structures. A structuration perspective allowed us to look at the ERP industry as a complex relationship of actions bound by rules and structures, to explain how an actor organizes to reproduce structures through agency. Agency helps explain the production of new structures and the recursive reproduction of existing structures through action. Human agent's actions are based on their ability to acquire knowledge, develop the idea, and form alliances that will allow them to create an organizational structure. Often, the agent's actions are brought about by the limitations in their previous organizational structures, where their actions hinge on efforts to reify existing structures. In the ERP industry, actors participated in an organic, self-managed process to enact certain practices in an ongoing process of organizing. Thus, the formation of the ERP industry as a social system is spurred by social practices that relate to business practices and the formation of network and technological structures. Its formation is dependent on a self selection of organizations that want to participate in the field (Macintosh and Scapens, 1990). However, in order to participate, they are expected to "act in a certain way," as guided by the normative structures (Macintosh and Scapens, 1990). By forming their own organizations through mobilizing resources (both material and authoritative), they are able to create new structures (*i.e.,* organizational or ERP Industry). Particularly in the ERP industry, we have illustrated not only the relationship but also the influence of ERP Industry structures (*i.e.,* industry practices) and technological structures (*i.e.,* technological inventions) to organizations and IT systems through the actions of human agents. This has allowed us to view ERP systems as a strategy tool that mobilizes information across departments, spanning time and space to secure outcomes.

We analyzed and discussed four generations of ERP systems by using narratives that focused on certain events. This paper investigated the environmental context of a particular industry to look for trends that played a role in shaping the industry and how organizations responded to that change. Similar to the findings of Pentland and Feldman (2007), we found that by investigating simultaneous actions situated in localized practices, we were able to find broad commonalities of action in institutionalized practices across organizations. We drew distinctions in the analysis in order to differentiate localized practices from industry's "best practices" to highlight how various actions were influenced and shaped by multi-level structures. By tracing the evolution of the ERP industry from four cases, we illustrated their respective contributions to business practices, we demonstrated how various influences from the industry shape action, and we pointed out how action changed the industry, emphasizing the duality of structuration. In doing so, we have provided an alternative way to study IS history. Moreover, we have expounded on how localized practices within an organization have shaped both the competitive and institutional forces at the industry level, similar to the work of Jarzabkowski (2004) in accounting. Although Nan (2011) suggests that there is no direct relationship between individual-level actions and collective-level practices, the socialization of such practices form part of the industry which recursively influence others to follow suit. When business practices around the creation of an ERP are routinized over time, they become institutionalized properties of the industry. This means that from a social shaping of technology perspective, business practices, values, and rules stabilize when an ERP system is made available to the market (Wang *et* *al.*, 2006). Thus, after an ERP system is available to the market, various types of organizations develop and institutionalize their own business practices as part of their routinization process.

As some business practices change over time, we can see how changes in industry practices, while seemingly new, are sometimes a recursive reproduction of the past. This is consistent with Koch (2007)'s findings that support the claim that ERP is not an accumulation of functions, but rather a creation of new and recreation of old functions. From a practitioner's perspective, this means that institutional properties of both old and newer technologies can be brought to market in a new ERP system. Talbert (2002) has likewise emphasized that the use of ERP should not be viewed as an process rather than as an event, spurred by the need for organizations to evolve. Future research can explore similar themes to look at other vendors' industry practices or interactions that shape the evolution of another IT system.

Finally, the study emphasized that ERP is actually created from a system that inscribes rules and resources from ERP industry structures and organizational structures, which are subsequently reflected in the features of the ERP. Rather than view ERP as merely a technology artifact, ERP should be seen as a system in itself, where the technological properties of such system becomes part of the technological structure.

This is consistent with Orlikowski (1992)'s definition of technology. By viewing ERP as a system, we can appreciate the complexity of the implementation process that requires strategic alignment of multiple organizations (Grant, 2003) and cross-functional coordination (Gosain *et al.*, 2005). Moreover, by showing that the resulting ERP system forms part of the process that shapes future business practices, the ERP system can also be viewed as an interpretative scheme which allows actors to create an understanding in order for various actors to work together.

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Appendix B: Why a Partner Ecosystem Results in Superior Value: A Comparative Analysis of the Business Models of Two ERP Vendors

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Abstract

The paper carries out a historical analysis of business conducted over 25 years by two enterprise resource planning (ERP) software vendors in Denmark, Maconomy and Navision, each employing its own business model. On one hand, Maconomy adopted a business model where the the company itself would develop, sell and implement ERP packages directly to its customers because the company's key executives believed that they would be best at it and that they would obtain valuable information about customer requirements in the process. Navision, on the other hand,

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adopted a business model which relied on an ecosystem of partners consisting of value added resellers (VAR) and independent software vendors (ISV) in order to sell, implement and further develop add-ons for their software.

Using the Resource Based View (RBV), the paper compared and contrasted the capabilities and resources of the two companies. The key finding is that Navision provided superior customer value and, consequently, collected superior rent, as shown by its selling price of as much as 16 times the selling price of Maconomy even though the two companies started at roughly the same enterprise values and at almost the same time. The analysis shows that the main reason for this huge difference is the value of Navision's ecosystem, which had enabled the company to achieve substantial economies of scale.

We believe that this finding has implications far beyond the ERP field. During the heyday of e-commerce/e-business, it was generally believed that the technology would dis-intermediate the value chain and further direct sales to customers. The results of our study point to the opposite direction: Technology will lead to more intermediation and the inclusion of more economic units in the traditional value chain or value network due to lower transaction costs and increased focus on core competences.

Keywords: Resource Based View, ERP, Value, Business model, Ecosystem.

Introduction

In the early days of e-commerce and e-business (Timmers, 1999; Kalakota and Robinson, 2000), it was believed that the number of economic parties in the value chain would be reduced due to the advantages of going directly to the (end-) customer even in business-to-business (B2B) relationships. The demise of intermediaries like wholesalers and retailers was predicted. However, our research in the field of ERP systems for small and medium enterprises (SMEs) shows that a business model of using partners for handling all sales and service to the ERP user organizations is far superior compared to the direct sales model (Sarker *et al.*, 2012).

This paper tracked the development of two Danish ERP vendors, Maconomy and Navision, and the different business models they each adopted to expand their market share. Since both of them have been acquired by US-based companies, we were presented with an excellent opportunity to measure the value of the business model as reflected in their respective acquisition values.

The contrast between the approaches taken by these companies is seen in the decisions and strategies each company made to sell and implement their respective ERP solutions. Maconomy executives decided that their company had the capability of selling and implementing their own system for two reasons; first, because they felt that they could better assess how to meet customer requirements through software modifications and customizations; and second, because they believed that this allowed them to gain valuable information for future revisions and further development of the general software.

Navision, on the other hand, decided that in order to provide superior customer value and higher economies of scale in selling licenses, it would be advantageous to sell through partners. This approach meant that the architectures of the kernel systems and the development tools for customizing to clients' needs became very different between the two companies. While Maconomy could rely on the competencies of their own staff regarding the development of their ERP system, Navision had to develop a number of development tools for the partners and a procedure for collecting information about customer requirements for future developments.

In 2002, Navision was acquired for $ 1.2 billion (DKK 10 billion)[2] by Microsoft; eight years later Maconomy was acquired by Deltek for $ 73 million (DKK 438 million). How did these valuations come about? From a financial perspective, one way of valuing a company is through a market approach, which estimates the earning potential of a company based on the market demand (Zwilling, 2009) or making a historical earnings valuation. From an Information Systems (IS) management perspective, however, it is the researchers' contention that the different business models employed by the two companies played a substantial part, regardless which financial perspective used in the transactional calculus.

Using the Resource-Based View (RBV) theory as a framework, this paper analyzes the strategies employed by Maconomy and Navision to establish and develop themselves as ERP vendors within the context of the competitive climate in Denmark and the global industry. The paper also discusses how the two firms took advantage of the resources available to them and how these vendors successfully developed their capabilities to achieve a core competency in developing ERP solutions.

[2] All currency figures are provided primarily in USD ($). If original amount was in Danish kroner (DKK), the equivalent amount is shown in USD and the amount in DKK is shown in parenthesis. The calculations are based on an exchange rate of 12 DKK to 1 USD before 2003, and DKK 6 to 1 USD after 2003 due to the depreciation of the USD particular in the early 00's.

Furthermore, this paper looks at how various resources can be harnessed and used by organizations to obtain competitive advantage. In particular, it looks at whether or not an ERP vendor should use a partner channel to develop and distribute their ERP solutions.

This paper is organized as follows: Firstly, it contains a literature review of the RBV. Secondly, it details the methodology used to conduct the case study. Thirdly, it describes how the two companies developed their capabilities. Fourthly, it applies the concepts of RBV to the case. Finally, it discusses the limitations and further implications of the case study.

Literature Review

The RBV theory argues that a firm which owns rare and valuable resources can use these to achieve temporary competitive advantage (Mata *et al.*, 1995). Moreover, a firm has intrinsic and extrinsic resources at its disposal which, taken singly or in combination with others, can be developed into capabilities. These capabilities, which are repeatable processes that markedly enhance the value of assets, include managerial and technical skills, as well as systems development or integration processes (Teece *et al.*, 1997; Wade and Hulland, 2004). If managed, as well as safeguarded from being copied, substituted or transferred, these capabilities can be extended towards long-term sustainability (Barney, 1991; Mata *et al.*, 1995; Wade and Hulland, 2004). Furthermore, the dynamic combination and coordination of capabilities enable a firm, operating in environments of rapid technological change, to identify and respond to opportunities that enables them to be tougher on rival firms(Teece *et al.*, 1997).

Previous researchers who have used RBV have applied it to explain how a firm develops capabilities toward sustainable competitive advantage (Barney, 1991; Grant, 1991; Mahoney, 1992; Mata *et al.*, 1995; Teece *et al.*, 1997; Ray *et al.*, 2004; Wade and Hulland, 2004), justify the value of strategic alliances (Eisenhardt and Schoonhoven, 1996; Das and Teng, 2000; Sarker *et al.*, 2012). Particularly in the field of ERP, RBV has been applied to account for the challenges of implementing ERP systems (He, 2004), relate the effects of ERP capabilities on business process outcomes (Karimi *et al.*, 2007), and highlight the co-creation value and governance mechanisms between an ERP vendor and its partners (Antero and Holst Riis, 2011; Sarker *et al.*, 2012).

RBV capitalizes on the ability of a firm to look at different resources and to identify resources that provide most value to its business. However, one shortcoming found in applying RBV is that researchers in the field have used terms and evaluation criteria inconsistently (Wade and Hulland, 2004). This paper adopts the definition of “resource” as both an asset and a capability (Barney, 1991; Ray *et al.*, 2004). These firm resources, whether pertaining to IS or not, include both tangible and intangible assets that serve both as “inputs” and/or “outputs” to a process that enables the firm to respond to market changes (Wade and Hulland, 2004).

Critics have noted that the theory fails to take into account the relationships between the firm, its environment, or the industry that it operates in (Eisenhardt and Schoonhoven, 1996; Das and Teng, 2000). In response, some researchers have extended RBV to show that based on the need to obtain additional resources, alliances are formed in order for firms to compete more effectively (Eisenhardt and Schoonhoven, 1996; Antero and Holst Riis, 2011; Sarker *et al.*, 2012). Eisenhardt & Schoonhoven (1996) suggest that the formation of alliances is advantageous for several reasons: First, an alliance allows the allied firms to share costs and risks; second, it legitimizes and/or enhances the status of the firms, especially in a crowded market; and finally, it provides the firms with the ability to combine “buying powers” and “distribution channels”.

The use of RBV to explain competitive advantage is an effective approach because it incorporates concepts from three other research areas: 1) strategic management; 2) industrial organization management; and 3) organizational economics (Mahoney, 1992). In the field of IS research, it has been adopted to explain the role of IS resources, as well as other resources, in the long-term competitiveness of a firm (Wade and Hulland, 2004). This study aims to contribute to the literature on RBV by examining the resources of two ERP vendors which influenced the strategic decisions they made to obtain competitive advantage.

Methodology

This paper uses both semi-structured interviews (Kvale and Brinkmann, 2008) and document analysis of secondary sources to validate and triangulate the findings and minimize risk of bias that can skew the results of the study. The scope of the research was determined based on a theoretical sampling of information pertaining to the two ERP vendors, so that the study can provide a perspective of diverse strategic approaches to fill theoretical categories of RBV (Eisenhardt, 1989). The interviewees were selected among current and former executives of the companies who have been around since the original companies were formed. All the interviews were summarized into a thick description and triangulated from secondary resource, whenever available.

The researchers applied an interpretative approach (Walsham, 2006) to describe the history of the two companies using the interviews. The write-up of the history allowed “unique patterns of each case to emerge before investigators push to generalize patterns across the case" (Eisenhardt, 1989, p. 540). Subsequent analysis was made by identifying the resources of each ERP vendor based on the interviewers' description of their product and business model. Then, the attributes of these resources were examined in RBV terms – *i.e.,* whether they were valuable, rare, inimitable, and non-substitutable. Finally, by comparing and contrasting the resources, the researchers were able to determine which of these resources provided a competitive advantage for the firms.

As part of the RBV analysis, a simplified financial analysis of the two companies was carried out. We have not found it necessary to provide an in-depth analysis of the financial performances of the two companies in order to substantiate our conclusions because their numbers were so widely divergent that even substantial inaccuracies and/or impreciseness in the data are without implications for our conclusions.

Case studies

Maconomy

Maconomy was founded in 1983, not in the garage but in the bedroom of Per Theis Knudsen, who remained the Chief Executive Officer (CEO) of the company until 2002. Early on, the company had received a request from Apple to develop an accounting package for the Apple PC. Walter Thygesen, the CEO of Apple in Denmark, together with the management of Maconomy, applied for a substantial grant of approximately $ 1.5 million (DKK 20 million) from public Danish sources (Dansk Udviklingsfinansiering) to develop such a system. However, only a small fraction of the requested amount was obtained in the end, and most of the development was financed by the company itself through unpaid or low-paid labor.

Unfortunately, the development of the accounting package took much longer than initially planned because of the strong focus on making the system graphic in line with Apple's philosophy. This proved to be very complicated, and it took almost five (5) years to develop a system robust enough to sell. It was later estimated that the cost of development of the system ended to be between $ 2.5 – 3.3 million (DKK 30 – 40 million), but by all accounts, the PPU system, as it was called, was an excellent system with many innovative features.

At that time, the idea was to sell "shrink-wrapped" software through the Apple stores, but it turned out that the market for this type of software was limited. Apple only commanded about 10% of the total PC market, and of that figure, only 10% would be interested in having an accounting package. Maconomy realized that they would never be able to get a large sales volume on the proprietary Apple platform. Thus, when Windows 95 came out, they decided to develop a version for the Windows PC platform and to build a general applicable ERP system to be sold similar to the way that SAP and Oracle are selling even today, where a major part of the sales is done by one's own sales organization.

In order to finance the development, sales and distribution of the system, the company decided to do an initial public offering (IPO). However, due to several delays, the IPO did not take place until December of 2000, shortly after the dot-com crash. Although the bank advising Maconomy had initially estimated a price of $ 10 (DKK 120) per share earlier in 2000 when the dot-com euphoria was at its peak, the board of the company reluctantly decided to price the offering at $ 5 (DKK 60) per share.

One of the strategic decisions of Maconomy, which later proved to be an excellent strategic move, was to establish a Maconomy Academy at the Technical University of Denmark. This move allowed Maconomy to train young electrical engineers to use the Maconomy tools and spread the knowledge about these tools; it also gave them first pick of the best and the brightest graduates of the university.

With the sole aim of "making the US market", the ambitious professional investors on the board pushed for Jim Beckman to be appointed as co-

CEO to Per Theis Knudsen. Subsequently, six centers were established with 75 employees during 2001-2002. In retrospect, this turned out to be an expensive decision to try to penetrate the US market using the company's own resources. Sales continued to be lackluster, and the company was losing money in most of the years after the IPO. Focus turned on selling and, in an attempt to close sales wherever possible, the firm ended up obtaining orders from customers with very different requirements, which meant a lot of extra work for the systems development department. According to Bent Larsen, the company's former CEO; "Essentially, to close sales, field representatives of the company had to promise customers a lot, and it was difficult to meet all the promises".

Larsen had taken over the reins of the CEO office in 2002 after returning from a top job as director of sales for NCR in Europe. With his sales background, Larsen attempted two major changes in the company's sales strategy. First, convinced that it would be an advantage, Larsen pushed to develop a partner channel for selling their packages and achieve economies of scale. Second, Maconomy decided to concentrate on the project- and service-oriented business niche, which had a sizable number of large organizations with a lot of project work, and needed a means to control hours spent on activities and other costs. The decision to focus on these types of organizations meant that the "typical" target customers were from large auditing and consulting companies.

The development of a partner channel, however, proved unsuccessful because the kernel architecture or the basic software package was not easy to modify for partners and the development tools were too complex for partners to use in the customization process. Thus, practically all sales to customers were done by Maconomy employees themselves. Additionally, according to Larsen, the company realized that "the cost of selling/marketing an ERP system is 3 to 4 times more than the cost of developing it", thus making it extremely difficult to create a profitable business.

In 2007, Larsen stepped down as CEO, and Hugo Dorph took over with the strategy of focusing on direct sales to large project-focused businesses. About three years later, in July 2010, Maconomy was then acquired for a price of $ 73 million (DKK 428 million) or $ 3.4 (DKK 20.50) per share by the Deltek, which is headquartered in Virginia, USA (Smith, 2010)(Smith, 2010)(Smith, 2010)(Smith, 2010)(Smith, 2010) and focuses on offering "solutions to every major sub-vertical within the broad professional services marketplace ... and drive innovation for project-focused organizations across the world" (Smith, 2010).

Navision

The company Personal Computing and Consulting (PC&C), later renamed Navision A/S, was founded in 1984 by three graduates of the Technical University of Denmark: Jesper Balser, Torben Wind, and Peter Bang. Its first product, originally developed for the Commodore 64, was an accounting solution targeting the small/home office market. In 1987, Navision released Navigator 1, which proved to be a commercial success.

A key reason behind its sales success early on was the decision of the company to allow its dealers to be certified resellers of the company's products. With this arrangement, which was considered a novelty at that time, IBM became the firm's major reseller in Denmark and pushed Navigator to become a bestseller (World, 2011). Additionally, as early as 1989, Navision had realized that the Danish market was too limited and that the German market represented a huge opportunity. Navision therefore partnered with a German company in Hamburg, which was tasked to oversee and carry out the localization for the German market including the different language, legal and other requirements. By 1990, Navision had also expanded into Iceland, Spain and UK, and because the company became profitable from the early 1990s, it became natural to attempt an IPO. The IPO, which took place in 1998, provided the company with funding for further development and provided the owners with a handsome compensation.

In 1983, a third Danish ERP rival was established by Preben and Eric Damgaard, Damgaard Data A/S. The company released its first accounting software called DANMAX, which is also distributed through IBM. In 1986, Damgaard released Concord Finance, one of the first business management solutions that utilized the LAN technology. About twelve years later, the company launched Axapta 1.0, a system which supported several modules for finance, trade, inventory management, logistics and production, and marketed to the American, Danish and other European markets. In 1999, the company subsequently released Axapta 2.0 with Active X support using the Axapta Object Server.

Damgaard A/S was listed on the Copenhagen Stock Exchange in 1998 following a successful IPO. However, in 2000, Damgaard and Navision decided to merge, much to the surprise of many observers, who thought that the funds obtained by the two companies in their respective IPOs would enable them to continue on their own. Insiders, however, characterized the "merger" as an acquisition by Navision, the more dominant of the two companies, due to the strong demand for Navision's very successful and effective ERP package. While Damgaard had the newest and most advanced system in Axapta, it was not fully operational;

in fact, it would take several more years before it could get to a stage where it could be sold to clients.

Critical to the success of the business strategy of Navision as well as Damgaard was to sell through partners. Both companies realized that economies of scale were all important. The marginal cost of producing “one more system” was negligible, and high sales volume meant that development costs could be spread over a larger number of systems, thus reducing the cost per unit sold. However, to achieve economies of scale, it was necessary to sell through partners, and it was important to enable independent software vendors building customized and focused solutions for industry verticals.

As a matter of design philosophy, Navision wanted to develop a flexible architecture that would allow it to (1) sell internationally in many countries/markets in Europe, India and the US; and (2) make modifications that would cater to various industry verticals. Accordingly, Navision came up with a three-layered architecture: a kernel architecture layer, a verticalization layer, and a localization layer. The kernel architecture provided all the basic stable functionalities general to ‘all’ companies and industries; the verticalization layer allowed partners to make modifications that would cater to particular industries; and the localization layer allowed the partners to adjust to cater to local requirements (typically involving legal requirements, standard practices, or reporting requirements in the different markets). This setup meant that customizations to a particular customer should not be done in the raw code of the kernel.

To allow partners to make the necessary localizations and develop verticals, the partners were given a development tool called C/Side. C/Side was relatively easy to use, and since all partners were using the same development tool, they could help each other by exchanging software modules. This created an ecosystem around the development, sales, implementation and further development of the Navision ERP system.

In 2002, Microsoft approached Navision and declared an interest in acquiring the Danish company (Kane, 2002) because “Navision's 2,400 partners, the bulk of which [were] based in Europe, [would] be a major asset for Microsoft” (Wright, 2002). Earlier on, Microsoft had acquired Great Plains Software, which had a successful ERP software for the US market, but it was not easy to modify and adjust to different markets because its architecture was not developed to handle modifications like changing the language, handling several currencies, etc. Accordingly, Microsoft was on the lookout for an ERP vendor which had a proven and successful architecture and which, with a minimum level of effort, could be modified to the Spanish, the Indian and even the Chinese market.

Following the acquisition, Microsoft's strategy on ERP systems was formulated around selling Great Plains and Solomon in North America, and Navision/Axapta in Europe and the rest of the world. That is still the case, although the largest development efforts are now going into developing the Axapta code base for the global market. All code bases are marketed under the same brand name of Microsoft Dynamics with the suffix NAV (Navision), AX (Axapta), GP (Great Plains) and SL (Solomon, predominantly a project management and customer relationship management or CRM solution for service companies).

The AX system is now developed in three places: (1) manufacturing, stock and logistics in Copenhagen; (2) finance and accounting in North Dakota; and (3) service modules, project management, Human Resources and CRM in Redmond, WA. Unfortunately, AX took much longer to develop than originally foreseen, and it did not really start picking up sales in the marketplace until 2007. Moreover, even though AX is doing well in the marketplace, it is still not performing to Microsoft's optimistic sales and distribution expectations, and NAV remains the cash cow for the company.

In the last few years, several AX verticals have been acquired by Microsoft from ISV developers among the partners, and the current strategy now seems to have two main foci. First, there seems to be a push for being able to make upgrades without a lot of work for the partners in each customer installation and thereby reduce the total cost of ownership (TCO). Second, there are strong initiatives regarding a web-enabling of the AX code base, such that Microsoft Dynamics can be acquired using an ASP solution, a SaaS solution or a cloud-based solution based on the Microsoft Azure platform.

Case Analysis and Discussion

Financial Analysis

Since their founding in the early 80's, the two ERP vendors have shown two divergent financial trajectories. While there may be varied reasons to explain the divergence, the use of RBV theory from an IS perspective offers an explanation. Table 1 summarizes various aspects of Maconomy and Navision as independent companies prior to their acquisition.

	Maconomy (acquired in July 2010 by Deltek)	**Navision (acquired in May 2002 by Microsoft)**
Year Founded	1983	1984
Year/month of IPO	December 2000	September 1998

Total capital obtained at IPO	$ 20 million	$ 120 million
Market capitalization at time of IPO	$ 93 million	$ 268 million
Sale price per share	USD 3.40 [3])	USD 37 [4])
Total sales price	USD 73 million[5])	USD 1,230 million[6])
Gross Profit the year prior acquisition	USD 37 million as of 2009	USD 102 million as of 2001
Sale price as a multiple of Gross Profit	2 times gross profit	12 times gross profit

Table 1. Financial highlights of the two vendors

As a function of valuation, profitability (both historical and expected) provides some insight into how the intrinsic assets of the companies add value. In order to control for the differences in the financial circumstances between the two companies (*e.g.,* initial capitalization, date of founding, date of IPO, date of sale, income), the researchers reviewed the key financial figures of the two firms. To aid the analysis, profitability was only used as an indicator of success and as a way to measure the firms' respective sale prices as a function of profit. Profit-related growth rates were also used as a way to compare the performances of the two vendors.

Figures 1 and 2 provide graphical representations of the financial figures for Maconomy and Navision in terms of Gross Profit and Net

[3] Maconomy 2000 – 2009

[4] Wright, R., 2002. Microsoft lays out navision plan. In: CRN.

[5] Echols, T., 2010. Deltek offers $73 million for maconomy. In: Washington Business Journal. Washington.

[6] Kane, M., 2002. Microsoft seals deal for danish company. In: CNET.

Income. Figure 1 below shows that the rate of increase in Navision's gross profits is at a much steeper curve than Maconomy's.

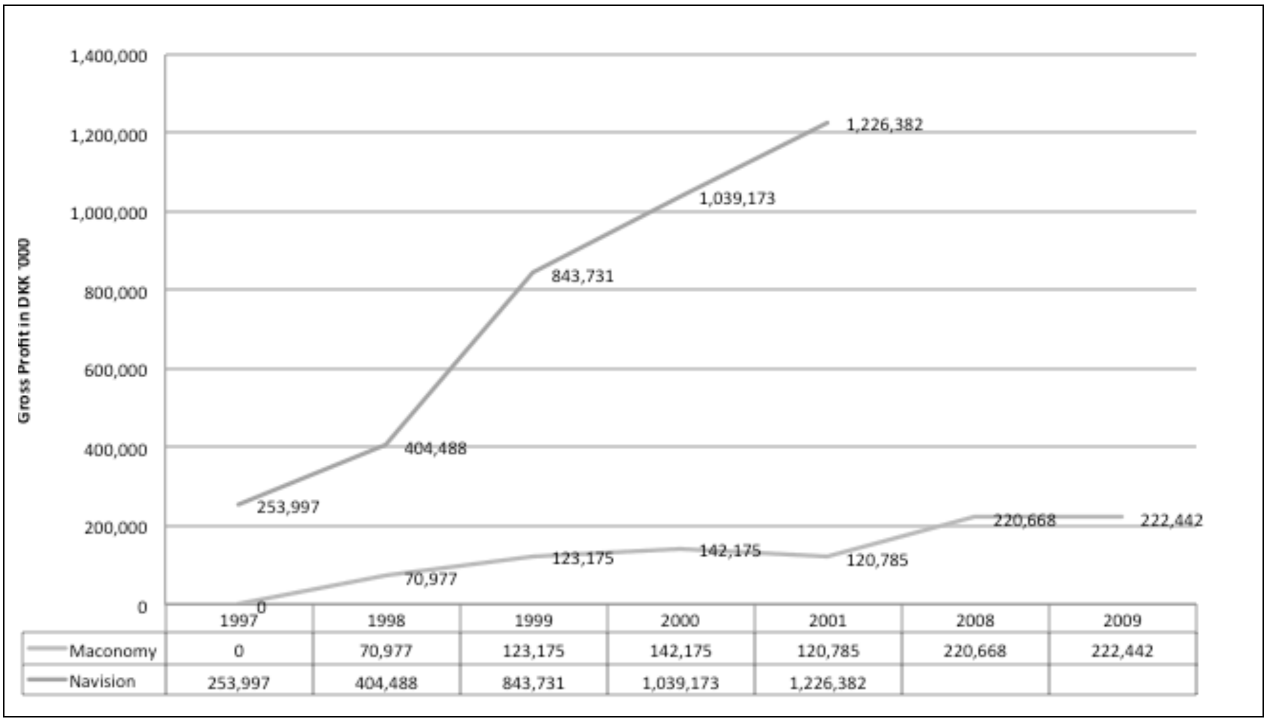

Figure 1. Gross Profit of Maconomy & Navision (1997 – 2009)

Figure 2 below shows that Navision had been profitable while Maconomy was primarily stuck in the red.

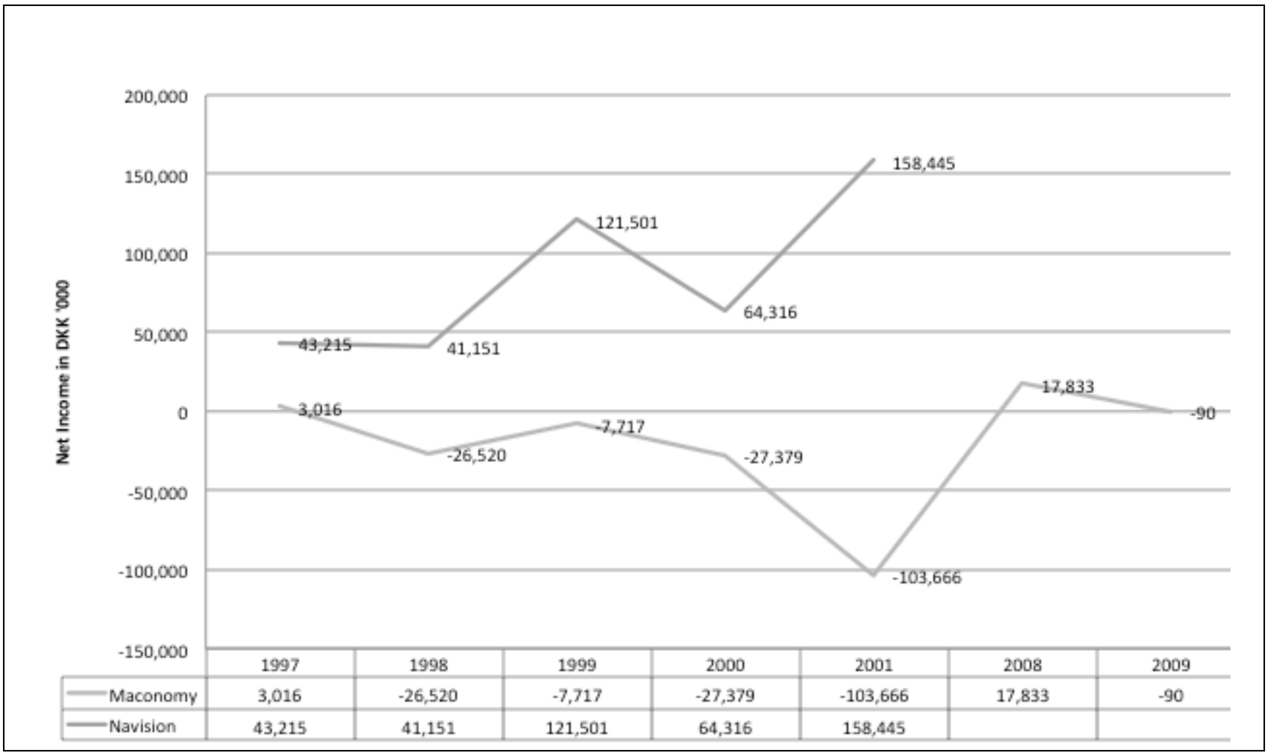

Figure 2. Net Income of Maconomy and Navision

From the data above, it is clear that Navision significantly outperformed Maconomy during the period covered by the analysis. For instance, in 2001, which is the year prior to the Microsoft acquisition of Navision, Navision managed to post a positive net income and had increased its gross profits by 23%. Maconomy, on the other hand, posted a 15% increase in gross profit but almost quadrupled the amount of its net loss from the previous year. The figures also reveal that at the time of their respective acquisitions, Navision was acquired for a multiple of 12 times gross profit while Maconomy was acquired for a mere 2 times gross profit.

RBV analysis

An RBV analysis can be used to explain why Navision has been able to achieve this superior financial performance compared to Maconomy. In order to do this, RBV suggests that we need to consider all relevant resources. Instead of reporting on the long of list of resources that we have looked at, we will focus on those resources that directly contribute to the core competency of developing and selling an ERP package. An overall analysis looking at the environmental factors will show that both companies were founded and developed in Denmark,. Denmark is one of the Nordic countries, which for some reason or other seems to be the birth place of a number of the leading ERP packages. In actual fact, no less than five of the bestselling ERP packages globally originate in the Nordic countries, i.e. ., Intentia[7], IFS[8], IBS[9], Maconomy and Navision, but there are also other uccessful ERP-vendors in these countries like Agresso and Compello. Evidently, the economic climate with high costs of labor (stimulating substitution of labor with IT), a high skill level within computer science, and a general open climate towards innovation have probably been some of the strongest reasons for this development.

[7] Intentia was founded in 1984 in Sweden

[8] Industrial Financial Systems was founded in 1983 in Sweden

[9] International Business Systems was founded in 1969 in Sweden

Since Maconomy and Navision had an almost identical environment, macro factors can be eliminated as explanations why Navision has done so much better than Maconomy. The main reason should be found in an analysis on a more detailed level, focusing on those differences in resources (skills, assets and capabilities) that according to our analysis make the difference between the two companies.

Maconomy and Navision were both founded in the early 80's, in the same city/country and developed ERP solutions in the same competitive environment. So the question we ask ourselves is: How did Navision manage to outperform Maconomy year in and year out? We analyzed this using RBV theory by looking at the attributes of each company's main resource – the software package each sells – and asked whether it was valuable, rare, in-imitable and non-substitutable (Barney, 1991).

Table 2 below summarizes the value of the software when both firms were just starting out.

RBV Resource Attribute: **Is the software package a resource that is**	**Maconomy's Software**	**Navision's Software**
Valuable?	Yes	Yes
Rare?	No	No
Inimitable?	No	No
Non-Substitutable?	No	No

Table 2. Comparative Analysis of the Two Vendors' Resource Attributes mid 80's

As Table 2 shows, both firms invested in building a capability of developing packaged accounting solutions that they can sell and later proved to be valuable. Additionally, both vendors' primary resource did not prove to be rare, inimitable and non-substitutable because of the presence of market substitutes for packaged solution on the PC and there were other firms also competing on this sphere. Over time, both companies developed their competencies further and made strategic decisions to expand their market share with each pursuing a different strategy.

On one hand, the key feature of Maconomy's business model was to focus on a particular niche industry where they can carry out implementation at customer site themselves with in-house staff. On the other hand, the key feature of Navision business model was to develop a partner ecosystem which could assist in development and implementation of the ERP package at customer sites. This strategy meant that Navision had to split the revenue from sales of licenses with one or more partners which results in a substantial reduction in gross revenue for Navision. Clearly, the partner selling the license and implementing it at customer site should have part of the license fee, and so should possible ISVs developing modules and/or industry verticals used in the final solution. For instance, a typical sale to a customer would be USD 300,000 and is broken down into 20% for the basic license, 10% for SW add-ons from ISV's, and 70% for customization and implementation. From this sale, Navision and of course later Microsoft Dynamics would only get 50-70% of the license, which amounts to approximately 10-15% of the total revenue. However, this low return on each sale is more than offset by the huge scaling possibilities considering that Navision had more than 2,000 partners selling and implementing the system at customer sites world-wide. Table 3 summarizes the new set of resources for Navision as the company developed its capabilities over time.

Resource	Valuable	Rare	Inimitable	Non-substitutable
1. ERP software package which allowed mass-customization by partners	Yes	Yes	No	No
2. Development tools that enabled customization and localization by partners	Yes	Yes	Yes	Yes
3. Partner ecosystem selling to different industry verticals	Yes	Yes	Yes	Yes
4. Partner ecosystem developing add-ons for different verticals	Yes	Yes	Yes	Yes

Table 3. Navision's resource attributes early 00's.

As the two firms developed, Navision surpassed Maconomy because it developed four key resources that enabled them to obtain competitive advantage, as follows: (1) packaged software with an architecture allowing for development of add-ons and easy customizations; (2) the development tool called C/SIDE for partners; and (3) a partner ecosystem that sells; and (4) a partner ecosystem that develops add-ons. These resources each contribute value, taken separately or in combination with the others, to create a final ERP solution. Both the development tools and the partner ecosystem would later also evolve and exhibit strong characteristics of rareness, inimitability and non-substitutability allowing Navision to substantially leapfrog Maconomy and other competitors as well as obtaining a sustainable competitive advantage.

While the ERP kernel in itself does not make it a rare resource, the ability of an ERP vendor to maintain a competitive advantage with its ERP architecture depends on continuous investments in its products to further increase their value and rarity. Navision did this by providing its partners with development tools enabling the partners to do two things. ISVs could develop industry verticals and general-purpose add-ons, while VARs could develop highly localized and customized solutions catering to their clients' needs. Maconomy, on the other hand, had to make the customizations themselves, thus limiting their ability to service multiple verticals.

The ability to develop tools as well as the ability to build a partner ecosystem is Navision's rare and inimitable resources, which contributed to sustainability of the firm's competitive advantage. Navision's early decision to adopt a partner model enabled the company to gain early profitability successes and enabled the firm to differentiate itself in a crowded market of vendors selling ERP solutions. Additionally, Navision's alliance with its partners provided all the network members with more visibility in the market, which further contributed to the legitimacy of the system being sold. Maconomy's eventual decision to adopt a partner strategy shows that it too realized, albeit belatedly, the value of having partners especially for wider- scale distribution, but as we have seen, to no avail.

In the ERP industry, sustainable competitive advantage is dependent on whether an ERP vendor is able to guard its resources from imitability and substitutability. These factors – the imitability and substitutability of the ERP system – are likewise dependent on the vendor's ability to make customizations based on its clients' needs. In the case of Navision, its partner ecosystem allowed it to achieve economies of scale and expand its base, owing to its partners' ability to reach new markets and customize the product using the development tools. This allowed Navision to compete in multiple industries by partnering with smaller software developers and software implementors, which had substantial knowledge, experience and contacts in various industries. Thus, where Navision was able to take advantage of various distribution channels that its partners provided, Maconomy was limited to narrowing its focus to project-focused organizations.

Due to the substantial lock-in effects once the customer had bought its first ERP system, the substitutability of the product is not likely to be seriously threatened by customers who need to upgrade existing systems. This means that it is absolutely critical for any ERP Vendor to capture the market for new customers. In this aspect, Navision is in a much better position than Maconomy to sell to new customers with its broader network of partners.

Conclusion and implications for future research

This paper applied the RBV theory to identify resources that contribute to the core competency of developing, implementing and selling an ERP solution for two Danish ERP vendors, Maconomy and Navision. These two firms followed two different business models. Maconomy sold directly to customers, while Navision used a partner ecosystem for sales/implementation at customer sites as well as customizations and localizations through the development of add-on's. The RBV analysis shows that Navision was able to effectively combine and leverage its resources – a well-designed ERP kernel architecture and an easy-to-use development tool, with a partner strategy for marketing ERP software, and for integrating add-on's from the partner ecosystem. These all contributed to accelerate the pace of development to deliver customized and localized products to meet the clients’ needs.

Our RBV analysis shows how an ERP vendor can form alliances to obtain competitive advantage in order to manage and leverage its resources more effectively by sharing the costs and risks of implementing ERP systems. Moreover, the analysis of the two ERP vendors shows how differences in the partner strategy can make a huge impact on the bottom-line of the company. As seen in the case of Navision, the network effect played a significant role in the higher valuation as compared to Maconomy. While the exact value of the partner ecosystem cannot be measured, the fact that Navision was sold for 16 times the value of Maconomy is a compelling evidence of the value of such a channel. The formation of alliances through a partner ecosystem provides competitive advantage through a much larger distribution/sales capability, but it also provides a competitive advantage through the enhancement of the capability to develop localized and verticalized ERP solutions as well as value creating add-ons.

Although the phenomenon of using a partner channel rather than developing everything yourself is demonstrated even more strongly in more recent years in the market for wireless phone apps, where e.g. Apple and Google (Android) are very successful in engaging development of apps for their platform, this is to the best of our knowledge the first time that the relative value of a partner ecosystem is documented for ERP vendors. The sales price to the larger US ERP vendor of both Maconomy and Navision, where the latter was price-tagged at 16 times the former, clearly documents the value of a partner channel.

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Appendix C: 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[2] *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)*

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

horizontal add-ons; (3) vertical add-ons; and (4) customer specific add-ons.

Moreover, the paper 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

Introduction

In the Enterprise Resource Planning (ERP) market for small and medium enterprise (SME) solutions, 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 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 *et al.*, 1995; Drucker, 2002; Porter, 2008). According to Mahoney & 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 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.

Literature Review

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 & Hulland (2004) summarized the various terms used by RBV researchers (Barney, 1991; Mahoney and Pandian, 1992; Ciborra and Andreu, 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.

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 *et al.*, 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 *et al.*, 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 & 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 to 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 *et al.*, 2009). Thus, there is a call for an effective governance mechanism to address this need. Dyer & 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)

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, 2002), 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 (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 & Dibbern (2009) found that partners are locked-in with ERP vendor-specific, there is 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, 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, 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 and 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. (Fox and Wareham, 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.

Methodology and data collection

The research presented in this paper utilized a case study of the ERPcorp with embedded case studies (Yin, 2009) 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) in 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.

Firm	Position in Firm	Alias
Vendor	Country marketing manager	CMM- Vendor
Vendor	Partner technology advisor	IMM – Vendor
Partner 1	CIO	CIO – Partner 1
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
Partner 5	Project Manager	PjM – Partner 5
Partner 6	CEO	CEO – Partner 6
Partner 6	Product Manager	PM – Partner 6
Partner 7	CEO	CEO – Partner 7

Table 1. Interview respondents

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.

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 Jr., 2006) 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.

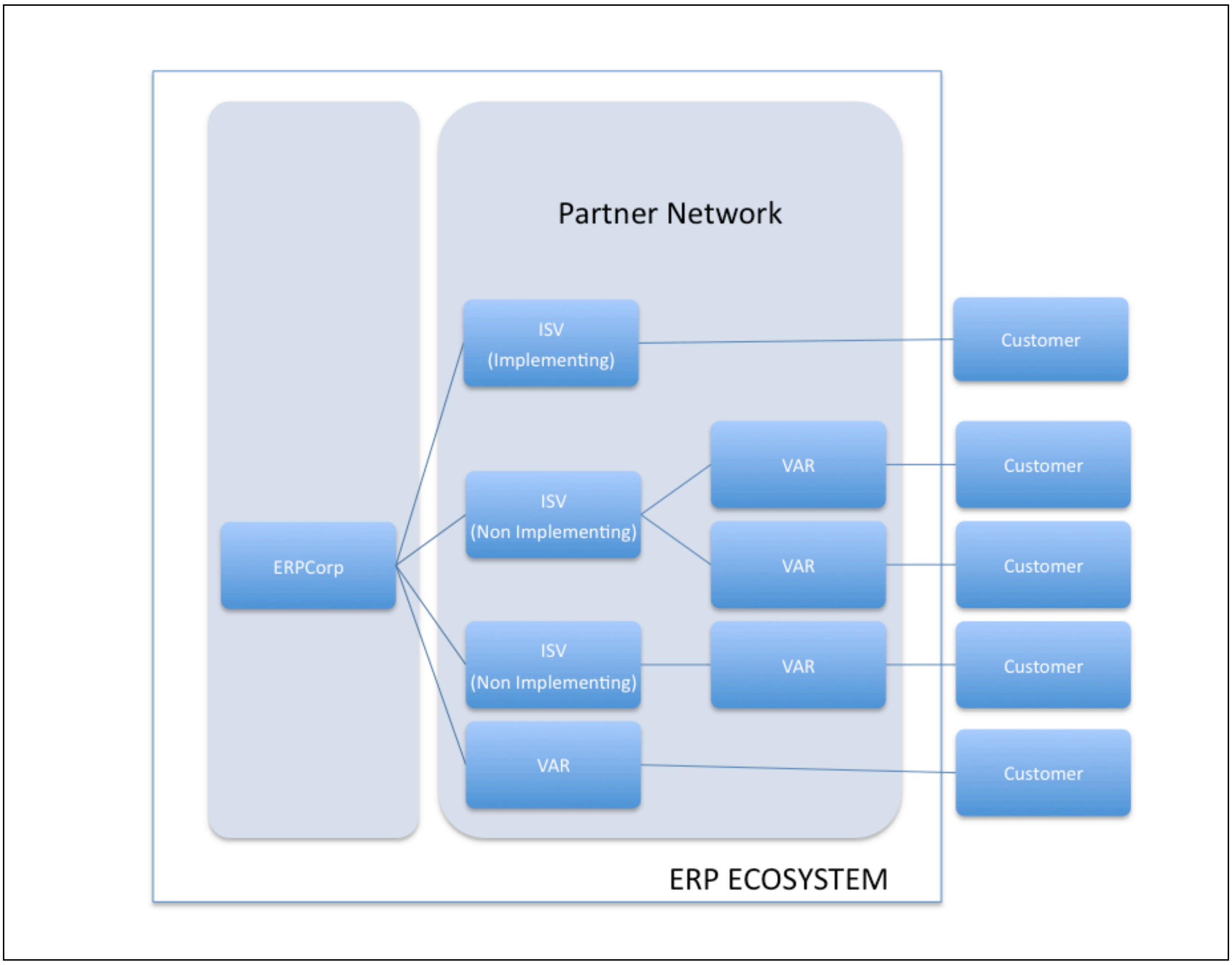

Figure 1. The ERPCorp ecosystem structure

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 *et al.*, 2001), or a service oriented solution. Thus, the ERP core product cannot be treated as a non-substitutable resource.

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).

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 only 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.

Company alias	Partner Type	Size	Solution focus		Collaboration	
			Vertical	Horizontal	Partners	Vendors
Partner 1	Implementing 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	Implementing ISV	250	Textile and Retail	Project management and some minor add-ons	Other ISVs and VARs	Yes
Partner 4	VAR	100	Life science and Warehousing	-	ISVs	No
Partner 5	Non-implementing 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

Table 2. Various Roles and Relationships in the ERPCorp Ecosystem

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.

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

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

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.

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

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

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

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 (Kude, 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.

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.

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 & Dibbern (Kude, 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 D: Hypercompetition in the ERP Industry: It takes all the running to stay in place

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Abstract

Applying the Red Queen Theory (RQT), the study posits that an enterprise resource planning (ERP) software vendor counters the Red Queen Effect (RQE) in the hypercompetitive ERP industry by strategically aligning itself with multiple partners to form an ecosystem that can be leveraged for growth, provide multiple opportunities for innovation, and produce and deliver a product to its customers. By carrying out a cross-case analysis of ERPCorp, its partners and rivals based on multiple qualitative interviews, the paper shows that ERPCorp was able to survive the entry process as well as adapt and avoid the competency trap by using a partner network to sell, implement and develop complementary offerings. The key finding is that in order to survive the "race", ERPCorp has to adopt new strategies to match or exceed the actions of its rivals which creates various tensions *with partners, thus requiring the ability to manage an inter-organizational network effectively.*

Keywords: Enterprise Systems, Evolution, ERP, Red Queen Theory, Competency Trap, ERP History

Introduction

As evidenced by the marked increase in adoption and use of ERP since the 1990s, an ERP system is considered a mainstay for running a business today. Due to the demand for it, the competition in the ERP industry is intense; thus, as more and more companies adopt ERP, ERP vendors have the continuous challenge of out-innovating each other by coming up with more and better features, whether organically or otherwise, in order to grow or simply maintain their market share. The intensity reached feverish point in the early 2000s, when several major ERP vendors opted for the non-organic route by participating in various mergers and acquisitions (M&A). While these vendors were clearly after gains in market share, they were just as clearly after equipping themselves with complementary capabilities to be able to fend off competitors in the industry's "evolutionary arms race" (Barnett, 2008).

Given this backdrop, the ERP industry, which is focused on the development and sale of pre-packaged software applications, can be characterized to have hypercompetition, defined as a fast-changing environment where competitors quickly create or erode competitive advantages (D'Aveni and Guntger, 1994). Because markets change quickly and one's competitive advantage does not last long in a hypercompetitive industry, an industry player has to depend to a considerable extent on its access to inter-organizational networks. In the ERP setting, this dynamic requires the capability to mobilize resources that are not part of the organization in order for a vendor to produce an ERP system acceptable to the market. Moreover, it gives rise to relationships to build complementary software products which, incidentally, are found to contribute further to the hypercompetition (Lee *et al.*, 2010).

This paper looks at how an anonymized ERP vendor (ERPCorp) manages an inter-organizational partner network to keep up with the dynamic changes in a hypercompetitive market by applying the Red Queen Theory (RQT) (Van Valen, 1973; Barnett, 2008). It builds on previous studies which have applied the RQT to explain a firm's ability to compete in relation to its competitors (Barnett, 2008; Barnett and Pontikes, 2008). It specifically attempts to answer the research question: What challenges does ERPCorp face as it seeks to keep up with an arms race that requires it to coevolve with the technology, the market and its rivals' actions? In answering this question, the paper will first review the ERP literature which provides the empirical basis of the discussion, then describe the RQT as a framework to explain the hypercompetitive dynamics among firms. Subsequently, RQT will be applied to (a) describe how ERP vendors utilize its partner network to co-innovate and outperform its competition; and (b) analyze the tensions which arise between the ERP vendor and its partners when the vendor changes its strategy to respond to the hypercompetitive ERP industry. Finally, the paper concludes by discussing the theoretical and practical implications of the research.

This paper aims to contribute to three main areas: first, to the ERP literature by exploring the problems that an ERP vendor faces as it competes for market share by adopting a business model that co-innovates with partners; second, to the study of co-creation literature by examining the dynamics between the ERP vendor and its partners as it strategically aligns with them to augment its resources; and third, to the study of the history of Information Systems (IS), which is often a missed opportunity by researchers in the field (Land, 2010).

Literature Review

A substantial portion of ERP studies conducted between 1990-2011 has looked into the implementation of ERP to reveal the success factors (Markus *et al.*, 2000; Lam, 2005; Remus and Wiener, 2010) or explain the complexities that lead to failure (Markus *et al.*, 2000; Soh *et al.*, 2000; Krumbholz and Maiden, 2001; Lee and Myers, 2004; Soh and Sia, 2004; Meissonier and Houze, 2010). These studies focused on providing insights for better implementation, not on the vendor which created the system that was intended to meet the needs of a changing competitive marketplace. There were few studies, however, which have examined the issues from a vendor's point of view by offering alternative ways to model business processes (Scheer and Habermann, 2000), build new architectures (Sprott, 2000; Yu and Krishnan, 2004), or co-create using partner networks (Fox and Wareham, 2009; Kude, 2009; Antero and Bjørn-Andersen, 2011; Antero and Holst Riis, 2011; Sarker *et al.*, 2012). These partner networks are often referred to as ecosystems to reflect the collaborative relations that foster innovation enabling them to build coherent solutions(Adner, 2006; Fox and Wareham, 2009).

Indeed, as the ERP industry evolves in phases of incremental and revolutionary changes triggered by important innovation (Shapiro and VarIan, 1999), vendors increasingly rely on inter-organizational relationships to keep up. Not surprisingly, the strategic potential of co-creation to enhance innovation capabilities has been emphasized in an emerging stream of research (Han *et al.*, 2012; Sarker *et al.*, 2012). However, while these studies have contributed greatly in understanding the benefits of utilizing strategic alliances to have access to additional resources as part of a maximization strategy, they do not consider how these complex relationships impact an organization's ability to evolve. Lee, et al. (2010) did look at software alliances and the factors that contribute to hypercompetition at a particular point of time, but did not consider how evolving strategies impact the relationships between the allies.

This paper aims to build on existing ERP literature focused on the use of partner networks to innovate. It uses an evolutionary theoretical perspective to explain that an organization's viability to survive a competition is dependent on its ability to co-evolve and keep up with the market. The Red Queen is a reference to a royal character in the novel, "Through the Looking Glass," who remarked, after the main protagonist complained that despite running as fast as she could, she still only found herself under the tree where she started: "Now, here, you see, it takes all the running you can do to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!" (Caroll, 1871). The lesson is clear: In today's hypercompetitive business environment, simply keeping the pace is not enough to outrun the competition.

Theoretical Framework

Originally put forward by Van Valen (1973) and advanced by Barnett (2008) in strategic management literature, RQT is predicated on the notion of coevolution – a theory which suggests that organizations are in a never-ending race that requires them to constantly adapt simply to sustain their level of relative fitness (Barnett, 2008). In this view, organizations are adaptive systems that are able to come up with strategies to respond to competition by searching for innovative solutions locally (Levitt and March, 1988; Barnett, 2008). The theory complements existing literature that suggest that organizations recognize new opportunities that will give it first mover advantage (Lieberman and Montgomery, 1988; Christensen and Overdorf, 2000; Drucker, 2002) or scale up and learn from early innovator's experiences (Markides and Geroski, 2005).

RQT views competition as simultaneous actions where competing firms co-evolve, thus rendering a particular firm's competitive advantage as also evolutionary. This view of competitive advantage departs from earlier static theories of competitive advantage (Porter, 1987; Barney, 1991) which suggest that competitive advantage can be sustained – *e.g.,* by creating core capabilities to market a new product and/or service that is unique (Porter, 1987), rare (Barney, 1991), low cost (Porter, 1987), valuable, inimitable, or non-substitutable (Barney, 1991). RQT provides a lens to understand how organizations co-evolve and compete by combining behavioral aspects that take into account organizational learning and economic rationalities – *i.e.,* to increase market share and profitability (Barnett, 2008).

An organization's adaptability and selection of innovation strategy can be analyzed through the actions and decisions of human agents (Sundbo, 2001). When new challenges are faced, human agents adapt and try to develop new capabilities by searching for innovative solutions that are driven by aspirations which are not only linked with prior aspirations but also social references to others by comparison (Barnett, 2008). Consequently, solutions tend to have elements of reflexivity, based on "competitive hysteresis, the current-time effects of having experienced competition in the past" (Barnett, 2008), not unlike what Giddens (1984) refers to as bounded knowledgeability. This means that the response to competition is informed by the experiences that the organization has had in the past and guided by practical consciousness of the human agents to act in a knowledgeable way (Walsham, 1993).

Over time, organizations accumulate experiences in responding to competition and gain the capabilities to deal with certain types of problems (Cooper, 1992). The more a firm encounters the same problem, the more it develops competitive hysteresis, which allows it to become a stronger competitor. However, one of the dangers for an organization that has established routines for solving similar problems is the possibility of falling into a competency trap, which limits organizational options when circumstances change (Levitt and March, 1988; Barnett, 2008). Such a trap occurs when established procedures, although inferior, provide satisfactory results primarily because of familiarity, thus stunting the organization's ability to develop new procedures (Levitt and March, 1988).

RQT assumes that the organization's viability is relative to the number, size and fitness of its competitors. Moreover, the context of competition is dependent on its historical and social setting which determines whether an organization has the requisite capability to succeed (Barnett, 2008). Accordingly, an organization historically exposed to competition produces stronger competitors and is more likely to be fit compared to an average organization that has not faced much competition. For new entrants, surviving the entry process typically entails coming up with a revolutionary innovation that changes the industry as part of a selection-driven process.

This selection process responds to a certain logic of competition – *i.e.,* "a system of principles in a given context that determines who can compete, how they compete, on what criteria they succeed or fail, and what are the consequences of success or failure". To win the race, an organization needs to outperform its rivals according to the context's logic of competition by "matching or exceeding the actions of its rivals" (Barnett, 2008; Derfus *et al.*, 2008). This can be carried out in two ways: by innovating to compete or by preying on rival organizations (essentially killing the Red Queen) (Barnett, 2008).

Research Methodology

To illustrate how ERPCorp has employed various strategies in order to compete, the paper applies qualitative analysis (Miles and Huberman, 1994) to an embedded case study (Yin, 2009). Qualitative data was collected between October 2011 and March 2012 through face-to-face and phone interviews with senior corporate executives of the vendor, its partners and its rivals. Each interview lasted anywhere between one to two-and-a-half hours. The interviewees were selected based on their employers' importance in the ERP field, as evidenced either by their market share or dominance of a particular niche. In order to get a wider spread of partner types, partners were solicited from multiple geographic regions through cold-calling from a partner list and referrals from the vendor or its partners. Table 1 below anonymizes and summarizes the list of interviewees, their roles within their respective companies (likewise anonymized) and how the interviews were conducted.

Position	**Company Name and Description**	**Interview Type**
Director	ERPCorp	Face-to-face
Director	ERPCorp	Face-to-face
Director	ERPCorp	Phone
General Manager Research & Development	ERPCorp	Face-to-face
Vice President, Partner Management	ERPCorp	Face-to-face
Founder/Business	Red Queen Alpha, Rival ERP	Face-to-face

Development Manager	Vendor	
Founder/Director of Business Development	Red Queen Alpha, Rival ERP Vendor	Face-to-face
Executive Vice President	Red Queen Beta, Rival ERP Vendor	Phone
Vice President	Red Queen Beta, Rival ERP Vendor	Face-to-face
Vice President, Product Strategy	Red Queen Beta, Rival ERP Vendor	Face-to-face
CEO	Independent Software Vendor, Non-Selling Alpha	Face-to-face
CEO, Partner Management	Independent Software Vendor Selling Beta	Face-to-face
CTO	Independent Software Vendor Selling Beta	Face-to-face
Board Member	Independent Software Vendor Non-Selling Charlie	Face-to-face
General Manager/Founder	Independent Software Vendor Selling Delta	Face-to-face
Senior Consultant	Independent Software Vendor Selling Delta	Face-to-face
Senior Manager	Systems Integrator Alpha	Face-to-face
Team Lead/Senior Consultant	Value Added Reseller Alpha	Face-to-face
Department Head	Value Added Reseller Beta	Face-to-face
Department Head	Value Added Reseller Charlie	Face-to-face
CEO	Value Added Reseller Delta	Face-to-face

Table 1. Interview List

The data from the interviews were triangulated using corporate documents, news articles and information from websites of the participating companies and their rivals. Based on the theoretical framework, the interview data were coded to reflect the relevant patterns of action, and then used as inputs to illustrate various practices within the

ERP industry through a narrative (Czarniawska, 2011). This narrative presents a complex network of events from the perspective of ERPCorp, which was selected for being recognized as a leader in a particular market segment. Simultaneously, the actions of ERPCorp's rivals and network partners were investigated to enable a cross-case analysis in order to see if the logic surrounding one vendor could be replicated to provide theoretical, industry-wide insights (Eisenhardt, 1991).

Case Study Analysis

In the early 2000s, the ERP industry went through a period of consolidation participated in by ERPCorp, Red Queen Alpha and Red Queen Beta. Twelve years later, the ERP packages developed by these companies still dominate the market.

ERPCorp's early success can be attributed to its strategic decision to co-innovate with multiple partners through a certification process wherein the partners became authorized resellers of the ERPCorp product. The collaborative arrangement was made possible because of ERPCorp's decision to split its revenues with its partners while allowing them to also make money on consulting fees. Revenues were generated from initial installation and maintenance fees for five years, which benefited all parties.

Using this certification strategy, ERPCorp developed a flexible architecture which allowed its partners to make localizations to cater to various customer requirements (*e.g.,* language, legal, etc.) and develop industry verticals using a software development tool. Additionally, ERPCorp also allowed its partners to resell their products, scale up their operations, achieve economies of scope, and develop their own complementary modules and add-ons.

Since it was able to amass a larger number of customers using the strategy, ERPCorp was also able to spread out development costs over a larger number of systems, thus making the cost of producing another system marginal. Hence, over time, ERPCorp was able to build up competencies in various functional areas such as customer relationship management (CRM), supply chain management (SCM), human resource management (HRM), product life cycle management (PLM), and workflow management (WFM).

ERPCorp’s Ecosystem

As a result of ERPCorp’s arrangement with its partners, an ERP Ecosystem developed around it composed of several diverse actors: (1) Independent Software Vendors - Non-Selling (ISVs-NS); (2) Independent Software Vendors - Selling (ISVs-S); (3) Value Added Resellers (VARs).

Independent Software Vendors - Non-Selling

An ISV-NS is a software vendor which develops business application add-ons to the platform and does not sell directly to a customer; it generates profit for itself through license-fees for its products. In some cases, it develops and sells its own software products but is incapable of selling ERPCorp products directly to the customer; it can, however, sell through VARs.

ISV-NS Alpha and ISV-NS Charlie fall under this category. ISV-NS Alpha was formed by an ex-ERPCorp employee who recognized the need to develop add-ons for VARs to enable them to migrate their solutions to newer versions of ERPCorp code, while ISV-NS Charlie was formed as a spin-off from a VAR focused in the furniture and fashion industry. ISV-NS Charlie's parent company recognized the potential of developing a generic vertical solution that facilitates a partnership with other VARs.

Independent Software Vendors - Selling

An ISV-S is a software vendor which develops business application add-ons on the code base (kernel), and directly sells and implements these applications. It is capable of developing its own custom solutions that it can sell directly to the customers or through VARs. It has insight into the buying behavior of customers in a particular local market and, in some cases, even specific knowledge about a vertical. It generates profit for itself through consulting fees as well as license fees, either from selling its own product or the ERPCorp package.

ISV-S Beta focused on developing WFM modules without an industry vertical focus so they could be integrated into a wider range of solutions offered by VARs. Its founders, who were former ERPCorp employees, also decided to sell the firm's own solutions because they felt they have the capability to make modifications at the customer site, having been part of the original design team at ERPCorp.

Meanwhile, ISV-S Delta focused on developing packages for the printing industry after it recognized that business applications that ran on a particular operating system was scarce. Learning quickly that ERPCorp pushes software updates on a regular basis, it has forbidden its partners to make non-repeatable customizations to its software. It also recognized that in order to have a stronger bargaining power to request for changes to the kernel, it needed to sell more licenses. Keen on doing just that, it therefore created a department in its headquarters to focus on sales.

Value Added Resellers

A VAR is a software vendor capable of developing business application add-ons on an ISV-NS solution or directly on the platform. A VAR can combine an ISV-NS solution with its own products as well as other ERPCorp products to create a custom solution for the customer. It has some insight about the buying behavior of business applications and specific knowledge about a vertical and local market. It sells and implements these applications directly to customers. Like an ISV-S, it generates profit for itself from consulting fees as well as license fees, either by selling its own product in combination with an ERPCorp solution.

VAR Alpha, VAR Charlie and VAR Delta developed solutions without a particular industry focus. VAR Alpha recognized a demand for cloud-based solutions for ERP and decided to fulfill that by hosting a private cloud for SMEs. While VAR Charlie focused on a particular market segment, VAR Delta opted to develop solutions for multiple markets. VAR Beta developed solutions that catered to the fashion industry and partnered with ISV-NS Charlie, Red Queen Alpha and Red Queen Beta.

ERPCorp's Rivals

Red Queen Alpha was established as a consulting company around the same time as ERPCorp. Like ERPCorp, Red Queen Alpha developed its own client-server accounting system which was distributed by a major hardware manufacturing company. To ensure that its software met its clients' demands, Red Queen Alpha focused on forming user groups that met a couple of times each year to brainstorm on new features that need to be included to the core package. This enabled Red Queen Alpha and the user groups to discuss the future technology roadmap for Red Queen Alpha and get immediate feedback on the system designs. The approach served it well as it developed a system that was easy to use, thus allowing it to gain a strong foothold in a particular market.

Red Queen Beta is reputed as a market leader known to set the pace of the competition. It developed its market by using implementation partners, typically referred to as systems integrators (SI), to keep up with the demands for ERP in the 90s. It managed to capture specific industry verticals through the SIs, enabling it to capture a major share of a specific market.

Avoiding the Competency Trap

As the race to get the lion’s share of the market became cut-throat, more complementary products became available and ERP vendors were challenged to come up with new strategies to keep up with the pace of competition. Red Queen Alpha decided to focus on developing solutions targeting a specific market in a particular industry vertical. Unfortunately, although many analysts believed it was poised to compete globally having undergone major changes in its operations and had managed to resist earlier takeover attempts, it recently fell victim to the RQE and was acquired by another player in the field. For its part, Red Queen Beta expanded its innovation initiatives by entering into strategic alliances with various partners and user groups; it also expanded its offerings to target other segments of the market.

The actions of ERPCorp's rivals prompted it to rethink its current strategy. As one of the Directors of ERPCorp put it, "I think some of our competitors have done us a favor by making the rest of ERPCorp wake up a little bit." ERPCorp responded by changing its strategy from one focused on a single target market to one focused on different customer groups (*i.e.,* large companies, mid-size companies, and small and medium enterprises). However, as ERPCorp made changes to its strategy to avoid the competency trap, conflicts with some of its partners arose.

First, the changes in the certification requirements for its partners meant that only those who met the certification criteria would be able to stay in the network. For ERPCorp, the ideal partners were those which (1) have a vertical competency to produce proven and repeatable solutions; and/or (2) could effectively gain market share through their increased capacity to implement, sell and support a software solution. In return for the higher standard of requirements, ERPCorp committed itself to subsidize advanced training, guidance and business systems that would allow the partners to monitor, manage and identify areas of opportunities so they could grow their businesses according to ERPCorp's strategic directions and priorities. ERPCorp's new partner strategy also contained several elements: marketing, training, new systems & tools, and support services.

While the changes in the certification process fit well with ISV-NS Charlie, ISV-S Delta and VAR Beta which develop ERP packages for a particular vertical, they were painful for VAR Delta and VAR Charlie. In particular, because it makes its money on consulting fees, VAR Delta came to believe that ERPCorp is squeezing out the revenues from its partners. VAR Delta therefore viewed this period as an opportune time to change its role from a regular VAR to what ERPCorp would now consider a SI. VAR Delta also entered into preliminary discussions with Red Queen Beta, a signal suggesting the possibility of leaving ERPCorp's Ecosystem altogether. In parallel, VAR Charlie changed its course to be in line with ERPCorp's strategy, thereby quickly winning the approval of ERPCorp. Said ERPCorp's Vice President: "I think VAR Charlie is doing the right thing: They're starting to be more precise about what they want to do whereas they used to be everything to everyone, with a little bit of a gun-slinging mentality."

Second, ERPCorp made changes to the revenue structures for its partners, which some found dispiriting. However, according to the VP of ERPCorp, the attrition of partners from a self-elected network was necessary to ensure that only partners whose goals are strongly aligned with it remain. As he clearly puts it: “We’re going to pay for performances, just like they do. So we have lost some but the ones that we’ve lost, candidly, were the ones we wanted to see move on. Now, in parallel to that, we want a place for some of that capacity to go for the ones that decided they didn’t want to be doing this as a full-time business anymore.”

Finally, ERPCorp began developing product features in its core package that are in the process of being offered or were already being offered by an existing partner. For instance, VAR Alpha has been developing a cloud-based offering, which appears to be an offering also included in ERPCorp’s new release. While VAR Alpha is apprehensive, it is waiting to see the features and functionality of the new package from ERPCorp in order to allow it to position and differentiate its own product.

Discussion

In order for ERPCorp to survive the entry process, it needed to understand the prevailing logic of competition in the market and establish itself as a significant player. For a vendor whose business model is dependent on the development and sale of an ERP system, this meant that it needed the requisite knowledge about its customers and the ability to offer a product that was technically comparable to all other market substitutes as well as respond to market demands and technological innovations.

ERPCorp's success can be attributed to: (1) its ability to makes changes to its strategies in order to evolve with the hypercompetitive market where other rivals compete; and (2) its use of a partner network to keep up with technological changes and market demands. These two things become especially important when technologies are in flux and customers demand for more features to be incorporated in the ERP package. By being an adaptable organization that can leverage its partners' competencies, ERPCorp could build the complementary capabilities that avoid the competency trap. Its partner network also allows ERPCorp to see from a distance which technologies or features are necessary to incorporate in its core package so that it can offer the functionalities demanded by the customers.

The results of the case study not only highlight the importance of using alliances in order to avoid the competency trap but also the challenges when alliances have established routines. As shown above, as ERPCorp strategically evolved, its actions sometimes became misaligned with its partners'. Further, because of ERPCorp's distance from the customers and its dependence on its partner network to deliver its package, it runs the risk of losing its customers to another vendor altogether. For instance, the more stringent partner-certification requirements which ERPCorp implemented have increased the possibility of partners leaving its network for another.

While there is a significant lock-in effect that deters its partners from leaving, ERPCorp, as the vendor, has to tread a very fine line. It needs to define clear criteria such as when and under what circumstances it needs to cut its losses for those partners incapable of making a transition. It also needs to balance incentive mechanisms to keep partners who can threaten the stability of the business if they opt to leave. For ERPCorp, this was a challenge when it wanted its partners to sell more products and upgrades to generate more license fees but partners preferred to customize the core product instead so they could generate more consulting fees. Likewise, conflicts arise when the ERP vendor incorporates features that are being offered by its partners in the kernel. Essentially, by innovating and increasing the features in the kernel, it makes the features developed by certain partners obsolete, thereby reducing their ability to succeed in the market place. As also shown, the affected partners' response to ERPCorp's actions also vary, suggesting that they too will do what it takes to keep their chances of survival higher in this hypercompetitive market. This suggests that as ERP changed its strategy, previous collaborative relationships where undermined resulting to a role reversal – *i.e.,* partner to competitor.

Conclusion

By applying an evolutionary theory that has not been widely applied in IS, the paper focused on the complexities that an ERP vendor is faced with as it evolves relative to its competition. In the hypercompetitive ERP industry, an ERP vendor must be able to analyze the actions of market participants that can occur simultaneously, and then react adeptly. In order to survive the rivalry among the vendors as well as the tensions that arise in the ERP ecosystem, the ERP vendor must be attuned to the dynamics of the marketplace.

By looking at the actions of the players from an industry-wide perspective, the paper was able to show the tensions that arise from the process of changing strategies. It further illustrated that an innovation ecosystem created to sustain product development requires the ability to manage innovation by challenging routines to avoid a competency trap. In the case of ERPCorp, it was shown that innovation in an ecosystem does not only emanate from within the bastion of a large organization, but can also occur at the nodes (*i.e.,* the smaller niche players). It was also shown that by changing various strategies in order to leverage multiple opportunities for innovation, an ERP vendor runs the risk of losing partners in its network. Although the network creates a significant lock-in effect that can discourage partners to defect, when routines are challenged, the affected partners view the occasion as an opportunity to explore other options. Therefore, the trade-offs in having an efficient and innovative network need to be managed in order to increase the chances of survival in a hypercompetitive environment.

The paper was able to look at disruptive challenges that threatened the survival of an ERP vendor because the qualitative study that had a longitudinal focus. While it focused on only three anonymized ERP vendors, it was able to consider actions across multiple periods of time to show how the industry evolved and how certain actions led to the survival or demise of an organization. As the industry continually evolves to produce dominant market solutions, more companies will experience the RQE. By viewing competitive advantage as something that is temporary, ERP vendors need the requisite capability to constantly co-evolve with rivals who also innovate. This means being adept at managing strategic changes (*e.g.,* markets, technologies and relationships between various organizations) in order to maintain the stability of the ERP ecosystem.

As industries begin to converge, the challenge for ERP vendors is how to survive the next revolution and stay as a focal player in the ecosystem.

Further research can be done to expand on this study by either looking from the perspective of other vendors or longer period. In hypercompetition, it takes all the running, constant innovation and adaptation to the environment, to stay in the same place because others are co-evolving at the same time. If these vendors grow complacent and fall into the competency trap, they may fall in the ranks of the Big Blues who no longer are the masters of its ecosystem.

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Appendix E: Evolution of Business Models: A Case Study of SAP

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Abstract

The ERP industry has undergone dramatic changes over the past decades due to changing market demands, thereby creating new challenges and opportunities, which have to be managed by ERP vendors. This paper inquires into the necessary evolution of business models in a technology-intensive industry (e.g., develop new offerings, engage in partnerships, and utilize new sales channels). This paper draws from strategy process perspective to develop an evolutionary business model (EBM) framework that explains the components and processes involved. The framework is then applied to a longitudinal case study of SAP to explain how its success in a technology-intensive industry hinges on its ability to reconfigure its business model. The paper contributes to the extant literature on business models in two ways: first, by identifying and explaining the need for an

evolutionary perspective; and second, by adopting different value configurations to reflect the convergence of customers, suppliers and vendors.

Keywords: Business Models, ERP, SAP

Introduction

In technology-intensive industries, firms have to create opportunities, respond to threats, or defend market positions using various technological innovations (*e.g.,* client/server, Internet, relational databases, object orientated technologies). On one hand, firms that can adapt to technological innovations are able to explore new business opportunities and create new business models. For instance, over its 102-year history, IBM started out as a manufacturer of weighing scales, and gradually moved into other markets (*e.g.,* automatic meat slicers, punch card equipment) before evntually moving into selling IT infrastructure, hosting and consulting services. On the other hand, firms that are unable to change its business model fail. For instance, Eastmann Kodak Co., a legend in the field of photography, filed bankruptcy in 2012. Although Kodak was considered a pioneer in outsourcing its IT infrastructure (Applegate and Montealegre, 1991), it was unable to survive the digitalization of its industry.

This paper inquires into the general question of how firms manage and respond to changes in the market. Answers are partially found in strategic management and organizational studies (Burgelman, 1991; Rosenbloom, 2000; Tripsas and Gavetti, 2000; Daneels, 2010). However, a firm's ability to manage changes cannot entirely be explained by one theory. Zott and Amit (Zott and Amit, 2007) proposed the use of business model as an appropriate framework to analyze change, for instance IT as an enabler of boundary-spanning organizational design. One key advantage of using the business model is that it bridges external forces with the internal properties of firms into a product or service offering (Hedman and Kalling, 2003). Thus, by drawing on the business model concept this paper answers the following research question: *How do business models evolve over time?*

Business model research has extensively explored components, definitions, archetypes, value creation in e-businesses, firm performance, and innovation and technology management (Hedman and Kalling, 2003; Shafer *et al.*, 2005; Zott *et al.*, 2011). However, much less is known about the evolutionary aspects of business models (Petrovic *et al.*, 2001; Zott *et al.*, 2011). Thus, this paper aims to make two principal contributions to the extant business model literature. First, it develops and illustrates an evolutionary business model framework (EBM). Second, it incorporate various value configurations to show the convergence of customers, suppliers and vendors.

The paper begins with a description and discussion of the EBM framework, followed by the research methodology. The EBM framework is subsequently applied to a retrospective case study of how a world-leading enterprise resource planning (ERP) system provider, SAP AG, managed its business model to compete in the ERP industry. The findings are summarized through a discussion of the EBM framework in relation to theoretical and practical implications. Finally, the paper concludes and presents future research directions.

A Framework for Evolution of Business Models

In the past decade, the term "business model" generated attention from both academics and practitioners regarding its theoretical and practical relevance. Business models are fundamental to describe the ways that business interacts with and relates to its customers, competitors, and suppliers in its value network (Magretta, 2002). Business models capture value creation (Amit and Zott, 2001), primary and secondary activities (Osterwalder et al., 2005), cost and value (Stabell and Fjeldstad, 1998), and the role of management (Hedman and Kalling, 2003). Additionally, the concept of business model has been treated as a set of different types, rather than integrated into a generic concept that captures a wide range of real-world scenarios. The use of the "business model" concept has evolved

(Osterwalder et al., 2005) from early attempts to define and classify business models for electronic markets (Dubosson-Torbay et al., 2002; Rappa, 2004); make policy evaluation (Poel et al., 2007); analyze firm performance (Malone et al., 2006); and understand business model economics (Brousseau and Penard, 2007).

A review of business model components forms the foundation for developing the EBM framework. Business model research is primarily focused on identifying components, conceptual models, design methods and tools, taxonomies, methodologies (Petrovic *et al.*, 2001), evaluation models, and adoption factors (Pateli and Giaglis, 2004). Most of the articles reviewed focused on a limited number of aspects, such as revenue model (Van Bossuyt and Van Hove, 2007), customers and competitors, and value proposition (Bouwman *et al.*, 2007). Shafer et al. (2005) classified 42 business model components into four main categories: strategic choice, value network, value creation, and value capture. Similarly, Pateli and Giaglis (2004) synthesized their research into seven recurring components: mission, target market, value proposition, resources, key activities, cost and revenue model, and partner network. They summarized their research as an "*…extensive research conducted towards identifying and analyzing key components…limited* *research…towards identifying the logic flow…between components*" (p. 308).

The conceptualizations of the business model vary in terms of focus and scope (*e.g.,* mainly on e-business). Thus, the concept have been criticized for being unclear, superficial and lacked an underlying scientific method (Hedman and Kalling, 2003). Zott, et. al., (2011) recently reviewed the business models concept and found some common themes emerge. In particular, they found the potential of using the business model as an analytical framework to provide a holistic view of the firm, and an emphasis on business activities to explain value creation. However, they also highlight the disagreements on "what a business model is" and state that the current research has developed in isolated scientific silos. Therefore, this provides us with a motive to strive for clarity in business model research.

Causation between components is usually discussed in terms of revenue models, or customers and competitors (Methlie and Pedersen, 2007). Hedman and Kalling (2003) proposed an alternative model which included a longitudinal component, which is interrelated with five other causal components: customer market, offering, activities and organization, resources, and factor market. The causality chain between the components is derived from Porter's (1991) dynamic strategy theory, while the longitudinal component is grounded in the work of Mintzberg (1998). However, both papers are primarily based on the industrial organization (I/O) logic and failed to consider the convergence of the customers, suppliers and vendors in the production of a key offering.

Hedman and Kalling (2003) also attempted to address the evolution of a business model and how it should be managed through a case study. However, because the production of a key offering is no longer linear, it is necessary to come up with meta-level business model concept that is generic enough to encapsulate both traditional and new business processes. Drawing on ideas from the strategy process perspective (Porter, 1991; Mintzberg *et al.*, 1998; Barnett, 2008; Daneels, 2010), which suggest that business components are causally interrelated and firms co-evolve with its competitors over time, we propose a generic EBM framework. It is based on Hedman and Kalling (2003) and extended to include value configuration analysis (Stabell and Fjeldstad, 1998). This model posits that the firm’s ability to evolve is dependent on its ability to identify various value configurations and incorporate them into its business processes. The initial EBM framework includes four generic components: (1) market, (2) resources, (3) *business processes and* value structure, and (4) *offering.*

The *Market*-component encapsulates the competitive space (customers, competitors, and substitutes) where technological innovations occur. It is based on Porter’s (1980) ideas that identified the threat of substitute products or services; established competitors; new entrants; customers; and suppliers. Porter (1980) suggested that it was critical to define and understand the bargaining power and influence of various entities to set and control the rules of the game.

The *Resource*-component focuses on the vital resources of the firm including the acquisition of its inputs such as physical, labor, knowledge, and financial capital. It draws upon the resource base view of the firm (Barney, 1991). In the ERP industry, there are few physical resources (such as computers, server halls, and sales offices locations). Financial assets, such as money, stocks and bonds, are essential to the survival of the firm. Labor refers to people, their skills and competences and various sourcing arrangements can be utilized to get the right people capable of doing the job. Intangible assets are brands, patents, and partners. Partners are essential particularly in the design, production, and distribution of offerings.

The *Business Processes and Value Structure*-component take into account various activities performed to acquire and transform resources into offerings and deliver it to the customer market. It is based on Porter's (1985) value chain analysis which refers to primary and secondary activities. However, since the value chain is not applicable to all businesses, we incorporated Stabell and Fjeldstad’s (1998) ideas of the value chain, value shop and value network. This value configuration analysis is based on Thompson's (1967) typology of long-linked, intensive, and mediating technologies. Long-linked technologies apply to firms that transform inputs to output and are referred to as value chains. Intensive technologies apply to firms that solve customer problems and are called the value shops. Mediating technologies are called value networks because it links together simultaneous activities.

The *Offering*-component is often referred to as the value proposition. Value proposition is what a company markets to its existing and potential customers based on the generic strategies of differentiation and cost leadership. Value is ultimately determined by how well resources improve the cost or price (or customer-perceived quality) of the offering (Barney, 1997). Since customers associate value to a particular offering, value proposition is not an objective. Thus, it is important to identify customer perceptions in order to understand the value of the offering.

Figure 1 describes the logic behind four generic components that connect. A firm in a market (1) has to identify its customer segment and develop an offering (2) in order to sell its products and services as it is compared to all available substitutes provided by its competitor. In response to technological and customer requirements resources (4) (labor, physical, intangible, and financial) are acquired from various areas of the market (1). The resources (4) are then “transformed or used” in the *business processes and value structure* (3) either as a value chain, value shop or value network to come up with an offering (2), the final product and/service that is produced.

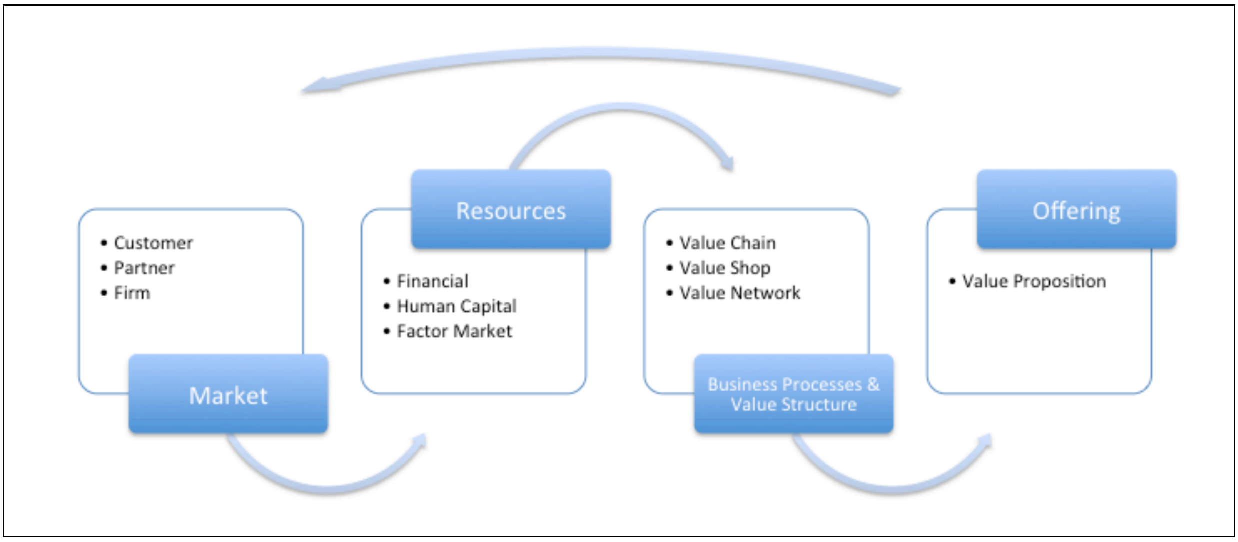

Figure 1. Generic components of the Evolutionary Business Model (EBM) framework

Research Methodology

Data was gathered from publicly available sources, including textbooks, thesis, news articles, conference proceedings, corporate documents and information from websites of SAP as well as its rivals. After identifying of key events (*e.g.,* announcement of a merger, change in strategy) related to business models, SAP’s narrative was written. The narrative tells the story and enables the analysis of events using theory. Subsequently, we performed a qualitative analysis of the data by applying the EBM framework (Miles and Huberman, 1994). To illustrate the causal linkages between various components of EBM framework, we used the framework to analyze the business model of an ERP Vendor in a case study (Eisenhardt, 1989).

The case was selected from a market-leader in the ERP industry as identified by industry analysts. SAP AG has an established record of success in selling pre-packaged software since the 70s, at a time when it entered a market that was dominated by IBM. It managed to withstand the dynamics of competition in the 90s. It also outlasted most of its competitors who succumbed to acquisitions in the 2000s. Instead of using a multiple-case study to compare different business models, we conducted a retrospective case study analysis of the same firm, SAP. The study allowed us to look at historical events and understand the impact of the introduction of technological innovations to its business model and showed how business models evolve. Prominent exemplars of retrospective case studies include Burgelman's (1991) study of Intel's transition from memory chips to microprocessors, Rosenbloom's (2000) study of how NCR transitioned into an electronics-based office equipment company, and Tripsas and Gavetti's (2000) study of how Polaroid's obsolete business model hampered entry into digital photography.

A retrospective case study has both advantages and disadvantages (Ring and Van de Ven, 1992). A retrospective case study lends itself to the creation of a high-level story that outlines major events, transformations, and their outcomes. Some important transformation processes span over decades, which make them are extremely hard to follow in real-time. In particular, it may only be possible to ex-post determine which transformational processes provide new interesting insights to fuel theory building. However, a retrospective case study is not appropriate to explain micro-level processes of *why* decisions were made, nor the cognitive processes behind these decisions. As explanations on these detailed-level decisions frequently become ex-post constructions that do not necessarily match how the processes played out a few decades earlier. Therefore, we limit our analysis to factual circumstances that can be documented. We also recognize the need for real-time process studies in the future to explain *why* some organizations manage to change.

Case Study

The story of SAP illustrates how a software firm deflects rival actions that destabilized the current way of developing software by adopting various business models. At a time when software was developed by consultants, such as IBM, SAP challenged traditional models of developing individual customized solutions for large enterprises. “New innovations by IBM’s rivals had to be exceptionally valuable from a customer’s perspective” (Barnett, 2008). SAP was started in 1972 by five former IBM employees with a vision of developing commercially off the shelf (COTS) application for real-time data processing. SAP changed how software was developed and deployed (Meissner, 2000).

In 1973, all the development was done on externally located mainframe servers. SAP released its first financial accounting module, which would serve as the cornerstone of a modular series that bore the name SAP R/1 (Meissner, 2000; Neumann and Srinivasan, 2009). As shown in Figure 2, SAP’s business model focused on the large enterprises. By developing its COTS offering it changed from the “IBM way” of customized solutions to repeatable pre-packaged solutions using a value structure of value shop. It leveraged two resources: IBM mainframe servers, and its know -how of its customer’s businesses processes thus building mainframe applications that “solve customer problems”.

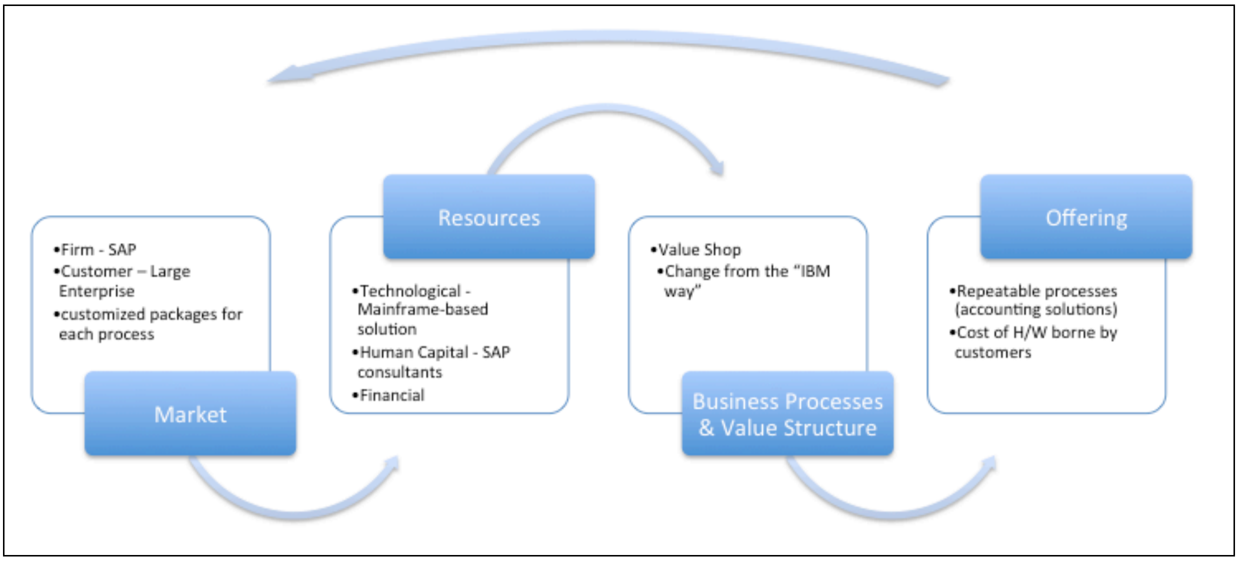

Figure 2. SAP's EBM in the beginning '70s

In 1974, the first technological shift occurred when SAP converted the financial accounting module from the IBM DOS to the IBM OS operating system, a change that enabled multiple applications to run concurrently. The development process further evolved and a module for asset accounting was developed. One of SAP's customers, John Deere, played a significant role in the internationalization of SAP's product when it requested a multi-lingual version of the SAP's module in 1975 (Neumann and Srinivasan, 2009). Within the next years, modules for purchasing, inventory management, invoice verification, and data integration were released.

It was not until 1979, when SAP began running its own development environment and servers, and its own data center. Later that year, SAP made an in-depth examination of IBM's database and dialog control system, which led to the release of SAP R/2. The following year, a sales and distribution application module was built based on a customer's development specifications (Neumann and Srinivasan, 2009). SAP continued to use joint development with customers to develop and enhance the mainframe-based R/2 system. By 1983, the production planning and control module was released.

In 1984, SAP expanded internationally and its first subsidiary, SAP International AG, was founded in Biel, Switzerland (Meissner, 2000). SAP's own data center grew and hosted four servers with a total of 64MB of main memory used for software development. It established its first US headquarters the next year. Its subsequent growth in employees, reaching 300, pushed SAP to restructure and create different departments. After three years of work, the human resource management module was completed.

As shown in Figure 3, SAP's business model focused on developing its offering (*i.e.,* modular solutions for multiple business processes) for a large enterprise. SAP continued to use a value shop configuration in its operations, but the technological change in the operating system enabled SAP to develop other modules. It also leveraged the joint development efforts with the customer to develop new application modules and expand internationally. As SAP's market expanded, it was able to expand its internal resources (*e.g.,* data center, employees) to support the production of its offerings.

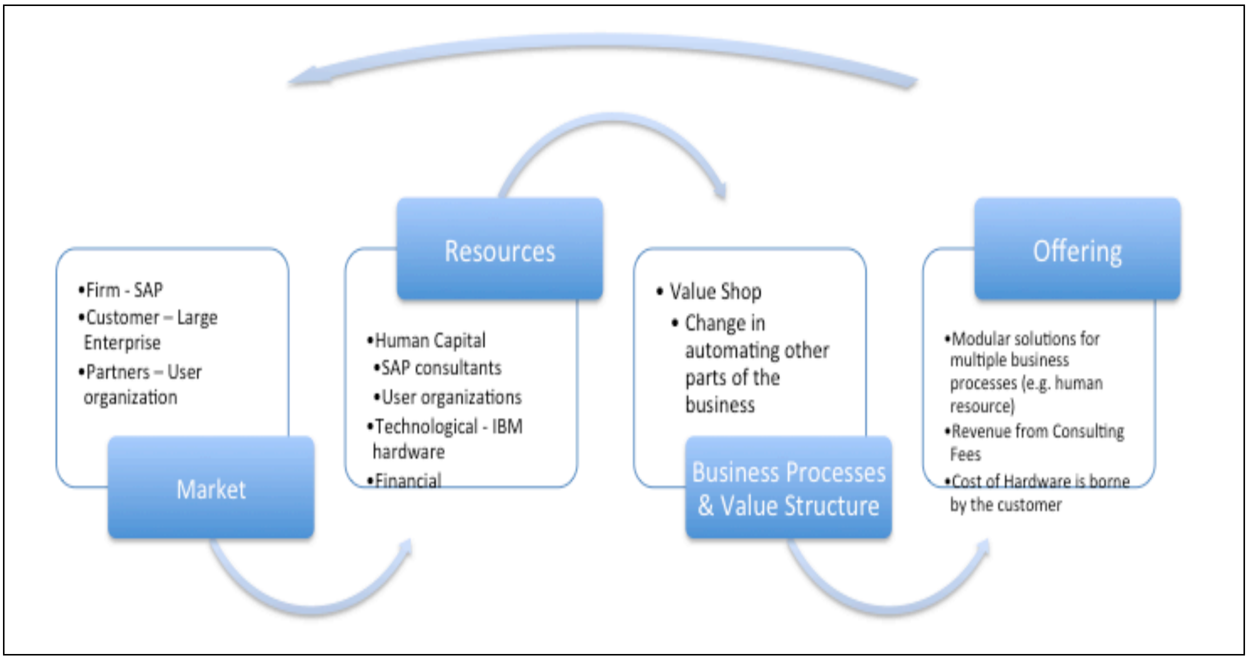

Figure 3. SAP's EBM Maturing in the '80s

Building on SAP's prior activities that leveraged its customers to gain the necessary knowledge to build new applications, it held its first user conference in Karlsruhe, Germany, in 1987. It also aspired to establish a platform that would enable current and potential users to share experiences. Additionally, it established SAP Consulting to support new customers. In 1990, SAP strengthened its financial base by raising DM 85 million in the capital market to further develop SAP R/2 and the new SAP R/3 system. In an effort to increase its target market, SAP acquired 50% of Steeb and 100% of CAS; both software companies focused on medium-size market.

Owing to the development of distributed computing, the possibility to develop new applications using UNIX workstations and personal computing increased in the ‘80s. Moreover, IBM's new generation of servers (*i.e.,* AS/400) showed the potential for SAP's software to be available to medium-size customers. At that time, SAP’s rivals - such as Baan Corporation, developed solutions on UNIX systems - focused on modular solutions for both large- and medium-size enterprises. In 1991, the first modules in the new SAP R/3 system were showcased at CeBIT. With its client-server concept, uniform graphical interface, dedicated use of relational databases, and support for servers from various manufacturers, R/3 was now available to the medium-size market, and to branch offices/subsidiaries of larger corporations.

As shown in Figure 4, the technological change introduced by UNIX and personal computing, and availability of substitute offerings compelled SAP to develop new offerings—*i.e.,* modular solutions for multiple business processes for medium-size enterprise. To make this change, SAP needed to raise the necessary funds to develop the new offering, demonstrate the offering in a road show to verify the demand before scaling up its operations. It also anticipated the need to find additional resources (*e.g.,* IBM AS/400 and labor) to implement its solution, so SAP changed its value structure from value shop to a value chain to allow it to work with partners.

Its two-tiered approach enabled it to target specialized industry verticals with its logo partners, develop different product lines on multiple platforms and change its sales and distribution to include implementation partners (Meissner, 2000).

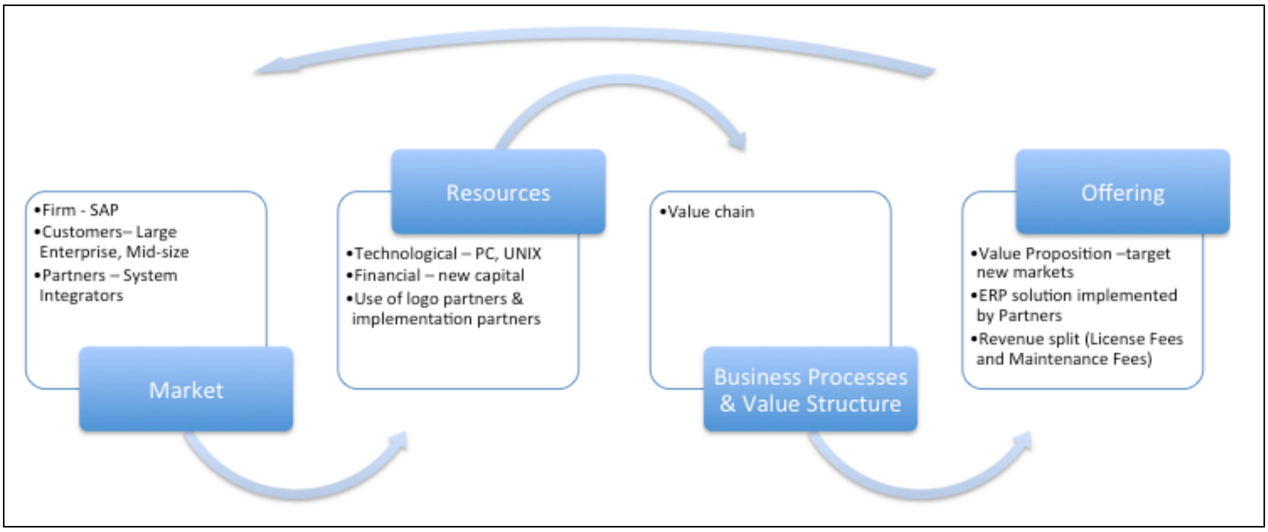

Figure 4. SAP EBM in the '90s

After the launch of R/3 in 1992, SAP changed its partner strategy to include independent consulting firms. In 1993, SAP took on another technological leap when it introduced its joint strategy with Microsoft – *i.e.,*

enhance SAP R/3 to operate on Windows NT operating system which was launched in 1996 (SAP, 2010; SAP, 2010). Together with Microsoft, SAP was able to develop a business applications protocol interface (BAPI), a standard to connect to various applications. Using open interfaces, customers could now connect online applications to their SAP R/3 systems.

SAP improved its technological base and subsequently released a version of SAP R/3, which supported kanji characters, to the Japanese market. R/3 was also compatible to SUN hardware, enabling it to run on all RISC platforms. SAP focused on the retail industry by acquiring a 52% shares in DACOS Software GmbH. By 1995, SAP used system resellers to put emphasis on medium-size companies. Later that year, SAP, developed telecom industry solutions with Deutsche Telekom AG.

SAP also continued to involve customers in its development processes. At one time, it had 4,300 guests at the European SAPPHIRE event in Vienna, and over 8,000 attendees flock to the corresponding U.S. event. In 1998, a new interface was launched – EnjoySAP – at SAPPHIRE in Los Angeles. SAP had planned to make its software easier to learn, faster to work with, and simpler to customize to customers' needs. This reorientation combined e-commerce solutions with SAP's existing ERP applications on the basis of cutting-edge Web technology. A German Internet subsidiary e-SAP.de was founded to support the Internet focus, marking its presence on the Internet age. New applications for market places and portals were developed, and SAP outsourced its development efforts to its SAP Portals subsidiary and started a partnership with Commerce One and the acquisition of TopTier. Additionally, a new platform was launched in 2004—*i.e.,* SAP NetWeaver (SAP, 2012). This platform enabled SAP to offer fast, open, and flexible business applications that supported end-to-end business processes based on SAP or other systems.

SAP Labs China marked the 9th opening of a development location outside of Walldorf, Germany. Along with other research centers in India, Japan, Israel, France, Bulgaria, Canada, and the United States, SAP sold its expertise to its customers. The industry subsequently experienced a period of consolidation and witnessed several mergers and acquisitions, including SAP. SAP also put in place a new technological vision when it introduced its plans for enterprise service-oriented architecture (SOA). Shortly after SAP released in 2006 its SOA-enabled ERP, SAP made several acquisitions – *e.g.,* Pilot Software, Yusa, OutlookSoft, Wicom, and MaXware – the following year. In 2008, SAP also purchased Business Objects, a company specializing in business intelligence applications (SAP, 2012). In 2010, it acquired Sybase, the largest business software and service provider specializing exclusively in information management and mobile data use, in order to strengthen its position in producing solutions for mobile/real-time applications.

As shown in Figure 5, the Internet invoked a technological revolution that required a change to SAP's business model and develop new offerings—*i.e.,* an Internet based solution for small-, medium- and large – enterprises. The change required the use of various resources from its partners, customers and competitors which changed its a value structure from a value chain to a value network allowing it to have the agility to make multiple combinations of its offering to suit the customer demands.

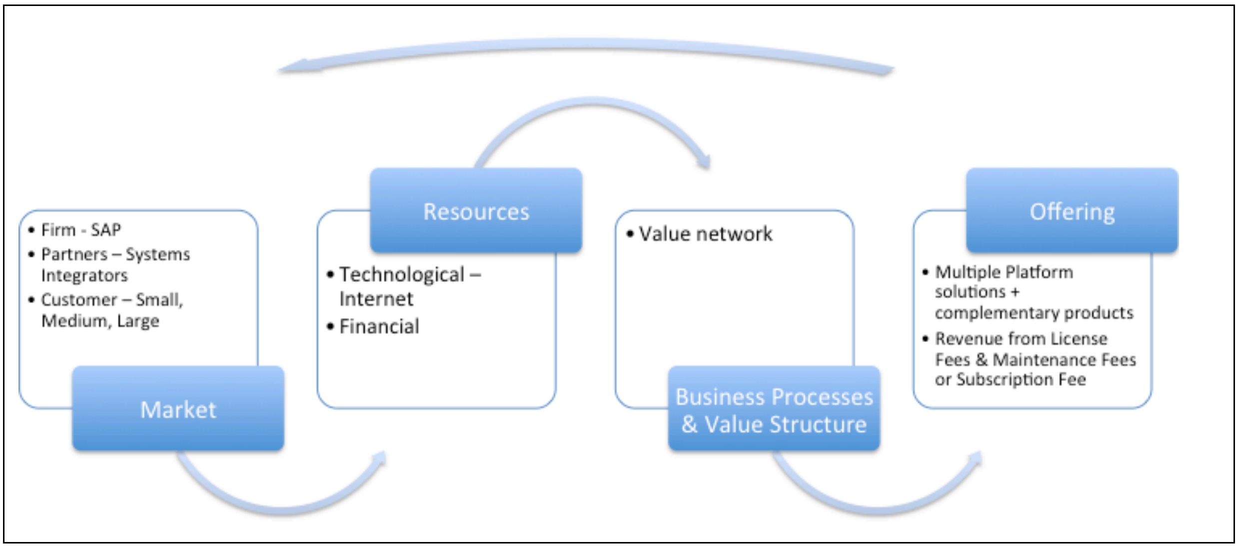

Figure 5. SAP's EBM in the '00s

Cross-case analysis of SAP's business models over time

The SAP case study reveals that changing the underlying business model components increased the viability of SAP and come up with new offerings. Key to making the change is its ability to recognize and incorporate technological innovations in the market, manage resources and create business processes and value structure. Its success can further be attributed to its close relationships with the customers, awareness of market substitutes, ability to raise capital and change its business processes and value structures. This underscores the importance of having a process perspective in the business model to incorporate the feedback mechanism that links the offering back to the market. In the case of SAP, it adapted various business processes in order to change (summarized in Table 2). In the early 70’s and 80’s SAP followed a business model that is associated to intensive technologies to firms solve customer problems, thus requiring a business process that supports a value shop. In the 90s, the increased demand for SAP’s products necessitated collaborative arrangements with systems integrators. This changed the offering to be a long-linked technology, where SIs transform SAP’s ERP core package (inputs) to customized solutions (output) by following a process associated to a value chains. In the recent years, SAP began producing a mediating technology (*i.e.,* a combination of the ERP core package plus complementary solutions) which required a value network to coordinate multiple partners, customers, and even competitors to come up with solutions.

Moreover, the introduction of radical innovations in the ‘90s and the ‘00s, made it possible for SAP to tap new markets which had a corresponding change to its resource allocations, thus requiring new value structures to come up with its new offering. In contrast to the ‘70s and ‘80s where SAP also made a change to its business processes to come up with its initial business model, the absence of a major technological shift did not require a revolutionary change to its business model.

Components	Event period			
	1970s	1980s	1990	2000
Market	SAP as an alternative to IBM's customized solution for Large Enterprises	SAP offers ERP solutions to Large (*i.e.,* Multinational corporations) and Medium-size Enterprises	SAP offers ERP solutions to Large and Medium-size Enterprises with vertical focus	SAP produces different products for Multiple target markets (Small- Mid- and Large Enterprises)
Resources	Technological - Mainframe-based solution Human Capital - SAP consultants Financial	Human Capital SAP consultants Joint development with user organizations Technological - IBM hardware Financial	Technological – PC, UNIX Financial – new capital Use of logo partners & implementation partners	Technological – Internet Financial
Business Process/ Value Structure	Value Shop Use Customer Resources to produce the solution	Value Shop Use Systems Integrators to Implement the Solutions	Value Chain Use Systems Integrators to Implement the Solutions	Value Network Use customer resources (*e.g.,* User Groups to gain ideas), Uses Competitor's (*e.g.,* Microsoft's Windows NT in 1996) complementary products Use Partners (*e.g.,* COIL in Palo Alto)
Offering	Pre packaged software	Modular Pre-packaged Solutions (*e.g.,* Accounting Solutions, Human Resources)	ERP Software on UNIX and PC	ERP plus complementary offerings (*e.g.,* PLM, WFM, SCM, CRM, HRM, Data Analytics, Mobile/Real Time Reporting)

Table 1. SAP's Business Model Evolution

We can gleam from SAP’s experience that various external conditions triggered a need to change one component of SAP’s business model (as summarized in Table 1). In the ‘80s, SAP brought about a change in its internal business process operations, which resulted to a change was evolutionary. In particular, the technological change in IBM’s operating system made the system capable of multitasking, thus giving the possibility to build other modular solutions. In contrast, when a technological change provided the potential to develop a new offering to capture a new market, SAP needed to change the underlying value structure. The changes in the value structure not only provided a means to produce the offering, but it also captured part of the value that was being delivered. The change enabled SAP to tap new markets and increase its financial resources and expand. A similar change was witnessed in the ‘00s when the value structure permitted SAP to have multiple partnerships that resulted in a myriad of offerings for a wider range of customers.

Theoretical and practical implications

The EBM framework is based on the idea of using value configurations (Stabell and Fjeldstad, 1998). Since business model research has mainly been explored to understand components of business models, value creation in e-businesses, and firm performance, this paper heeds the call of Zott and Amit (2011) to explore and integrate theories that can explain innovations to a business model. It identifies causal relationships between the components and traces the longitudinal effects (Hedman and Kalling, 2003). Through the case study from the ERP sector, we were able to illustrate the impact of the integration of various components from business model literature into an EBM framework.

This paper enables a broader and in-depth investigation of business models both from a practical and theoretical perspective. From a practical perspective, the model may be used as an analytical tool for managers to better understand the value creation logic and the interrelationships between internal and external components. It also allows both practitioners and researchers to view the business process not as a sequential process (*i.e.,* value chain) but an evolutionary process that may take the shape of various value configurations. Theoretically, the EBM framework enables researchers to relate different findings to an integrated framework that can be used as a checklist to analyze different components and their relationships. It also allows other researchers to focus on specific elements that can explain the value creation processes inherent in business models in a longitudinal study.

Although this paper cannot claim to be exhaustive, it offers reasonable insights into ERP Industry business models. The results presented in this paper have several important practical and theoretical implications. Firstly, the concept of business model has primarily been based on industrial organization (I/O) logic and value chain logic reflecting components that imply sequential access from the supplier-firm to customer. As a result, the business model includes primary activities such as inbound logistics, outbound logistics, marketing, sales, and operation, which are less applicable to an industry with processes that converge. Consequently, important aspects of how the business model evolve and create value and how firms collaborate may be missed when changes to business models are only investigated in relation to new emerging technologies (see for example Ballon, 2007). Secondly, research on business models has not been applied to the ERP Industry, which possesses unique characteristics based on the notion of value configurations (Stabell and Fjeldstad, 1998)The discussion of the EBM framework contributes not only to the business model literature but also to the ERP Industry.

We recognize that the concept needs further and broader theorizing to increase its explanatory power. Future research can be made using comparative studies of business models in countries or industries, in order to relate past and future knowledge to each other. There is room for studying the relationship between business processes within the ERP Industry. One area could be related to the business processes of network promotion and contract management, service provision infrastructure operation, product-service systems and service engineering. Another potential area of study is to investigate how ERP industry firms collaborate with partners both in delivering the value propositions using other business processes such as outsourcing. Various sourcing arrangements (*e.g.,* role of partner network, customers and external agencies) have changed the way an offering is produced and have been neglected in most pertinent research on business models in ERP Industry.

Conclusion

This paper presented an EBM framework with four components that can be explained by underlying theories based on business model literature. The generic business model concept is summarized in four components and their relationships enhance our understanding of business models providing an alternative that can be used to study business model transformation. The causality between components and the longitudinal dimension resolve the critique posed by Pateli and Giaglis (2004). It contributes to business model literature by identifying and explaining the need for an evolutionary perspective on business models, building on the work of Petrovic *et al.* (2001).

There are many different interpretations of the business model concept both in terms of components and causalities. However, based on the reviewed material and the EBM framework we believe there is a need for further study of the evolution of business models to allow a firm to come up with a new offering. By adapting the EBM framework to the ERP Industry to illustrate the casual complexity among business model components and the evolution of business models we contain previous criticism held against business models (*i.e.,* unclear definition, cf. Magretta (2002)).

The EBM framework provides a holistic and longitudinal view of the firm as it conducts various activities aimed at value creation. Therefore, instead of speaking about core business processes, we propose that the offering should be explained in terms of four components: business processes and value structures, resources, and market. The causality between these components can be explained as an evolutionary process using various value configurations(Stabell and Fjeldstad, 1998). The inclusion of various value configurations into the EBM framework enables us to capture traditional and non-traditional business models that deal with the convergence of customers, suppliers and vendors. Thus, departing from the conventional business model literature that focuses on value creation by individual firms based on an I/O logic.

The integrated business model framework incorporates different value configurations. This framework was illustrated using a case study to show how an ERP vendor evolved its business model. This evolutionary aspect raises the level of analysis that has been almost absent in the reviewed literature, cf. Amit and Zott (2001). It also implies that research should not neglect resources and the processes that have to be performed to deliver an offering to the market. The inability to change the business processes or activities that correspond to technological revolutions is something that, in some cases, has been the cause for a major failure.

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