Determinants of Business Model Performance

in Software Firms



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Abstract

The antecedents and consequences of business model design have gained increasing interest among information system (IS) scholars and business practitioners alike. Based on an extensive literature review and empirical research, this study investigates the factors that drive business model design and the performance effects generated by the different kinds of business models in software firms. The main research question is: "What are the determinants of business model performance in the software industry?" To address this question, the study conceptually and empirically investigates three topical issues in the software industry: (1) the prolific service dominance in software delivery; (2) the growing role of information technology in business; and (3) the openness of innovation activity in software development. These issues and the manifestations of software firms' diverse business models are analyzed in five separate essays included in this dissertation.

First, the study formalizes the definitions of software firms' business models as the theoretical and conceptual layer between corporate strategies and operational processes. Second, it investigates the antecedents to business models through an empirical multimethod approach. It organizes the extant interdisciplinary research centered on the three firm-level orientations of service orientation, technology orientation, and openness of innovation activity, into a research model that explains the variation evident in software firms' business models. Third, the study discusses the contingent role of business model type in the determination of firm performance. The performance effects of different types of business models are analyzed through a quantitative empirical study using structural equation modeling of data gathered from almost 200 software firms.

This study makes several contributions to theory and practice. Overall, it adds to the understanding of the complex relationships among business model determinants, business model type, and firm performance. The results add to the resource-based theory of the firm and its extensions, as well as to the research on services and open innovation. According to the analysis, software firms with a service-oriented mindset are likely to focus on customer proximity in their business models. Such business models have a stronger relationship with financial performance than with market performance. Conversely, firms engaged in open innovation focus mostly on product uniformity, meaning that their innovation activity emphasizes the development of products and services that are new to the industry. Such companies have better market performance than financial performance. Moreover, the findings indicate that technological issues constitute an important antecedent in all types of business models.

Keywords: Business model, Software, Service, Open innovation, Information systems

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	PART II: ORIGINAL RESEARCH PAPERS					

LIST OF THE ORIGINAL PAPERS

- Paper I:Kristian Möller, Risto Rajala, and Mika Westerlund. (2008). Service
Innovation Myopia? A New Recipe for Client-Provider Value Creation.
California Management Review, Vol. 50, No. 3 (Spring 2008), pp. 31-48.
- Paper II: Sami Kajalo, Risto Rajala, and Mika Westerlund. (2007). Approaches to strategic alignment of business and information systems: a study on application service acquisitions. *Journal of Systems and Information Technology*, Vol. 9, No. 2, pp. 155-166.
- Paper III:Risto Rajala, Mika Westerlund, and Kristian Möller (accepted for
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Models for Open Source Software. European Journal of Marketing.
Forthcoming, pp. 1-21.
- Paper IV: Risto Rajala and Mika Westerlund. (2007). Business models a new perspective on firms' assets and capabilities. *International Journal of Entrepreneurship and Innovation*, Vol. 8, No. 2, pp. 115-125.
- Paper V:Risto Rajala. Antecedents to and Performance Effects of Software Firms'
Business Models. HSE Working Papers, Helsinki School of Economics, W-
476, pp. 1-31.

PART I: OVERVIEW OF THE DISSERTATION

The first part of the dissertation introduces the research theme and provides an overview of the implementation of the study. Chapter 1 discusses the theoretical positioning, objectives, and delimitations of the study. Chapter 2 discusses the methodology and scope of the study, as well as the relevant aspects of the standpoint taken on the philosophy of science. Chapter 3 reviews the results from the separate papers included in the dissertation and relates the results of these papers to the overall theme of the study.

1 INTRODUCTION

Academic research into business strategies and competitive advantage has a long history. The terminology used in these studies has varied since the mid-1970s according to the specific purpose and domain of the research. The recent literature recognizes the concept of the business model of a firm in academic fields including information systems, management, marketing, and electronic business. The contemporary research focused on business models investigates the ways of creating and capturing value through sets of actors, activities, and collaboration. It rests in many respects on strategy discussion and draws on strategic concepts and issues. Despite the terminological confusion among the strategy and business models, prior research has achieved consensus on the position of the business model as a conceptual and theoretical layer between business strategy and business processes (Wheelwright, 1984; Osterwalder et al., 2005). However, there is a growing demand to develop the concept of business models towards an established construct that can be used in academic research. This study contributes to the research on business models, which has produced several theoretical constructs for business model analysis (e.g., Konczal 1975; Schafer et al., 2005; Morris et al., 2005; Tikkanen et al., 2005).

The software business has faced fundamental changes in the past 10 years. Three topical issues related to the changes of business models in the software industry surfaced in the early phases of this study. First, digitization of the elementary functions of business operations and the emergence of the Internet as the backbone of the industry ecosystem have changed the ways software firms develop and deliver their offerings. Students of information systems have investigated this phenomenon from a variety of perspectives; for example, as firms' respond to industry characteristics (Melville et al., 2004), their IT-dependent strategic initiatives and sustained competitive advantage (Piccoli and Ives, 2005), and managing IT-enabled change (Benjamin and Levinson, 1993; Markus and Robey, 1988). Second, the emerging service dominance has demonstrated fundamental changes in the business models of software firms, including the proliferation of alliances and networks as strategic resources (Swaminathan and Moorman, 2009). This is congruent with the current literature on services; e.g., the widespread service-dominant logic (Vargo and Lusch, 2004 and 2008), which emphasizes resource access instead of resource ownership as well as user involvement in the service delivery and value creation through service, both of which are visible in the contemporary software business models in business-to-business and business-to-consumer markets (Rao and Klein, 1994). Furthermore, the emergence of the open innovation paradigm has changed software development processes and opened software innovation activity towards user communities (von Hippel and von Krogh, 2003). The open source phenomenon

has had fundamental effects on software business (Fitzgerald, 2006). What are the influences of these issues on the business models of software firms? Moreover, what are the resulting performance effects? These questions have become momentous in the minds of academicians and business practitioners alike.

1.1 Theoretical positioning of the study

This study is linked to the academic discussion on business models in information systems science, management, and marketing. The literature reviewed in this chapter shows that business models can be studied from several theoretical and disciplinary perspectives. Taking the theories of inter-organizational exchange and the resource-based view of the firm (and its extensions) as its basis, this study investigates the key attributes of different types of business models in the software industry.

1.1.1 Selected theoretical perspectives

The theoretical lenses adopted in the present study include transaction cost economics (TCE), the resource-based view of the firm (RBV) and its extension, the dynamic capabilities (DC) perspective. In addition, the investigation into the influence of information systems (IS) on software firms' business models is grounded on the literature of business-IS alignment.¹ The alignment discourse draws upon myriad theories, including the RBV and DC, which are used widely in the IS research.

Transaction cost economics

For the analysis of the phenomena related to the economic exchange and structures in the software business, the study draws on transaction cost economics (TCE). Transaction cost economics, first presented by Coase (1937) and developed further by Williamson (1985), provides us with some attributes for the exploration of market versus hierarchical structures for analyzing strategic dependencies in business models. The transaction cost approach identifies three attributes of exchange that are pertinent to different governance structures: (1) the frequency with which transactions occur focuses on the type and degree of interorganizational exchange. Moreover, Dwyer and Oh (1988) explain that transactional exchange typically involves single short-term events with a distinct beginning and end; (2) the uncertainty to which transactions are subject; and (3) the asset specificity involved in supplying products and services. The first two provide us

¹ For an annotated bibliography of the business-IS alignment literature, see e.g., Chan and Reich (2007).

with the support to identify and describe the business relationships used to classify different types of business models, while the third concerns the resources essential to different businesses. For the purposes of this study, the limitation of the transaction cost approach is its strict focus on the transactions and the view of the extremes between markets and hierarchies. It also focuses on the assets of actors, but does not consider their capabilities in relationships, which are essential in the present study. However, although its original form has attracted some criticism due to the fact that it deals with polar forms of buyer-seller relationships – markets and hierarchies – and despite its inability to explore all available governance structures adequately, this study benefits from its explanation power related to repeated transactions and the dynamic evolution of governance of transactions (Ring and Van de Ven, 1992).

The resource-based view of the firm

The resource-based view of the firm (RBV) originated from the work of Penrose (1959) and was formalized as a theory by Barney (1991). It focuses on resources as analytical units for understanding firm-level sustained competitive advantage. The RBV recognizes that the value of the firm's resources and capabilities is determined by the market context within which the firm is operating (Wernerfelt, 1984; Priem and Butler, 2001). Its basic assumptions consider resources as assets that can be acquired and owned by a company. Furthermore, it assumes that through resource procurement, production, distribution, and consumption, firms generate competitive advantage (Barney, 1991; Ballantyne and Varey, 2008). According to Lusch and Vargo (2006), this view has led to interpretations of firm resources as being primarily tangible, static assets that require some action to make them valuable. Because of its focus on the sources of competitive advantage that are internal to the firm, RBV has tended to overlook the role of joint exploration and exploitation of resources (Dyer and Singh, 1998). Therefore, this study also recognizes the extensions of the RBV, such as the dynamic capabilities perspective and relational perspective (Dyer and Singh, 1998; Ulaga and Eggert, 2005), which suggest that in addition to being assets, resources are capabilities: intangible, dynamic, and capable of creating value. Drawing on this view, the limitations of the RBV are discussed also to identify the relational perspective, which emphasizes the collaborative development of resources by the client and the provider (Ramirez, 1999; Amit and Zott, 2001; Vargo and Lusch, 2004). This view extends the scope our study to move away from a strict focus on firms' internal resources, which is characteristic of traditional RBV studies, to knowledge and skills external to the firm. This provides grounds for adapting the dynamic capabilities perspective in this study as discussed in the next section. However, the RBV (Penrose, 1959; Wernerfelt 1984; Rumelt 1984; Barney 1991) and its extensions (Bharadwaj, 2000) provide grounds for the assumption that business model development builds on resources and information technology capabilities.

Dynamic capabilities

The concept of dynamic capabilities (DC), introduced by Teece *et al.* (1997) and Eisenhardt and Martin (2000), has arisen from the shortcomings of the resourcebased view of the firm. The RBV has been criticized (Eisenhardt and Martin, 2000; Priem and Butler, 2001; Winter, 2003) for ignoring the capabilities that surround resources, and assuming instead that they simply "exist," and provide access to capabilities that are external to the firm. According to this criticism, considerations such as how resources are developed, how they are integrated within the firm, and how they are released, have been under-explored in the RBV. Dynamic capabilities attempt to bridge these gaps by adopting a process approach. By acting as a buffer between firm resources and the changing business environment, dynamic resources help a firm adjust its resource mix and thereby maintain the sustainability of the firm's competitive advantage, which otherwise might erode quickly. Hence, while the RBV emphasizes the strategic management related to resource choice or the selection of appropriate resources, dynamic capabilities emphasize the process of resource development and renewal.

For the account and discussion on network and relationship issues which provide access to capabilities that are external to the firm, this study draws upon prior studies on relationships and networks; e.g., alliances and partnerships (Kandemir *et al.*, 2006; Lavie and Rosenkopf, 2006; Rothaermel and Deeds, 2004), the industrial networks approach (INA) and strategic networks (Gulati *et al.*, 2000; Anderson *et al.*, 1994; Cannon and Perreault, 1999), innovation networks (e.g., Pittaway *et al.*, 2004; Küppers, 2002), SME networks (Larson, 1991; Liao and Welsch, 2003; Park *et al.*, 2002), and the marketing and management literature on the networks' perspective (e.g., Jarillo, 1988; Powell, 1990; Gulati *et al.*, 2000). In sum, these theoretical and empirical discussions underscore the role of inter-firm relationships as a crucial vehicle in providing access to capabilities.

Based on these three theoretical perspectives, the present study investigates the determinants of business models of software firms. One of the issues addressed is the role of information systems in business models, which is investigated through the lens of the strategic alignment of business and information systems (IS). This is considered an important aspect due to the increasing value of information in competition (e.g., Ponssard, 1976; Cachon and Fisher, 2000). Moreover, Wade and Hulland (2004) point out that IS resources may take on many of the attributes of dynamic capabilities, and that they may be particularly useful to firms operating in rapidly changing environments. Thus, even if IS resources do not lead the firm directly to a position of superior sustained competitive advantage, they may nonetheless be critical to the firm's longer-term competitiveness in unstable environments as long as they help it develop, add, integrate, and release other key resources over time (Im and Rai, 2008).

The influence of IS on business models (e.g., Timmers, 1998; Osterwalder and Pigneur, 2002) and the performance effects of firms' business-IS alignment have been suggested in many conceptual studies (e.g., Henderson and Venkatraman, 1993; Sauer and Yetton, 1997) and demonstrated in a number of empirical studies (e.g., Chan *et al.*, 1997; de Leede *et al.*, 2002; Irani, 2002; Kearns and Lederer, 2003). Moreover, the productivity effects (e.g., Panko, 1991; Brynjolfsson and Hitt, 1998) and the business value of IS (Dewan and Min, 1997; Barua *et al.*, 2004) are widely discussed in the IS literature. The benefits of IS range from lowering coordination costs (e.g., Barua *et al.* 2004) to enabling new business models (e.g., Osterwalder 2004). To summarize, the findings of these studies support the hypothesis that the organizations that successfully align their business and IS strategies will outperform those that do not. Finally, the results suggest that alignment leads to a more focused and strategic use of IT, which in turn leads to better performance (Chan *et al.*, 1997; Chan *et al.*, 2006).

1.1.2 Comparison of the selected theories

Each of the theoretical perspectives specified above proposes a different rationale under which firms pursue their preferred outcomes. The RBV focuses on resource ownership and bases the choice of governance structure on the type and similarity of exchanged resources. Under a similar rationale, the DC perspective identifies the processes based on the need for creation versus exploitation of new capabilities, the relative competencies of collaborators, and the levels of uncertainty and risk incurred by the exchange. Respectively, TCE emphasizes the selection of exchange and governance structures considering the nature of assets and the costs and risks of the exchange in order to safeguard firms against the opportunistic behavior of their partners. A comparative summary of these theories is presented in Table 1.

	TCE	RBV	DC
Name	Transaction cost theory; theory of the firm, markets and hierarchies	Resource-based theory	Dynamic capabilities perspective
Originating area	Microeconomics	Strategic management, Microeconomics	Strategic management
Concise description	A transaction cost is a cost incurred in making an economic exchange, which takes place either in market or hierarchical governance structures (Coase, 1937; Williamson, 1973 and 1985).	A firm's valuable and rare resources can lead to competitive advantage, which can be sustained over time subject to the firm's ability to protect against resource imitation, transfer, or substitution (Penrose, 1959; Barney, 1991).	Dynamic capabilities are "the abilities to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece <i>et</i> <i>al.</i> , 1997).

Table 1. Comparison of the selected theories

(Table 1 continued)

	TCE	RBV	DC
Strategy as	Economizing	Decision Making	Adaptation
Purpose of organization	Minimize transaction costs (Williamson, 1991)	Firms as coalitions; adaptive rational systems (Cyert and March, 1963)	Solution to coordination and communication problems
Determinants of organization structures	Structure of transaction costs	Identity, loyalty, and conflict resolution mechanisms	Environmental selection
Main independent constructs	Coordination costs, transaction risks, asset specificity , uncertainty, and trust	Assets, capabilities, and resources	Capabilities, absorptive capacity, environmental turbulence, and agility
Main dependent constructs	Governance structure, degree of outsourcing and its success, inter- organizational collaboration and coordination	Competitive advantage, and superior, long-term performance	Sustainable competitive advantage
Responses driven by	Drive to optimize	Changing aspirations	Inertia and environmental shocks

While both the RBV and TCE address the endogenous uncertainty that derives from partners' behavior, empirical work using the resource-based view or transaction cost logic traditionally predict that under conditions of high uncertainty, firms opt for more hierarchical forms of governance (Leiblein and Miller, 2003; Sutcliffe and Zaheer, 1998). However, many studies that identify with the DC show that firms opt for network relationship structures in highly uncertain environments (Eisenhardt and Martin, 2000, Salomo *et al.*, 2007). This inconsistency among research findings can be explained by the differences in meaning assigned to the "uncertainty" factor, which may be rooted in the different areas of origin and underlying assumptions of these theories.

1.1.3 Prior literature on business models

The existing literature is reviewed here for the express purpose of establishing a context and framework for the research, and for formulating sharper research propositions based on the primary research questions. This follows the principles suggested by Hockey (1991) and Hart (1993), according to which a literature review section should comprise: (1) the provision of a conceptual and theoretical context in which the topic under research can be situated; (2) the provision of a brief up-to-

date discussion of literature on the issues relevant to the topic and to the reader; (3) the provision of reasons why the topic is of sufficient importance to be researched; and (4) the discussion of relevant research carried out on the same or similar topics.

Proliferation of the business model concept in the literature

As with the concept of strategy, there are no dominant definitions of a business model, in either the information systems (IS) literature or the management literature, which would be both consistent and rigorous. This seems to be the case in both the e-commerce and software business contexts, although the term has been prominent in e-commerce discussions for several years. The current semantic confusion related to business models is complicated by consultants and practitioners who use the term "business model" to describe any unique aspect of a particular business venture. One of the earliest definitions of the concept of business models was offered by Konczal (1975), who described a business model as a computerized model in which a simple modeling of business functions was seen as a necessary aid in managing a company's internal processes and routines.

To read up on the origins of the business model concept in the essential academic literature, and to gain an overview of its evolution, a comprehensive review of scholarly articles was necessary. Therefore, a literature review was conducted that included all articles in the annual "EBSCO Business Source Complete" electronic database from 1970 through 2008. The articles were sought using the search term "business model" in (all text) scholarly (peer reviewed) journals, restricting the search to article type documents. The total number of scholarly articles matching these criteria was 9,655. This set includes articles in all of the "Business Source Complete" databases hosted by the EBSCO.

In addition to the selected article database, a number of other databases and search engines were considered, including ProQuest and ISI Web of Science. Yet the EBSCO Business Source Complete database host was selected, as it provided access to the largest number of scholarly articles concerning business models in an electronic format. After the initial article search, a number of articles on each five-year period were selected for further analysis. These articles were chosen on the basis of their titles, abstracts, and keywords. The exact number of articles selected for further content analysis is presented in parentheses by each of the periods in Table 2. The selection criteria were that the articles had the term "model" in the title or abstract, contained the concept "business model" in the document text, and embodied either conceptual or empirical investigation of some aspect of the business model concept in business organizations. The articles selected were read in their entirety, and their key definitions and arguments concerning business models were analyzed. Moreover, their focus and content of business model investigation were noted and coded. Finally, a consensus view of the analyzed articles was condensed to reflect the focus of business model research during each of the periods under examination.

Period	No. of articles	Identified themes	Focus	Sample articles
1971-1975	36 (4)	 Management science models on firm operation Organizational effectiveness models Computerized models on logical interrelationships 	Intra- organizational operation	Kaufman (1971); Urban and Karash (1971); Konczal (1975); Steers (1975); Assmus (1975)
1976-1980	46 (5)	 Corporate planning models Sales effort management Production allocation models Strategic intelligence systems Indicators of business success/failure 	Strategic	Naylor and Schauland (1976); Parasuraman and Day (1977); Mairs <i>et al.</i> (1978); Montgomery and Weinberg (1979); Sharma and Mahajan (1980)
1981-1985	59 (6)	 Strategy support and simulation models Decision support systems Contingency models of organizational structure Success models/strategies Strategies for intrafirm operation and outside sourcing 	planning support	Alavi and Henderson (1981); Morecroft (1984); Chakravarthy and Lorange (1984); Lee <i>et al.</i> (1982); Thietart and Vivas (1984); Harrigan (1985)
1986-1990	70 (7)	 Models for pricing and supplier-vendor exchange Models for the operationalization of the strategy concept Systematic ways for classifying business strategies Asset pricing theories and models Strategies for development of information systems and implementing packaged software 	Linking strategy and operations	Banerjee, (1986); Mintzberg (1987); Chrisman <i>et al.</i> (1988); Affleck-Graves and McDonald (1989); Apte <i>et al.</i> (1990); Davidson and Davis (1990); Lucas Jr. <i>et al.</i> (1988)
1991-1995	123 (5)	 Strategic business planning Financial models for business development Management models incorporated in strategic information systems planning (SISP) Models for linking organizational context and managerial action Strategy selection models 	Cognitive models	Laware (1991); Murray and Trefts (1992); Earl (1993); Ghoshal and Bartlett (1994); Elangovan (1995)

Table 2. Proliferation of the business model concept in the literature

Sample articles	Sengupta and Turnbull (1996); Lyons (1997); Sampler and Short (1998); Van Vliet and Pota (2000); Kodama (1999)	Feng <i>et al.</i> (2001); Rosenbaum (2001); MacInnes <i>et al.</i> (2002); Odeh and Kamm (2003); Engelhardt (2004); Bakhru (2004)	Tikkanen <i>et al.</i> (2005); Bremser and Chung (2005); Sen and Sen (2005); Shapiro (2006); Sgriccia <i>et al.</i> (2007); Drake <i>et al.</i> (2006); Brousseau and Penard (2007); Freeman and Engel (2007); Feng and Chern (2008); Johnson et al (2008); Zott and Amit (2008)
Focus	Inter- organizational strategies	Modeling business ecosystems	Estimating business performance outcomes in collaborative environments
Identified themes	 Optimization of the entire supply chain Models for business process reengineering Models for e-commerce and strategies for dynamic information-intensive environments Models for online shopping, e-business strategies, online retail and Internet intermediaries Modeling community-based information networks 	 Modeling the new economy (econometric/ microeconomic) Technology-enabled supply chain network Business models for mobile content and services Bridging the gap between business models and system models Entrepreneurial models; models for managing online businesses 	 Dispersed themes including models of networked businesses and growth models for enterprises Performance measurement in e-business Metamodeling of management information systems Innovation models Drivers of business models; Strategic decision models and outsourcing models Modeling IT-enabled business, and digital business models Business models for open innovation Pricing policies, operational models for supply-chain management
No. of articles	1058 (5)	3240 (8)	5023 (14)
Period	1996-2000	2001-2005	2005-

*The number of articles selected for content analysis is shown in parentheses.

In the literature (see Table 2), the business model manifests itself in the two main functions of a firm: the distinct processes of value creation and value capture (Lepak et al., 2007). While the firm business model is described by Magretta (2002) as the story that explains how an organization works, the processes of value creation and capture are seen as the plots behind that story. The first part of this plot, the process of value creation, refers to the ways of creating value for the target customers (Westerlund et al., 2008). Conversely, the second part, value capture, discusses the ways of turning these market opportunities into desired performance outcomes of the firm, and thereby justifies the creation of value for the customers. Some of the specific definitions of the business model concept noted in the literature are illustrated in Table 3.

Authors	Definitions
Amit and Zott (2001)	"A business model depicts the design of transaction content, structure, and governance so as to create value through the exploitation of business opportunities."
Chesbrough and Rosenbloom (2002)	"The business model provides a coherent framework that takes technological characteristics and potentials as inputs, and converts them through customers and markets into economic outputs."
Morris <i>et al.</i> (2005)	"A business model is a concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets."
Shafer <i>et al.</i> (2005)	A business model is "a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network."
Tikkanen <i>et al.</i> (2005)	"We define the business model of a firm as a system manifested in the components of related material and cognitive aspects."
Westerlund <i>et al.</i> (2008)	"Business model of a firm spells out how the company generates revenue by specifying the nature of relationships with other actors as well as the firm's position in its value-creating network"
Johnson et al. (2008)	"a business model consists of a number of interlocking elements that, taken together, create and deliver value."
Zott and Amit (2008)	A business model is a "structural template that describes the organization of a focal firm's transactions with all of its external constituents in factor and product markets."

Table 3. Business model definitions - value creation and capture D.C.

In sum, for the purposes of the empirical investigation of the determinants of business models in software firms, and to illustrate the focus of the present study, a definition of the concept of business model is needed. Following the ontological conventions of the prior literature (e.g., Osterwalder, 2004 and Morris et al., 2005), which typically define the business model of a firm through the elements it includes, this study defines the concept of business model as a concise representation of how

an interrelated set of elements – the offering, relationships, resources, revenue model, and management mind-set – are addressed to create and capture value in defined markets. In the present study, this definition provides a starting point for the investigation of the attributes of business models, as well as their antecedents and performance effects.

Business model as the manifestation of strategy and an abstraction of business processes

Despite the confusion over the terminology related to strategy and business models, prior research has achieved consensus on the position of the business model as a conceptual and theoretical layer between strategy and business processes. According to recent studies on business models (e.g., Osterwalder and Pigneur 2002, Morris *et al.* 2005; Tikkanen *et al.* 2005) the business model concept includes some elements of business strategy, and aims at describing the business as a practical manifestation derived from strategy. Thus, the choice of a business model is also strategic in nature and can be a powerful tool for analyzing, implementing, and communicating other strategic choices (Shafer *et al.* 2005). Similarly, Tikkanen *et al.* (2005) conceptualize that strategy gives meaning and direction to the development of the company's business model.

Level of strategy	Contents	Attributes
Corporate level	Corporate strategy	Competitive advantage and value creation through domain selection and business portfolio strategy, resource acquisition and allocation, general business strategy and SBU strategies, and through synergy between units and investment priorities.
SBU level	Business model	Competitive advantage, value creation, and capture through the firm's competitively relevant, business- level characteristics.
Functional level	Business processes	Support for the desired competitive advantage through the development and maintenance of core competences by function-specific and inter-functional processes

Table 4. Business model positioning – levels of strategy

Levels of strategy modified from Hofer and Schendel (1978) and Wheelwright (1984).

The business model of a firm has also been defined as an abstraction of that business (Seddon and Lewis, 2003), which characterizes revenue sources and specifies where the company is positioned in its value-creating network in a specific business (Willemstein *et al.*, 2007). Osterwalder and Pigneur (2002) have depicted business models as the missing link between strategy and business processes. They observe that there is often quite a substantial gap between these two "worlds." According to them, people responsible for the strategic management position in a company define

and formulate objectives and goals, whereas business process and information system designers must understand and implement this information. Timmers (1998) defines business model in the e-commerce context as the architecture for the product, service, and information flows, including descriptions of the various business actors and their roles, the potential benefits these actors would accrue, and the sources of such revenue. Hence, a business model can also been defined as an abstraction of business (Seddon and Lewis 2003), which characterizes revenue sources and indicates where the company is positioned in its value-creating network within a specific business.

Business model elements

On the basis of the literature reviewed in the previous sections, the present study proposes that business models can be analyzed by their distinctive value-creating elements. Several scholars have attempted to identify and define the attributes and elements of business models through which a company creates and captures value and transforms it to desired performance outcomes. To identify the key components that represent the crucial aspects of the business model of a firm, the present study draws upon prior research in the fields of management, marketing, and information systems (e.g., Hedman and Kalling, 2003; Pateli and Giaglis, 2003; Osterwalder, 2004; Morris et al., 2005; Tikkanen et al., 2005). Many of these studies identify a number of elements that are characteristic of different business models. These elements, expressed in different terms by different authors, include: (1) the offerings (Morris et al., 2005); (2) the resources and capabilities needed to conduct business (Pateli and Giaglis, 2004); and (3) relationships with other actors (e.g., in Timmers 2003; Osterwalder, 2004; Morris et al., 2005). These elements are interconnected with (4) the revenue model that is seen as an inseparable element of business models (e.g., Pateli and Giaglis, 2004). In addition, the management mind-set beyond these design characteristics of a business model is identified as a manifestation of management values, principles, and ways of thinking (Tikkanen et al., 2005). Next, each of these interrelated elements of a firm's business model (presented in Figure 1) is discussed separately.

The offering (Morris et al., 2005, 2006), as an element of a business model (Chesbrough, 2007; Linder and Cantrell, 2000), refers to "anything offered to the market – that might satisfy a want or a need of the target customers." According to Linder and Cantrell (2000), offerings can range from products, services, solutions, experiences, and information, all the way to content (Linder and Cantrell, 2000). In the present study, the interesting decisions made regarding company offerings include, for example, the degree of the customization of offerings (standardized or customer-specific), depth and breadth of the product/service mix (Linder and Cantrell 2000), the share of a firm's offering relative to the customers' overall need, the role of offering in production or service delivery, and how the service is made

available to the customers (Morris *et al.*, 2005). Furthermore, Westerlund *et al.* (2008) emphasize its direct link to the value creation logic, which to date is probably the most investigated element in business model frameworks (Pateli and Giaglis, 2003). In this study, the offering is investigated as the *value proposition* that a software firm offers its customers and other stakeholders, and with which it positions itself in the market.

Resources constitute a prominent element in the business model of a firm. They can be defined as the assets and capabilities that are needed to develop and implement a given business model (Pateli and Giaglis, 2003). Betz (2002) investigates resources by distinguishing them in two forms: tangible (e.g., personnel, equipment, facilities, cash flows, and location) and intangible (e.g., design capability, brand names, and relationships to customers and suppliers). A common way to investigate resources is by describing them in terms of a firm's internal source of advantage, "the core competency" (Morris *et al.*, 2005) or "distinctive capability" (Linder and Cantrell 2000). Congruent with Morris *et al.* (2005 and 2006), these concepts refer in this study to a firm's capabilities or skills in providing value, based on specific benefits to customers in specific ways, including heterogeneous capabilities as a function of their activities and search processes. According to Amit and Shoemaker (1993), these capabilities are rooted in the organizational skills and routines that serve as organizational memory to execute repetitively the sequence of productive activities.

Relationships within a business model form a value creating network of the social and inter-organizational relationships essential to the business. Chesbrough (2007) defines this component as the value network that links suppliers and the customers with the focal firm, including the identification of complementors and competitors. However, due to their relational nature, organizational processes and activities (Betz, 2002; Tikkanen et al., 2005), as well as the organization's structures (Linder and Cantrell 2000), are included in this element of the business model of a firm. The management of a company's relationships, involving the actors who have a direct linkage to company operations (e.g., customers and partners) and the so-called extrabusiness constituents (e.g., competitors, debtors), has been identified by Tikkanen et al. (2005) as one of the crucial aspects in executing the company's business model. In this study, as one of the elements of the business model of a firm, these relationships are perceived as resources and also as a means for the firm to gain access to external resources and capabilities. This study thus follows the argument presented, e.g., by Ethiraj et al. (2005), according to which software vendors' capabilities related to the management of relationships appear as an essential source of competitive advantage.

Revenue model. As an element of a firm's business model, the revenue model specifies the ways a firm captures value (Chesbrough and Rosenbloom, 2002). Most often, this component, which is also referred to as the revenue mechanism (Chesbrough and Rosenbloom, 2002), economic model (Morris *et al.*, 2005), or profit formula (Johnson *et al.*, 2008), is discussed in terms of revenue sources, pricing

policy, cost structure, and revenue velocity (Johnson *et al.*, 2008, Pateli and Giaglis, 2003; Chesbrough and Rosenbloom, 2002). On the one hand, the first two involve determining the pricing options (e.g., cost plus or negotiable/fixed prices) and transaction modes (e.g., subscription pay or free products and sale of after-purchase support) (Chesbrough and Rosenbloom, 2002; Linder and Cantrell, 2000). On the other hand, cost structure refers to the operating leverage, margins, and volumes (Morris *et al.*, 2005 and 2006), but it is the financial performance of a firm in terms of profit that ultimately determines the success of any given business model (Chesbrough and Rosenbloom, 2002). In this study, the revenue model is investigated in terms of revenue sources, pricing policy, cost structure, and revenue velocity. It is considered as the firm's means to *capture value* of its offerings through its resources and in its business relationships.



Figure 1. Business model elements

In the present study, these concepts (see in Figure 1) are employed as the principal elements of business models. These elements are also utilized to establish the dimensions applied in the investigation of the generic types and foci of business models. The dimensions, grounded in the theoretical perspectives selected for this study (see section 1.1.1), were used in the analysis of the determinants and performance effects of diverse types of business models in software firms. It should be noted that while these elements are interconnected, their reciprocal causalities are not explicated in the figure.

In addition, other elements could be considered as parts of the business model of the firm; e.g., *management mind-set*, which signifies the existence of business models in the minds of the people pursuing them. This is congruent with the view of Weick *et al.* (2005), who emphasize the role of sensemaking and human action in organizational behavior. The immaterial aspects of a business model are still an emerging topic in the related literature. However, the research of Morris *et al.* (2005, 2006) on ambitions of management and Hedman and Kalling's study (2003) on the processes by which the business model evolves can be seen as stressing the salience

of the management mind-set aspect of the business model. Tikkanen *et al.* (2005) argue that managerial cognition should be considered as an inseparable element of the business model. The present study, however, differs from their view by using the term "management mind-set" instead of "managerial cognition." This conceptualization distinguishes the business model as something that stems from the values, emotions, and attitudes of management, and not only as a result of cognitive, rational thinking and planning.

1.2 Research objectives and delimitations

The main objective of this study is to contribute to the business model discussion by advancing the development of the business model concept from one that lacks clarity towards a more established construct, which can be used both in academic research and in the work of software industry practitioners. This outcome is pursued by identifying the antecedents, undergoing changes, and examining the performance effects of contemporary software business models. Moreover, the aim of the empirical analyses is to enrich the understanding of the attributes, forms, and implications of software firms' business models.

For these purposes, the following research question is posed: "*What are the determinants*² of business model performance in the software industry?" This research question is subdivided into three more precise questions to be addressed in different parts of the study:

- (1) What are the observable determinants of business model design in the software industry?³
- (2) What are the basic types and elementary attributes of business models in software firms?
- (3) What are the performance effects of different types of business models in software firms?

Hence, this study makes three principal contributions. First, it organizes the extant interdisciplinary research around the fundamental changes in software business models. Second, it formalizes the definitions of business models and identifies their basic types in the software industry context. Third, it suggests a research model that offers an explanation of the determinants of the performance of firms' business

² Congruent with the Merriam-Webster's Online Dictionary, determinant is expressed herein as an element that identifies or determines the nature of something, or that fixes or conditions an outcome ("determinant." Webster's Third New International Dictionary, Unabridged. Merriam-Webster, 2002. http://unabridged.merriam-webster.com, 4 Nov. 2009).

³ Note: observed period 1996-2008

models and tests whether such a conceptualization and model are empirically valid. This model should prove useful to both research and practice. Finally, the analysis of business model performance provides the basis for future research directions.

The main delimitation is that the focus in this dissertation is centered on software firms' business models as described later in section 2.2.1. Hence, efforts are not devoted to generalizing the findings to industries beyond the primary software industry. Moreover, the empirical investigation is delimited to analyzing the three antecedents of software firms' business models that were identified in the pre-study phase. These antecedents are (1) the service orientation, (2) technology orientation, and (3) the openness of innovation in software business.

1.3 Outline of the study

The qualitative field study process of this dissertation project (see Figure 2) was conducted over a 4-year period from 2003 to 2007, during which time primary empirical data was collected from software firms. In addition, from 2007 through 2009, the process entailed the administration of two quantitative empirical surveys of software firms. This kind of data collection approach has offered possibilities for triangulation of the analysis, as will be discussed in the methodology section. The main approach to the collection of the empirical data analyzed in the three qualitative papers (Papers I, III and IV) is based on semi-structured interviews with senior managers in the selected case companies. In addition to this kind of primary data, a polymorphic set of secondary data has been collected from the case companies. Moreover, quantitative data has been collected and analyzed in three papers focusing on service co-creation (Paper I), business-IS alignment (Paper II), and business model performance (Paper V).

1.3.1 Research design

As shown in the literature review, the concept of "business model" was not well established in the prior research literature, particularly at the beginning of the study. For that reason, the literature review reflects an apparent conceptual evolution, and a research process consisting of both inductive and deductive phases was considered suitable for the present study. According to Dubois and Gadde (2002), this allows the researcher to explore the meaning of a construct without strictly predefined theoretical frameworks. Therefore, an open-minded interpretation of the empirical findings; i.e., the highly heterogeneous instances of identified characteristics of different software business model, is a guiding principle in this study.

Phase	2001-03 Preliminary study	2004-06 Data collection	2007-09 Data analysis
Focus	Preliminary knowledge – initiating the dissertation	Data collection and analysis – reporting qualitative research	Data analysis and reporting – quantitative investigation
Methods		Literature review	
	Qualitative: case study approach	Qualitative: longitudinal and comparative case studies Quantitative: exploratory factor and cluster analyses	Quantitative: structural equation modeling Qualitative: comparative cases
Data	• 18 interviews with industry experts and senior managers in 12 firms	 36 interviews with senior managers in 20 software firms Telephone survey (N=118) 	Online survey (N=197) Secondary data
Outcomes	2 in-depth case studies Initial frameworks	Paper	Paper II
	Paper		Paper

Figure 2. Research process

For this purpose, the overall research process has comprised both inductive and deductive phases, as is the case with abductive research (Dubois and Gadde, 2002), which pursues a systematic combination of theoretical knowledge and insights gained from empirical inquiries. With abduction, Dubois and Gadde (2002) refer to the parallel processing of the conceptual world based on the prior literature, and the analysis of the observations gathered through empirical research. This is a challenging task for all studies, as researchers may easily identify only those findings that support the researchers' understanding of the studied phenomena in a way that does not represent a rich enough interpretation of the real world occurrences and observable facts. Therefore, the present study has focused simultaneously on the empirical data and its interpretation, and has engaged prior research on business models and software business.

Phase	Focus	Theory	Data	Outcomes
2001-03	Preliminary knowledge	 Contingency theories Ontology and typologies of business models 	Open-ended, semi- structured interviews with industry experts and senior managers in 12 software firms	 Two in-depth case studies Initial frameworks Conference paper⁴
2004-06	Data collection and analysis	 TCE and RBV Network perspective (INA and strategic networks) Business-IS alignment 	Semi-structured interviews with senior managers in 8 software firms (Data used in papers I, III and IV) Telephone survey with 118 senior managers of firms using application services (Paper II)	 Paper II: Business-IS alignment Paper III: OSS business models Paper IV: Business model-specific resources
2007-09	Data analysis and reporting	 RBV and DC Network perspective (Alliances and strategic networks) 	Interviews and secondary data on 12 ICT firms (Paper I) A survey among software firms (N=197) (Paper V)	 Paper I: Service innovation Paper V: Business model performance

Table 5. Research phases

In the final phase of the study, the research process focused on the development of questionnaire items to measure the antecedents and performance effects of software

⁴ Rajala, R., Rossi. M., and Tuunainen, V. K. (2003). A Framework for Analyzing Software Business Models. Electronic Proceedings of the European Conference on Information Systems, Naples, Italy. June 18-21, 2003 – New Paradigms in Organizations, Markets and Society.

firms' business models. This process was deductive in the sense that prior literature and research results were used to aid in the development of scale items and constructs, and in the formulation of research hypotheses. The hypotheses were developed based on the knowledge gained in the preceding phases of the research process. Finally, the investigation of research hypotheses was conducted according to the principles of deduction via structural equation modeling.

1.3.2 Relationships of the included articles

In the first phase of the present research, emphasis was placed on the *antecedents of software firms' business models*. In this respect, the methodology adopts a theory development approach. In the second phase, the study focused on the *business model manifestations*, and on interpretive and comparative case study analyses. The selection of the case companies and a more detailed account of research methods applied in each study are described separately in each of the original papers. In its third phase, the present study explains the *performance outcomes* of business models. The placement of the separate papers in this dissertation is depicted in Figure 3, which also shows the focus of each paper.



Figure 3. Relationships of the articles included

The arrows in Figure 3 depict the logical interrelationships of the papers, and they describe the paths of knowledge accumulated in the process. This knowledge embodies theoretical, methodological, and empirical understanding, skills, and expertise. In the aggregate, the figure illustrates the rough cognitive model of the study.

1.3.3 Structure of the dissertation

This study consists of two parts. *Part I, Overview of the dissertation*, introduces the research area and reviews the relevant literature, and it describes the objectives of the study as well as research methods used. Moreover, it reviews the results from the separate papers included in the dissertation as scientific essays, and relates the results of those papers to the overall theme of the study. *Part II, Original research papers,* consists of the five original research papers presenting the research efforts taken to meet the objectives of this dissertation.

2 METHODOLOGY AND SCOPE

The empirical inquiry conducted in this dissertation focused on the business models of firms operating in the software industry. This section provides an overview of the data collection and analysis methods, the unit of analysis, the ontological and epistemological views of the study, and the essential reliability and validity issues.

2.1 Software industry as the context of study

The origins of the software industry can be traced to IBM's decision to unbundle software from its supply of computers to independent software companies in the 1960s (DeLamarter, 1986). By 1965, a number of major independent suppliers of software and programming services had been established, along with several hundred smaller organizations (Fisher *et al.*, 1983). These companies are often referred to as the primary software industry (BMBF 2000). The primary software companies consider the development, maintenance, and publication of computer software as their main activity. Conversely, the term "secondary software industry" refers to companies that focus on some other industry, but include software as part of their products or services (BMBF 2000).

Software comprises four broad areas: systems infrastructure, applications development, embedded software (e.g., mobile devices), and applications solutions (OECD, 2006). Moreover, there are multiple subsections within each of these four areas. In the present study, the software industry is defined in terms of the production and supply of software for sale as stand-alone products or as part of information system solutions that are not embodied in other non-ICT products. That is, software which is embedded⁵ in other applications, such as controls for electronic devices and domestic appliances, are beyond the scope of this study. Even considering this constraint, there are difficulties with statistics for the industry, since many software producers may identify themselves with the industry represented by their customers.

⁵ Steinmueller (1995) argues that there is no clear boundary between hardware and software. His argument is grounded on the notion that any information processing operation that can be achieved with "instructions" can also be achieved by a hardware subsystem. Similarly, many electronic systems employ programmable components in which a single set of instructions is permanently included at the time of system manufacture. The software in these systems is thus "embedded" in the electronic system. The economics and industrial structure implications of embedded software, while of growing importance, are not considered in this study.

The software business is claimed to be one of the fastest growing industries in the world (Nukari and Forsell, 1999). However, due to the challenges posed by statistics for the industry as a whole, there is a great variance in the estimations of the size of the industry. For example, Hietala et al. (2003) estimated that in 2002, the Finnish software product supply generated revenues of 1,000 M€, of which 40% (400 M€) originated from exports. At the same time, Tyrväinen et al. (2004) estimated that the total revenue in the primary software industry exceeded 3,000 M€, of which almost 1,000M€ originated from software products and 1,400M€ from software consultation and the rest from other software services. Despite the difficulties in estimating the size of the industry, there seems to be consensus that the software industry has grown rapidly since the 1990s. According to recent aggregate sales data from the primary Finnish software firms, the size of the Finnish software product industry amounted to 1.52 billion \in in 2008, not including software-related services. The annual growth of the Finnish software industry exceeds 10%, which is notably higher compared to the growth rates of the European (6.5%) and U.S. (8.4%)software industries (EITO, 2007).

The exact number of software firms in Finland is unknown, since the software business has traditionally been classified under the category of ICT firms in the official industry classification of Statistics Finland. According to Rönkkö et al. (2007), there were approximately 1,000 software product firms in Finland in 2006. To develop an understanding of the size of Finland's software industry, the present study included a procedure to acquire the contact information of all firms in that industry using four steps. First, the names and contact information of firms that belonged either in the Association of the Finnish Software Entrepreneurs or the Finnish Software Business Cluster in 2008 were acquired from these societies. Second, the names and e-mail addresses of the senior managers in those firms were collected from the companies' Web sites. Third, the preliminary set of firms was completed using the standard industrial classification of Statistics Finland, selecting all firms in the category of software consultancy and supply (TOL 2002-722) in January 2009. Finally, the missing contact information was obtained by consulting the nationwide electronic telephone catalogues. The final data set included all identifiable software firms collected from these three sources. After deletion of the overlapping firms, the total sample consisted of 1,355 firms.

2.2 Data collection and analysis

In the separate parts of this dissertation, the empirical inquiry incorporated both qualitative and quantitative research approaches, which were selected to expand understanding of the phenomenon, and to learn from one method to another. The qualitative approaches employed both single (longitudinal) case study and multiple (comparative) case study settings. The applied quantitative methods included two separate surveys; a telephone survey and an online survey.

2.2.1 Unit of analysis

The unit of analysis is the business model of a software company at the strategic business unit (SBU) level. It should be noted most of the firms in the sampling frame are small and medium-sized enterprises (SMEs) that consist of only one SBU. Although this definition of the phenomenon under examination might appear straightforward, the present study investigates the attributes and contents of software business models in the real world and natural contexts, where it can be difficult to separate the unit of analysis from its environment. Lee *et al.* (1982) emphasizes that researchers, especially in organizational contexts, may have trouble determining whether the phenomenon of interest is a particular decision, its enactment, the people who make that decision, the circumstances surrounding that decision, the market and firm, or all of these categories in combination. The present study tackles this challenge by focusing on the business model at the SBU as the overall phenomenon under study while addressing its identifiable dimensions through the particular theoretical and practical perspectives selected in the separate papers.

The focus is placed on software suppliers' business models. However, it is acknowledged that business models are impacted by many factors, including the collaborative action between the supplier and its clients, which is the focus in Paper I. Moreover, it is recognized that business models are not designed in isolation. Indeed, overall market trends and customer preferences have an effect on software firms' business models, such as through the role of technology in business and the use of IS, which is the focus in Paper II. In addition, the software supplier's market-oriented business model design is conditional based on openness to initiatives and inspiration from the environment, which is examined in Paper III. Finally, the resources and capabilities needed in diverse types of business models can be possessed by the supplier or other actors, as investigated in Paper IV. The availability and type of such resources may have a significant influence on a software supplier's business model.

Given the focus discussed above and keeping the delimitations in mind, the present study investigates software firms' business models at the SBU level, between the theoretical and phenomenological layers of strategy and processes. As discussed earlier in section 1.1.3, the concepts behind business model and strategy are sometimes used interchangeably. However, this study relies on the definitions which hold that a business model is not the same as a strategy (Shafer *et al.*, 2005, Magretta, 2002). In general, strategy answers the question of how firms outperform their competitors (Magretta, 2002) by engaging in different activities or by performing the same activities in different ways (Porter, 1980). Porter's (*ibid*.)

classification of firm strategies into the three generic strategy types of segmentation, differentiation, and cost leadership, is the most widely used strategy conceptualization in the marketing literature. A business model, in turn, is a reflection and a result of this strategy, as well as a way of implementing it. In other words, it is a way to position the firm in its competitive environment (Willemstein *et al.,* 2007). As discussed in the literature review, despite controversial views on many business model aspects, the scientific community has reached a consensus regarding the business model's position as a conceptual and theoretical layer between strategy and operations.

2.2.2 Ontological and epistemological views of the study

Before it moved to the actual empirical analyses that focus on the antecedents and performance effects of business models, the present study included a pre-study phase oriented on the business model concept and its meanings in the software industry. In doing so, the pre-study was driven by the interest in scientists' and business practitioners' processing of stimuli from the environment and the resulting cognitive structures that were observable in the way they expressed their conceptions of software firms' business models. According to Mingers (2001), the object of social science is intrinsically value-laden, and social research will inevitably question society's and individuals' self-understandings. Hence, he argues that any discipline that researches aspects of the social world must inevitably have a critical potential in that the social world of meanings and practices. One potential problem considered in the pre-study phase was whether the educational background and experience of the researchers and business practitioners contributing to the discussion on business models led to socially constructed, yet weakly discernible views of reality. Therefore, the concept formation processes and their outcomes represented significant challenges that called for a closer look at the conception of facts, the theory of knowledge, and the concept formation in science. The present study acknowledges that the view of the relationship between these epistemological, ontological, and methodological issues is grounded in the perspective taken on the philosophy of science.

First, Lincoln and Guba (2000) describe the nature of paradigms as a set of basic beliefs (or metaphysics) that deals with "ultimates" or first principles in science. It represents a worldview that defines, for its holders, the nature of the "world." They phrase an *ontological question* related to the beliefs of this kind, such as: "What is the form of nature and reality, and therefore, what can be known about it?" In the pre-study phase, specific attention was paid to the ontological assumption that the world is socially constructed such that it can only be understood by examining the perceptions of the human actors. This contrasts with an objective point of view, which sees the world as external to the researcher. However, towards the end of the pre-study phase and before the actual empirical investigations, the present study

leaned toward the concept that there may be an objectively knowable, mindindependent reality, whilst acknowledging the roles of perception and cognition. This view was associated with the standpoint related to the philosophy of science, which originated in the work of Bhaskar (1978). According to this position of ontological realism, researchers assume a real world, which exists independently of cognition, such that it is independent of thought and speech processes.

Second, Lincoln and Guba (2000) raise an *epistemological question*, which is phrased as "What is the nature of the relationship between the knower or would-be knower and what can be known?" This deals with concerns on either objective detachment or value freedom in order to discover "how things really are" and "how things really work." Herein, Lincoln and Guba (ibid.) emphasize that the assumption of an objectivist posture implies the existence of a "real" world about which to be objective. These considerations are constrained by the first question.

Epistemological aspects		Positions advocated by the consensus-oriented approach				
I.	The object of cognition (Ontological aspect)	<i>Ontological realism:</i> A world exists independently of human cognition; for instance, it is independent of thought and speech processes.				
II.	The relationship between cognition and the object of cognition	<i>Constructivism</i> : The relationship of cognition and the object of cognition is determined by the subject.				
III.	Considerations on true cognition and the concept of truth	<i>Consensus theory of truth:</i> A statement is true (for a group) if it is acceptable to the group. <i>Semantic theory of truth:</i> A condition for truth is the differentiation of an object and a meta-language.				
IV.	The origin of cognition	<i>Kantianism</i> : Both experience and intellect are sources of cognition. Thoughts are meaningless without content and cognitions are blind without being linked to terms.				
V.	The means to achieve cognition (Methodological aspect)	<i>Inductivism</i> : Induction is understood as the extension from individual cases to universal phrases, the generalization. <i>Deductivism</i> : Deduction is the derivation of the individual from the universal.				

Table 6. Consensus-oriented epistemological views of the stud	Table 6.	Consensus	-oriented	epistemo	logical	views	of the	study
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(Adapted from Becker and Niehaves, 2007)

Third, Lincoln and Guba (2000) argue that the fundamental *methodological question* of scientific studies, phrased as "How can the inquirer (or would-be knower) go about discovering whatever he or she believes can be known," is constrained by the ontological and epistemological considerations described above. Therefore, as suggested by Becker and Niehaves (2007) for researchers working under conditions of methodological pluralism, a consensus-oriented view of epistemology (see Table 6) was considered. The consensus-oriented approach is aimed especially at information systems (IS) research, where the epistemological assumptions made by
different researchers may vary fundamentally. This is also the case in the present study, as the researchers and business practitioners who contribute to the discussion on strategy and business models view the issues from the perspectives of their respective disciplines and research communities.

Throughout the primary research process, special attention is paid to selecting and rationalizing the theoretical perspectives used to analyze different aspects of business models. However, the present study can be considered theoretically challenging, as there are no dominant paradigms that cover the entire field, but the study uses several paradigms. According to Robey (1996, p. 406), "theoretical foundations for research and specific research methods are justified by research aims, or purposes. They should not be chosen because they conform to a dominant paradigm or because the researcher believes in their intrinsic value. Rather theory and method are justified on pragmatic grounds as appropriate tools for accomplishing research aims." Therefore, the study utilized both inductive and deductive phases, as the means to achieve cognition.

Mingers (2001) argues that it is possible to use multiple research methods and methodologies and use them, critically and knowledgeably, within a context that makes different assumptions. Therefore, critical pluralism, based on Bhaskar's (1978) critical realism, provides with the key epistemological premises for this study. Furthermore, on the basis of the three questions posed by Lincoln and Guba (2000), and consistent with several methodological studies (e.g., Bryman *et al.*, 2003; Collis and Hussey, 2003; Ritchie and Lewis, 2003), a multimethod research design as a combination of qualitative and quantitative research approaches, that pay special attention to triangulation, is most natural for this study.

2.2.3 Qualitative research

Preliminary study

The first phase of the research, its preliminary study, was highly iterative and inductive. It initiated the dissertation and sought preliminary knowledge about the topic. As well, it followed Silverman's (2004) suggestion that "researchers need to focus on ways in which the actors order their own world, and avoid counting everything" (p. 181). This exploratory phase was carried out using the case study methodology suggested by Yin (1994), in which interviews and observations are used to collect primary data, coupled with an inductive case study approach (Glaser and Strauss, 1967, Strauss and Corbin, 1998) for analysis and theory building. As the research question did not imply a clear and testable hypothesis, an inductive approach was essential. The research framework applied in the first phase of the study can be described as a multiple case study, which is composed according to the theory building structure described by Yin (1994). This method was justifiable because the context included non-quantifiable concepts. The concept "business

model" itself had to be constructed from understandable elements prior to further analysis.

Strauss (1987) emphasizes the usefulness of the case study approach when used in combination with theory generation. The utmost form of inductive theory generation, the grounded theory approach, seeks to generate theoretical statements and ultimately, theories based on empirical evidence. In the pre-study phase, the case study method of qualitative data analysis was used to identify the essential attributes of business models. However, the aim was not to build a complete theory; instead, it was to find a suitable level of abstraction for the analysis of business models. Hence, the research question of the pre-study phase was twofold: What are business models? What are their principal elements in the software industry?

The data collection began with 18 interviews of senior managers from 13 software firms and 2 experts of the field. The interviews are listed in Appendix I. One of the experts was a representative of the scientific community, a senior management scholar, and the other was a business practitioner. The expert interviews helped to define the problem domain and paved the way for the interviews with the managers of the selected case firms. In the empirical setting, 13 software firms were selected to be analyzed in a multiple case study. Later, one of these cases was rejected from the analysis as it did not incorporate an identifiable business model. In fact, that company went bankrupt later during the research project. The cases were selected based on preset criteria including market focus, company size, and company age. In addition, two business model dimensions, the type of offerings and the nature of customer relationships, were used to address the different types of software businesses. After 12 cases, the same key issues started to surface in the interviews; therefore, these 12 were considered sufficient. The interviews were tape-recorded, and the parts that concerned the business models were transcribed.

The interviews included open-ended questions, like "describe your business model [in words]." To make sense of the data, the observations were organized according to a classificatory scheme developed on the basis of the interviews. Following the process suggested by Strauss and Corbin (1998), items were identified from the data and defined according to their generic properties discovered in the cross-case setting. The open coding resulted in four root categories (offering, resources, revenue model, and relationships), which served as a starting point for analyzing the elements of business models in the primary study. Moreover, the interviews conducted in the pre-study phase uncovered factors that influenced the business model design in software firms. Exploration of the business model antecedents in the interview data highlighted that the prolific service dominance in software delivery, the growing role of information technology in business, and the openness of innovation activity in software development seemed to entail new ways of thinking in the software business. Congruent with the findings from literature review, these themes were considered noteworthy factors that affected business model design during the period observed. These themes guided the interest in the primary study phase and provided a reasonable delimitation for the empirical investigation of business model determinants in software firms.

Qualitative data collection and analysis

In the primary qualitative field study phase of this research, senior management representatives were selected as the key informants due to the sensitive nature of the information being sought. Given the research questions in this phase (see Appendix III for an outline of the interviews), senior managers were seen as viable sources of information in the critical evaluation of the representativeness and validity of the data. The interviews were recorded and transcribed. The semistructured interviews conducted in this phase of the study contained many openended questions, discussions, and considerations by management related to selected themes. The interviews followed the guidelines suggested by Yin (2003), relative to which type of questions asked in the interviews should be considered from the perspective of the research setting and objectives. In this respect, the present study focused on "what" questions as it tried to explore the empirical phenomenon; i.e., the identified behavior related to business models in the software industry. Therefore, a majority of the questions asked in the management interviews focused on what had happened in real life concerning the business models of the case companies. In addition, the analysis focused on "how" questions, as the study identified and described the identifiable patterns of business model transformation through multiple empirical observations.

In the primary field study phase, data collection included 36 interviews in 20 software firms. The interviews lasted for one and half to thee hours each. The average length was two hours. A list of the interviews is presented in the Appendix I. and, an outline of the themes of these interviews is presented in the Appendix III. The interviews were exploratory in nature and sought to elicit managers' views on the business models of their firms, with their own frames of reference, without imposing researcher's preconceptions. That is, in the qualitative field study, there were no models set out to test specific points, but rather to elicit and analyze the views of knowledge-rich experts.

A multiple (comparative) case study approach was selected as the main method for analyzing the qualitative empirical data. This approach was selected to gain and understanding of the construct under study; i.e., the essential attributes of business models among the cases. An example of the case comparison is presented in Appendix II. In addition to these comparative case analyses, a longitudinal single case study was conducted to gain insight into the business model transition in a software firm. As Lukka and Kasanen (1993) and Yin (2003) illustrate, the aim of case studies in general is to acquire a deep understanding of the nature, significance, and functioning of one or a few cases, and to report this understanding thoroughly, carefully, and credibly to the larger scientific audience. At the same time, they contemplate a common argument against case studies, such that they provide little basis for scientific generalization. Eisenhardt (1989) discusses this concern by introducing a process for building more generalizable theories from case study research. Her theory-building process is based on the use of multiple cases and cross-case analysis, which allow the researcher to draw more generalizable theoretical conclusions. As this is the aim in the second phase of the study, a closer look at the multiple case study methodology is considered reasonable.

Eisenhardt (1989) is clearly in favor of a positivist view of research in that her theory-building process is "directed toward the development of testable hypotheses and theory which are generalizable across settings." She has received some criticism, such as from Dyer and Wilkins (1991), who see the method as paradoxical because its purpose is theory generation, yet it includes many of the attributes of hypotheses testing. Dver and Wilkins (ibid.) do not think that Eisenhardt's approach is necessarily wrong, but they do believe that it is limited in important ways because it neglects some of the strengths of the classic, in-depth case study research approach. Dyer and Wilkins' (1991) argument is directed especially towards Eisenhardt's advocacy of multiple over single case studies. They emphasize that the essence of classic, in-depth case study research is "the careful study of a single case that leads researchers to see new theoretical relationships and question old ones." This argument embodies an essential point for the present study, as there is the risk that multiple case studies may lead to rather "thin" descriptions while single case studies can produce "rich" and "deep" descriptions. As Dyer and Wilkins (1991, 615) point out notably, single case studies can reach a deeper level of contextual insight and understanding, while multiple case studies are likely to provide a rather distorted picture-or no picture at all-of the underlying dynamics of the case. However, Eisenhardt's (1989) view of the strength of the multiple case study approach is valid in the theory-building process when exploring the underlying dynamics of the phenomenon under study. This is the case relative to the overall objectives of the present study, as it is not seeking an answer to questions like "Why things happen?" Rather, its focus is on the analysis of "how things happen" at the level of the business model of a firm, based on the occurrences identified in software firms' businesses.

In addition to conducting the intensive field study to collect primary data, an extensive set of secondary data was collected on the case companies. The data comprise internal documents, brochures, bulletins and annual reports, presentation material, reviews, and information published on internal and external Web sites, and pages of independent forums and industry associations. This principle was borrowed from Yin (2003), who emphasizes the importance of using multiple sources of evidence, creating a case study database, and, maintaining a chain of evidence as essential principles of data collection. For these reasons, a multifaceted,

yet comparable case study database was created on each of the selected case companies.

2.2.4 Quantitative research

Survey research is one of the most important methods available in the social sciences for the collection and measurement of empirical data. It is the method used to gather data from respondents seen as being representative of some population by utilizing an instrument composed of closed structure or open-ended items. This study utilizes questionnaires with a closed structure, where the latent variable items were drawn from the prior research literature.

In the quantitative field study phase, two kinds of survey methods are employed: telephone and online. First, a telephone survey was conducted in June 2005 to investigate the role of information technology in business models. Specifically, the survey focused on business-IS alignment in the context of application service decisions. From the perspective of the present study, this survey offered intriguing insights into the role of information technology as an antecedent in business model development. As a byproduct, it also provided insights into software (application service) providers' customer relationships. The sampling frame in this survey consisted of the 200 largest firms in Finland. However, public organizations and firms that did not have information systems management functions in Finland were excluded. The final sample consisted of 146 Finland-based firms, of which two people, a SBU manager and a representative of the IS management, were selected as informants. Hence, the targeted number of respondents was 292. The study yielded 118 usable responses (40.4%), which can be considered excellent in this kind of research. The representatives of the IS management functions were either chief information officers (CIOs) or managers of information management departments. The SBU managers included directors of business units, business development managers, chief financial officers (CFOs) and financial managers.

Second, an online survey of software firms' business model antecedents, business model focus, and performance was conducted in 2008-2009. This survey was administered to virtually all software firms in Finland. The total sample consisted of 2,547 potential respondents representing 1,355 software firms. The respondents were recruited via e-mail, in which an invitation and a link to the survey were included in the message body. The questionnaire yielded 197 usable responses for the analysis from 179 firms out of 1,355, which means that more than 13% of Finnish software firms were polled by the survey. In order to validate the proposed research model, the present study utilized a structural method technique known as Partial Least Squares modeling (PLS), which falls into the category of latent variable analyses. Multi-item scales were used to measure all constructs. The survey explored the antecedents, business model type, and performance effects of software firms. The

theoretical knowledge gained during the earlier stages of the research process has guided the selection of variables used in the quantitative analysis.

2.3 Reliability and validity

Lee (1999) emphasizes that while reliability is defined traditionally as the total amount of shared systematic variance, which includes any systematic error or bias, validity can be defined as the shared "true" variance between an underlying concept and its empirical scores. Therefore, he concludes that validity defined in terms of the true variance includes only the "theoretically meaningful" systematic variance between an underlying idea and its explicit representations. Therefore, special attention was paid to the objectivity of the interpretation of the empirical data by striving for a certain degree of distance from the research material and by representing them fairly and transparently as emphasized by Strauss and Corbin (1998). However, in the literature focused on research methodologies, the topics of reliability and validity are sometimes viewed as controversial among qualitative and quantitative researchers. Lee *et al.* (1982), concludes that the traditional, still cardinal, concepts of validity and reliability are socially constructed, pluralistic, and compatible with multiple and coexisting worldviews.

For the *qualitative* empirical inquiry, the present study relies on the views of validity and reliability of qualitative methodologists, such as Yin (1994), who discusses these concepts in the context of case study research, and Kvale (1996), who addresses these issues in terms of the active and dynamic efforts of the researcher on site. According to them, a qualitative case study approach should not be evaluated in terms of generalizability (or lack thereof), but in terms of whether it contributes to increased contextual insight. However, Lukka and Kasanen (1993) note that if a case study is able to offer a credible understanding of a specific context, it may be possible to use this understanding in other contexts. In other words, it may be possible (in a non-positivist and non-probabilistic sense) to "generalize" research results from one specific context to other contexts. A multiple case study may therefore be "generally useful," if it is based on a thorough understanding of four elements (Lukka and Kasanen, 1993): (1) theoretical knowledge of a substance area, including concepts, models, claims, interpretations, and research tradition; (2) prior empirical results and their interpretations, including laboratory, survey and case studies; (3) the researcher's own empirical results and their interpretations; and (4) the environment of the phenomenon, including history, institutions, and markets. Hence, a general point is made here that although case studies do not offer generalizability in a positivist or probabilistic sense, the results of a case study may also be useful in contexts other than that of the specific case study.

Regarding the reliability and validity of the *quantitative* parts of the study, a critical concern is whether the findings can be generalized into a larger population. In

regard to the data collection method described in Paper V, the questionnaire was administered to 1,355 software firms. As discussed earlier in section 2.1, it indeed be claimed that virtually all software companies in Finland were invited to the survey. The questionnaire yielded responses from 179 firms, which means that more than 13% of Finnish software firms were covered by the survey. In addition, for the purposes of checking non-respondent bias, data from an additional 101 respondents was received later via an additional reminder about the survey invitation. Analysis of the data from these 101 respondents showed no significant difference compared to the data obtained from the earlier responses, which can be seen as an additional support for validity and reliability. With all responses included, the data represents 258 out of 1,355 firms, which is a 19% representation of the Finnish software industry. Hence, the data enables reasonable grounds for generalization of the results from the quantitative analysis to Finland's entire software industry.

To address common method variance (CMV), which can be a problem when both dependent and independent variables are measured in the same survey, the study used Harman's one-factor test. Factor analysis revealed that there were five factors with an eigenvalue greater than 1, and no single factor dominates the explanation of the total variance. The first factor explains 19% and together, the five factors explain 65% of the total variance. Thus, according to Podsakoff and Organ (1986), CMV is unlikely to be a concern. Firm size provides another important aspect to be discussed when generalizing the results. According to prior studies and industry reports on the software business in Finland (e.g., Rönkkö et al., 2007), the majority of software firms in Finland are small, and fewer than 10% of them have more than 100 employees. Distribution of firms in the sample in the present study is congruent with that of prior studies: 23% of firms have fewer than 5 employees and 81.6% have fewer than 100 employees in cumulative terms.

The analysis of the survey data follows the criteria presented by Marcoulides *et al.* (2009), who insist that in structural equation modeling, the proposed model should meet the underlying structural assumptions for the methodology and be developed in a manner consistent with all available theoretical and research-accumulated knowledge in the respective substantive domains. This has been a guiding principle in the modeling conducted in the present study. In addition, the present study has paid special attention to the distributional assumptions of the data including linearity of relationships, completeness of data, multivariate normality, and adequate sample size. The sample size (N=197) is more than adequate considering the minimum data set requirements for the selected analysis methods as presented by Hu *et al.* (1992) and Chin (1998). In addition, the study pays special attention to the theoretical knowledge gained in the earlier stages of the research process, which has guided the selection of variables used in the subsequent quantitative analysis.

2.3.1 Triangulation

Triangulation is widely recommended as a way of improving the reliability and validity in social research (Denzin, 1978; Flick, 1992; Bryman et al., 2003). Notably, triangulation does not merely validate claims or strengthen data sets; instead, it also offers ways to enrich data analysis. It is grounded on the principle of looking at the research question from several viewpoints. One form of triangulation, data triangulation, uses multiple data types (e.g., qualitative and quantitative,) to investigate the research question. Yin (1994) emphasizes that a reliable study requires multiple sources of evidence, a sufficiently operational set of measures, and internal and external validity. Huberman and Miles (1994) describe this as "selfconsciously setting out to collect and double check findings." In the present study, data triangulation is followed through time, space, and among people. For example, most interviews included more than one senior manager of the firm in order to avoid overly subjective opinions and views. Furthermore, data was collected from different types of firms according to a theory-based business model classification, in order to avoid the bias of unintended firm similarity. The average duration of the interviews was about two hours. The interviews were tape-recorded and transcribed. The survey data includes respondents from about 200 firms in the Finnish software industry. To ensure external validity, two firms were selected from outside Finland, one from Norway, and another from Denmark (see Appendix I).

In addition to data triangulation, Denzin (1978) identifies three other types of triangulation: methodological, investigator, and theory. The premise of methodological triangulation is that the researcher can be more confident about a result if different methods lead to the same outcome. Therefore, it is employed in both qualitative (inquiry) and quantitative (validation) studies.

Similarly, investigator triangulation involves multiple researchers in an investigation. In the present study, investigator triangulation was addressed in the first two phases of the study when two separate researchers analyzed the qualitative data. In the last phase, due to the requirements regarding dissertation studies, the collection, analysis, and reporting of data was conducted solely by the dissertation author. Even then, the survey questionnaire was planned in cooperation with another researcher to maximize the potential respondent rate and ensure the quality of the questions. In sum, for those parts of the research that were conducted by a research team, the interpretations of the findings were verified separately by several individuals. In the part of the study that was carried out by one person, the transparency of the analysis from data collection to conclusions is highlighted.

According to Denzin (1978), theory triangulation entails the use of more than one theoretical scheme in the interpretation of the phenomenon. The present study draws in all respects from several distinctive theoretical approaches, including the TCE, RBV, and DC perspectives. These theoretical lenses, all of which are

recognized in the field of information systems research, are applied in each part of the study. In this vein, the principle of theoretical triangulation was addressed throughout the study. The analysis process was a continuous interaction between theory and empirical research as suggested by Dubois and Gadde (2002). In the abductive research process, data is collected simultaneously with theory building, which results in a back and forth action between theory and empirical study (Dubois and Gadde, 2002). The abductive approach begins with real-life observations and continues with an attempt to find a matching framework with which to extend the theory used prior to the observations based on the empirical findings. According to Dubois and Gadde (2002), this enables the investigators to expand their understanding of both theoretical and empirical phenomena. However, as argued by Eisenhardt (1989) and Dubois and Gadde (2002), this approach is challenging since it requires the researcher to maintain a clear focus of the analysis.

Denzin (1978) concludes that all of these types of triangulation are required in order to meet the triangulation requirements. Bryman *et al.* (2003) and Olsen (2003) add to the discussion on triangulation that when conducted properly, triangulation becomes a series of steps associated with changes in the researcher's conceptual map of the terrain. Therefore, quantitative and qualitative techniques are increasingly integrated (e.g., Robson, 2001). Bryman *et al.* (2003) describe the result of multimethod research strategies as "convergent validity." As a result of triangulation, common ground emerges between social constructionist and realist research techniques despite their epistemological differences.

2.3.2 Challenges relating to the analysis methods selected

Multiple case studies

Robert Stake (in Denzin and Lincoln, 2000) argues that both qualitative and quantitative approaches provide narrow grounds for strict comparison of cases, despite a tradition of grand comparison within comparative anthropology and related disciplines. Dyer and Wilkins (1991) emphasize that the essence of a classic, in-depth case study research is "the careful study of a single case that leads researchers to see new theoretical relationships and question old ones." This argumentation embodies an essential point for the present study, as multiple case studies may lead to rather "thin" descriptions, while single case studies can produce descriptions that are "rich" and "deep." Similarly, Yin (1994) is critical of some case study research settings. He argues that case study investigators have been sloppy too many times by allowing equivocal evidence on biased views to influence the direction of the findings and conclusions. Yin (*ibid.*) concludes that case study research is remarkably hard to conduct, despite the fact that it has been considered a "soft" approach. Moreover, he argues that the softer the research strategy, the harder it is to employ.

Consistent with this argument, Easton (1995) identifies three weaknesses in case study research. He regrets that some case studies are simply rich descriptions of events from which the readers are expected to draw their own conclusions. Second, some case studies are really examples of data that appear to provide, at best, partial support of particular theories or frameworks and are used in a quasi-deductive theory testing way. According to him, the third kind of case study approach employs multiple "case studies" in a way which suggests that they rely on some notion of statistical generalization. Weick (1979, p. 38) delivers a similar criticism of case studies by stating that many "pseudo observers" fail to describe anything in their attempt to describe everything. His solution to this problem is to "invest in theory to keep some intellectual control over the burgeoning set of case descriptions."

Bearing these challenges in mind, this study systematically combines theoretical constructs with empirical observations. Dubois and Gadde (2002) identify this kind of an approach, in which a stronger reliance on theory than is suggested by true induction, as a process of "systematic combining." They have been inspired by what is referred to as abductive logic (Peirce, 1931; Kirkeby, 1994). According to these "abductivists," investing in theory might improve the explanatory power of case studies.

Structural equation modeling

Satorra (1990) and Marcoulides and Saunders (2006) point out that in order to use any latent variable methodology to its fullest potential, the proposed model must satisfy the underlying structural and distributional assumptions for the methodology, and be developed in a manner consistent with all available theoretical and researchaccumulated knowledge in a given substantive domain. Furthermore, they emphasize that structural assumptions demand that no intended (observed or theoretical) variables are omitted from the model under consideration, and that no misspecifications are made in the equations underlying the proposed model. An example of such a structural misspecification would be the omission of a relevant predictor variable (observed or theoretical) that is correlated with other exploratory variables. The omission of such a predictor variable would bias the estimates. Furthermore, the psychometric properties of the variables-the strength of the relationships among the variables, the model, and the characteristics of the datahave received a considerable amount of attention in the broad statistical literature. According to Marcoulides et al. (2009), the demands of the distributional assumptions of the data include the linearity of relationships, completeness of data, multivariate normality, and adequate sample size.

There is no doubt that the sample size plays an important role in almost every statistical technique applied in practice. The claim about the desirability of larger sample sizes when using PLS is not new. For example, Hui and Wold (1982) determined that PLS estimates improved and their average absolute error rates were

reduced as sample sizes increased. Similarly, Chin and Newsted (1999) determined that small sample sizes (e.g., N = 20) do not permit a researcher to detect low valued structural path coefficients (e.g., 0.20) until much larger sample sizes (i.e., between N = 150 and N = 200) are achieved. Small sample sizes could only be used with higher valued structural path coefficients (e.g., 0.80), and even then will result in "reasonably large standard errors" (Chin and Newsted, 1999, p. 333). Although there is universal agreement among researchers that the larger the sample the more stable the parameter estimates, there is no agreement regarding what constitutes a large sample. In the present study, the latent variable methodology was applied to analyze a sample of 197 responses.

A rule of thumb in structural equation modeling (SEM) applications suggests that the sample size should always be more than 10 times the number of free model parameters (Bentler, 1995; Hu et al., 1992). The term SEM is used generically to refer to path analysis with latent variables or covariance-based models. Chin (1998) suggests that researchers use a rule of thumb of 10 cases per predictor, whereby the overall sample size is 10 times the larger of two possibilities: (1) the block with the largest number of indicators (i.e., the largest so-called measurement equation) or (2) the dependent variable with the largest number of independent variables impacting it (i.e., the largest so-called structural equation). Chin generally favors this approach when indicating that "under this circumstance it may be possible to obtain stable estimates" (p. 311). He still admonishes researchers to be cognizant of the fact that, "the stability of the estimates can be affected contingent on the sample size" (p. 305). Taken together, the sample size (N=197), compared to the number of free model parameters, is concordant with the requirements presented by Hu et al. (1992) and Chin (1998), thus addressing the critical considerations raised by Marcoulides and Saunders (2006).

Finally, the research design that employs abductive research process as suggested by Dubois and Gadde (2002) necessitated that researchers should pay attention to systematic combination of theoretical knowledge and insights gained from empirical inquiries. In the present study, the theoretical knowledge gained in the preceding parts of the study has guided the selection of variables used in the subsequent quantitative analysis that employs PLS-based structural equation modeling. Nine out of the ten variables in the structural model are derived from the prior research literature, while one is based on the insights gained in the longitudinal study conducted as part of the present study.

3 REVIEW OF THE RESULTS

This doctoral dissertation includes five research papers. In this section, the results of the papers are reviewed from the perspective of their contributions to the objectives of the present study. The objectives are distilled into the main research question: "What are the determinants of business model performance in the software industry?" The first paper addresses the service dominance in software business by analyzing several approaches to software-intensive service innovation and clientprovider collaboration. The second paper investigates the influence of information systems (IS) on business models from the perspective of business-IS alignment. The third paper analyzes the influence of a firm's engagement in open innovation to its business model design in the field of open source software. The fourth paper is focused on the manifestations of business models through investigating the basic types and elementary attributes of business models in the software business. The fifth paper condenses the study into an investigation of the antecedents and performance effects of the different types of business models through a quantitative analysis. Next, each of the papers is reviewed in terms of its research objectives and methods, as well as their findings and the contributions they make to the entire doctoral dissertation.

3.1 Service Innovation Myopia? A new recipe for client-provider value creation

Paper I: Möller, K., Rajala, R., and Westerlund, M. (2008). Service Innovation Myopia? A New Recipe for Client-Provider Value Creation. *California Management Review*, Vol. 50, No. 3, Spring 2008.

3.1.1 Research objectives and methods

This paper addresses the second and third research questions of the dissertation: "What are the observable determinants of business model design in the software industry?" It examines the service innovation strategies in the ICT field from the perspective of the resource-based view of the firm and the management competencies involved. It discusses the shortcomings of traditional management thinking, which addresses either the service provider's or the client's individual competences and competitive advantage in service innovation. The paper argues that this is myopic in the extreme, and shows that value creation should be based on the simultaneous recognition of the interests and competencies of both parties.

The paper establishes conceptual frameworks that outline the main types of service innovations and service strategies of both service providers and their clients. The

characteristics of three main types of service innovations (established service, incremental service innovation, and radical service innovation) are outlined, as these can be shown to require different approaches to value creation. Moreover, a service strategy matrix is constructed to illustrate the client-driven, provider-driven, and collaborative service innovation strategies. Second, the paper discusses these frameworks through a qualitative empirical analysis of selected cases in the field of ICT. The primary data for the cases is gathered through interviews conducted both personally and via e-mail. Moreover, the study utilizes secondary material available online from the 12 case companies.

3.1.2 Findings and contribution

The article provides a recipe for managing the service co-creation modes, along with guidelines on how to succeed through collaborative capabilities and culture, as well as appropriate business models. The results of the analyses conducted on the selected business cases illustrate the discussion on service co-creation drawn from the prior literature on RBV and its extensions. Furthermore, this paper formalizes the definition of service innovation myopia into a concept that should prove useful to researchers and practitioners alike.



Figure 4. Collaborative modes of service co-creation

The paper introduces the concept of service innovation myopia in order to continue the discussion in the marketing discourse stimulated by Theodore Levitt's seminal work on "Marketing Myopia" (1960). The paper argues that the prior discussion on services in many respects faces the same challenges that product-oriented thinking had at the time of Levitt's argument. The present paper argues that *"Service innovation development is myopic in the extreme if it overemphasizes the interests of either the service provider or the client."* In short, service innovation myopia refers to the service co-creation process, where either the client's or the provider's perspective dominates the other's development. Hence, the focus is on the interests of a single party. Then again, the focus may be too much on the value creation process instead of value realization (i.e., the current or future value that could potentially be realized through the process). The argument of the paper is that service innovators should benefit from collaborative service co-creation. The paper contributes to the whole dissertation by identifying and analyzing three different modes of service innovation in software-intensive contexts. Moreover, the paper adds to the understanding of service strategy as one of the dimensions of firm's service orientation and discusses its implications for business model design.

3.2 Approaches to strategic alignment of business and information systems

Paper II: Kajalo, S., Rajala, R., and Westerlund, M. (2007). Approaches to strategic alignment of business and information systems: a study on application service acquisitions. *Journal of Systems and Information Technology*, Vol. 9, No. 2, pp. 155-166.

3.2.1 Research objectives and methods

The purpose of this paper is to analyze the factors that drive the consistency in technology-related decisions and result in diverse modes of business-IS alignment. Technology-related issues have an increasing impact on business. The alignment among overall business objectives and technology-related decisions, such as decisions on application service acquisitions, resurfaces occasionally in the intense academic discussion on information systems (IS). Prior research indicates that the alignment of business and IS decisions remains a major concern for business practitioners.

The paper sheds light on the first research question: "*What are the observable determinants of business model design in the software industry?*" by investigating the ways firms make use of IS in business. The study investigates application service acquisitions among the top 200 firms in Finland. The contact information was obtained from the customer database of a major Finland-based software vendor and software service provider. Thus, the analysis extends beyond the boundaries of software firms and focuses on their customers' preferences and strategies, which are considered salient in market-oriented business model design (Jaworski and Kohli, 1993; Javalgi *et al.*, 2005). In this quantitative empirical study, principal component analysis using the Varimax rotation method examines the companies' drivers of business-IS alignment. Moreover, the firms are categorized using the cluster analysis method.

3.2.2 Findings and contribution

Based on a literature review, the paper identifies different levels associated with the maturity of the business-IS alignment, which have been structured in prior studies (e.g., Chan and Reich, 2007). Luftman (2000) describes the maturity through five modes including *nonexistent* alignment, where there is a complete lack of effort to align IT and business strategy. In such a mode, information technology functions in a purely supportive role. Moreover, in the mode defined as *ad hoc alignment*, there is evidence that the organization recognizes the need to align IT and business strategy. However, there are no standardized processes available; rather, only fragmented attempts are made, often on a case-by-case basis within individual business units. Moreover, repeatable alignment represents the awareness of alignment issues across the enterprise. In such a situation, business-IS alignment activities are under development and include processes, structures, and educational activities. While strategy alignment occurs in some business units, it does not take place across the entire enterprise. However, some attempts are made to measure and quantify the benefits. In addition, alignment described as a *defined process* manifests the need for IT and business strategy alignment that is both understood and accepted. In such a mode, a baseline set of processes is defined, documented, and integrated into strategic and operational planning. Measurement criteria are developed, and activity is monitored. Finally, optimized alignment describes a situation where there is advanced understanding of IT and business strategy alignment. Processes have been refined to a level of external best practices based on the results of continuous improvement and maturity modeling with other organizations. External experts are leveraged, and benchmarks are used for guidance. Monitoring, self-assessment, and communication about alignment expectations are pervasive.



Figure 5. Modes of business-IS alignment

The empirical analysis identifies four factors that drive the achievement of business-IS alignment: awareness of the impact and risks of IS decisions, the efficacy of IS management, a systematic decision making process, and the business development orientation of IS management. Moreover, the study identifies four clusters of firms that illustrate diverse modes of business-IS alignment: ad-hoc alignment, businessdriven alignment, consensual alignment, and technology-driven alignment. Figure 5 summarizes the factor differences in each cluster by illustrating the mode of business-IS alignment in firm groups.

The main contribution of this paper to the objectives of this dissertation is in investigating the influence of information technology on business model design. It reveals that information technology plays an ever more important role in firms' business strategies. Bearing in mind that customers' preferences and strategies in the use of technology are essential factors in software firms' business model design, the study investigates the information technology needs and preferences of application service users in the selected sample of firms and analyzes their business-IS alignment. The study identifies four distinct approaches to business-IS alignment. Moreover, the paper suggests that business-IS alignment stems from several factors, including the collective development of strategies that reflect the combined knowledge of business and IT managers. Hence, the study adds to the understanding that software vendors need to take their customers' different approaches to IT use into consideration when designing their business models.

3.3 Strategic Flexibility in Open Innovation: Designing Business Models for Open Source Software

Paper III: Risto Rajala, Mika Westerlund, and Kristian Möller. *European Journal of Marketing* (accepted for publication).

3.3.1 Research objectives and methods

This paper explores how market orientation facilitates the strategic flexibility of business models grounded in open innovation. The aim of the paper is to explore the key considerations in designing a business model for a firm operating in the field of open source software (OSS). Congruent with the arguments of Fitzgerald (2006), the paper acknowledges that strong commercial orientation has become a mainstream and viable form of OSS business. Yet designing a winning business model has proven to be a challenging and complex issue within the OSS movement. This is because OSS business models are based on software that is typically distributed freely or accessed by any interested party, usually free of charge. Moreover, the ambiguous free software tradition within the OSS movement encompasses culture and values that sometimes contradict the strategies and strong commercial orientation traditionally associated with proprietary software-based business models. It should be noted, however, that as with all "traditional" software is the generation of profits.

This paper explores the antecedents of transition of business models grounded in open source software. In doing this, it paper strives to answer the first research question of the study: "*What are the observable determinants of business model design in the software industry?*"

The paper suggests that the new paradigm of open innovation may impact a firm's adaptability and responsiveness under conditions of environmental flux. In a world of widely distributed knowledge, firms cannot afford to rely entirely on their own capacity for innovation. Therefore, businesses increasingly build upon collectively created innovations accessible in diverse communities throughout the World Wide Web. However, extending innovation capacity by opening the innovation process poses major challenges for those conducting business.



Figure 6. Business model adaptation in the field of OSS

The study draws upon a qualitative research approach through a longitudinal case study in the field of open source software (OSS). The empirical case investigates how an OSS firm utilizes signals in its environment to alter its business model flexibly.

3.3.2 Findings and contribution

The paper focuses on the special characteristics of OSS business and provides grounds for investigating the business models that embody open source products and components, and for firms engaged in open innovation in general. This study makes a theoretical contribution to OSS research by outlining issues related to the balance between collective action, copyright philosophy, and commercial incentives in the OSS business context. The key contribution made to the dissertation by this paper lies in its investigation, through a case study, of one of the fundamental changes in the software industry. That is, the paper focuses on the influence of the emergence of the open innovation paradigm, which seems to have a remarkable influence on business model design by accentuating a firm's market orientation and increased utilization of resources that are external to the firm, both of which necessitate a good deal of flexibility in the business model design. The established conceptual model on the interrelationships among open innovation, market orientation, strategic flexibility and the business model of the firm is presented in Figure 6.

The findings illustrate a firm's business model design and its transition in the field of OSS. The paper points out that a business model that embodies open sourcing to a great extent raises balancing dilemmas between the open and closed innovation paradigms. However, the paper improves the understanding of an approach that combines market orientation with the principles of open innovation. The case study shows that such an ambidexterity increases both short-term profitability and effective market access, and enhances a firm's future innovation capability. Furthermore, this paper sheds light on the relationship between strategic flexibility and market orientation in the transition of business models. It combines two areas previously discussed separately: market orientation and open innovation. The results have profound implications for industrial marketers, managers, management consultants, and business educators. They can use the insights gleaned from this research to guide the development of their business models that involve open innovation. The paper suggests that the need for strategic flexibility among firms involved in open innovation exceeds that of firms relying merely on closed innovation. However, the investigation in this paper is delimited to the field of OSS; consequently, one must be cautious about generalizing the findings to other contexts of open innovation.

In addition, the paper contributes to the whole dissertation by providing insight into the issues of open innovation and market orientation in business model design. This insight may also lead to future conceptual developments concerning the noneconomic exchange relationships within open innovation communities. The findings support the view of Brito (2001) that collective actors are sometimes established simply to resolve a specific problem, and as soon as progress is made on that front, the role of collective action changes, along with the dynamics of the value system. Specifically, this means that collective action, in conjunction with the development of a value system favoring the more established forms of operation, is replaced by economic-exchange relationships, thus causing its share of the value system's activity to decrease. Therefore, the findings of this paper can be generalized to discussions of open innovation in businesses other than software.

3.4 Business-models: A new perspective on firms' assets and capabilities; Observations from the Finnish software industry

Paper IV: Risto Rajala and Mika Westerlund. (2007). Business models – a new perspective on firms' assets and capabilities. *International Journal of Entrepreneurship and Innovation*, Vol. 8(2): 115-125.

3.4.1 Research objectives and methods

This paper focuses on the key assets and capabilities in the software business from the entrepreneur's business model perspective. Network-intensive business behavior and specialization in core competencies have increased the importance of utilizing resources outside the company boundaries. In recent years, resource exploration and exploitation have attracted increasing attention from researchers on interorganizational exchange and strategic networks. However, the study is premised on the assumption that resources have not been sufficiently analyzed in connection with types of business models. Taking the theories of inter-organizational exchange and the resource-based view of the firm as the basis, key assets and capabilities are identified in four different types of business models in selected software companies.

3.4.2 Findings and contribution

In response to the second research question of this dissertation, "*What are the basic types and elementary attributes of business models in software firms?*" this paper discusses the characteristics of diverse types of business models from the perspectives of TCE and RBV. The empirical part of the paper investigates the assets and capabilities that firms attempt to create in different business models (Figure 7).



Figure 7. Classification of generic forms of business models in the software industry

The empirical findings indicate that resources are among the central issues in firms' business models. Moreover, the findings indicate that there is a significant difference in the emphasis on internally and externally obtained resources between different

types of business models. Capabilities were found to be an essential extension of the assets suggested by the reviewed resource-based theories of a firm. In the business models examined, access to capabilities external to the firm necessitated interorganizational relationships as an integral part of firms' business models.

Interviews with the senior managers of six software firms revealed that these firms had a total of nine different business models that were identifiable in terms of the attributes considered in the pre-study phase. This finding supports the view that a business model is best understood from a conceptual perspective at the SBU level. That is, the business model of a firm is a theoretical and conceptual layer situated between corporate strategy (defined at the corporate level) and business processes (defined at the functional level).

The contributions made by the paper to this dissertation include (1) a classification framework to distinguish among four types of business models of software firms and (2) improved understanding of the characteristics of these basic types of business models, including the analysis of business model-specific resources. Drawing on the TCE and RBV, the paper suggests that two dimensions explain a great deal of the variance in software business models: the degree of involvement in customer relationships (i.e., customer proximity) and the level of homogeneity of offerings (product uniformity) in the business model. These dimensions were later utilized in the quantitative empirical analysis of diverse types of business models as part of this dissertation.

3.5 Antecedents to and Performance Effects of Software Firms' Business Models

Paper V: Risto Rajala (2009). HSE Working Papers, Helsinki School of Economics, W-476, pp. 1-31

3.5.1 Research objectives and methods

This study examines the relationships among firms' service orientation, technology orientation, openness of innovation, business model, and performance. In doing so, the study examines business models from the focal firms' perspective by examining their business model focus in terms of customer proximity and product uniformity. The analysis focuses on the consequences they exert for firms' financial and market performance.

Thus, the specific objectives of the paper are (1) to investigate how three firm-level responses to the changes in the industry, operationalized as service orientation, technology orientation, and openness of innovation, affect the business models of software firms; and (2) to discuss the relationship between a business model focus and firm performance. In this vein, this paper addresses the third research question

of the dissertation: "What are the performance effects of different types of business models in software firms?"



Figure 8. Antecedents-business model focus-firm performance relationships

Based on a structural equation modeling of data gathered from almost 200 firms, the study investigates how firms' service and technology orientations and engagement in open innovation activity antecede firm performance. The conceptual model of the study is presented in Figure 8.

3.5.2 Findings and contribution

The analysis shows that firm-level orientations in the software business (in terms of service orientation, technology orientation, and openness of innovation) influence both firms' business models and performance. The findings support the argument that service orientation (SERVOR), technology orientation (TECHOR) and innovation openness (OPENNESS) have remarkable influences on a firm's business model design. In particular, firms' service orientation is found to affect their customer-focused business models. Moreover, service orientation seems to have a significant positive impact on firms' financial performance. In this respect, firms' engagement in open innovation activity is found to improve their standard offering-focused business models, which have a direct and positive effect on their market performance.

This study makes three principal contributions. First, it formalizes the definitions of an organization's service orientation, technology orientation, and engagement in open innovation. Second, it organizes these constructs into a research model for an empirical analysis of firms' business models in the software industry. This model offers an explanation of how and why the identified industry-level changes affect individual firms' business models, and it shows their respective performance effects. Finally, the mode should prove useful to both research and practice, and the analysis of business model performance offers the basis for future research directions.

3.6 Summary of the findings

This dissertation seeks answers to the four research questions posed in section 1.2, and the findings are discussed relative to these questions. The main question was: "What are the determinants of business model performance in the software industry?" First, business models are investigated in relation to the identified changes affecting the software industry. Second, the elementary attributes and diverse forms of business models are discussed. Finally, the performance effects of different types of software business models are discussed.

3.6.1 Business model determinants

The present study organizes the extant interdisciplinary research around the identified business model determinants in software firms into a research model that should prove useful for both research and practice. Three issues that were identified in the preliminary study and explored in the primary study have been found to be influential factors affecting the software business during the period considered. These are: 1) the emergence of the service-centered logic in business in lieu of product and production-centered logic, 2) the emergence of the open source software and open innovation paradigms in software development, and 3) the increasing role of information systems in the business models of both software firms and their customers. In the final quantitative analysis, these factors are found to have significant effects on software business models as discussed in the separate research papers.

The results indicate that these determinants affect individual firms' business models in a variety of ways, which are contingent upon several factors. These factors are investigated through five principal business model elements: firms' offerings, resources, relationships, revenue models, and management mind-sets. In the empirical analyses conducted in the present study, these elements are condensed to two dimensions that describe the business models of different types of software firms through the degree of involvement in customer relationships (later customer proximity) and level of homogeneity of offerings (later product uniformity). These analyses show that the determinants studied explain a great deal of the variance in software firms' business models.

3.6.2 Business model attributes

The qualitative empirical research focused on the characteristics of business models in the software industry. The ontological elements of business models, identified empirically in the pre-study phase and established conceptually by a literature review, include firms' offerings, resources, relationships, revenue models, and management mind-sets. The practical manifestations of business models, and their attributes in particular contexts, were explored through qualitative and quantitative empirical research. Based on the two dimensions selected, as discussed in Paper IV, business models of software firms were classified into four generic types summarized in Table 7 with their respective (illustrative) attributes.

	Software tailoring	Applied formats
Offering	Tailored solutions. Emphasis on meeting customer's needs.	Customized solutions, based sometimes on a uniform core of several products or customer specific solutions tailored to a degree, product platform, or component-based solution.
Resources (assets and capabilities)	Internal: Related to the capability of mastering customers' business External: Project management skills and methods, and technological capabilities	Internal: Related to the development of technological solutions in narrow segments External: Technological knowledge of new domains and system integration capabilities
Revenue model	Driver: Economies of scope Determinant of profitability: Share of Wallet	Driver: Scalability Determinant of profitability: Quality and performance of solution
Relationships	Close collaboration between vendor and customers including direct consultation	Software integrators as value adding resellers, especially in the growth and maturity phases of the business

Table 7. Key attributes of software firms' business models

	Resource provisioning	Standard offerings
Offering	Product/service concept based on a set of components, middleware, or platform	Uniform product offering, modular product family, or standardized online service
Resources (assets and capabilities)	Internal: Related to customer relationship management, operations management, and technological capabilities External: Production resources and process improvement capabilities	Internal: Related to production, network management, technical innovation, and marketing capabilities External: Market sensing, business innovation, and network development capabilities
Revenue model	Driver: Efficiency of sales processes Determinant of profitability: Speed and efficiency of development and implementation	Driver: Economies of scale Determinant of profitability: Utilization of facilities and low-cost operations
Relationships	Internal hierarchy	Wide distribution network or online distribution in Software as a Service (SaaS) models (such as ASP)

The illustration of the business model attributes in Table 7 is based on the analysis of the cases studied as part of the present study. It should be noted, however, that the generic business models illustrated sometimes exist in parallel with any number of business models in the same firm. For example, the software project business, labeled here as software tailoring, was periodically conducted in parallel with system solution business, labeled as applied formats. In this respect, "Software tailoring," "Resource provisioning" or "Applied formats," were sometimes conducted parallel to "Standard offerings" in distinct SBUs in the same firm. The possible reasons for simultaneous and different business models within the same firm or in its diversified business units, varied from diminishing the risk of focusing exclusively on a single business model and ensuring short-term financial position and cash flow, to developing business models for the future. In this vein, the firms were seeking what the literature recognizes as organizational ambidexterity (Tushman and O'Reilly, 1996; Gibson and Birkinshaw, 2004; Raisch and Birkinshaw, 2008) through simultaneous explorative and exploitative activities.

3.6.3 Business models and performance

Papers I-IV discussed the empirical manifestations of business, which was investigated at the SBU level. These papers concentrated on the attributes and focus of firms' business models. More precisely, Papers I-III provided insights into the identifiable determinants of business models in the software industry. Paper IV focused on the empirical manifestations of software firms' business models in terms of their types and attributes. The analyses conducted in Paper V investigated the antecedents and performance effects of different types of business models.

The quantitative empirical analysis (in Paper V) identifies two types of business models: those focused on customer proximity, and others that focused on product uniformity. The findings, aggregated from all the analyses conducted in this study, provide support for two overall propositions of the dissertation:



Figure 9. The overall propositions of the study

- **P1**: A software firm's service orientation, openness of innovation, and technology orientation have significant effects on its business model design.
- P2: The business model design has a significant effect on firm performance.

These overall propositions, grounded on the analyses conducted as part of the present study, are illustrated in Figure 9. The findings indicate that a firm's service orientation is associated with business models that focus on a high degree of customer proximity. Conversely, the findings indicate that a firm's engagement in open innovation is associated with business models focused on product uniformity. Technology orientation was found to be an important determinant of all software business model types.

A focused business model affects firm performance in a variety of ways. According to the findings, business models that focus on product uniformity are associated with good market performance, while customer proximity focused business models have a stronger relationship with financial performance than with market performance. These propositions contribute to the academic discussion on business models as discussed in the next section. First, identification of the determinants of business models is relevant to the analysis of business model design. Second, the formalization of the basic types of software business models is an important contribution to the investigation of the performance effects relative to the business model design choices made in software firms.

Overall, the findings add to the understanding of software firms' business model antecedents by showing how three firm-level orientations—service orientation, technology orientation, and openness of innovation activity—affect the business models of software firms in their search of business value. Furthermore, the study discusses the business model focus-firm performance relationship. The research papers in this dissertation shed light on various aspects of software business models. Together, they provide a fresh view on the antecedents and performance effects of business models in the software industry. Moreover, the efforts invested in the triangulation of data collected, theory and methods used, as well as the investigators who participated in the analyses, make this view reliable according to the standards set for scientific research.

4 DISCUSSION AND CONCLUSIONS

The antecedents, characteristics, and performance effects of business models have been of growing interest in recent IS research, and the findings in this dissertation contribute to that discussion. These findings improve the understanding of the complex relationships among business model determinants, business model type, and firm performance. In this section, the findings are described, along with the selected theoretical perspectives, based on the prior research literature. Finally, the theoretical and managerial contributions of this dissertation and the potential avenues for further research are discussed.

4.1 Discussion of the main findings

The main research question of the current study was: "What are the determinants of business model performance in the software industry?" This central question was divided into three more precise questions to be answered in different essays as part of this study: (1) "What are the observable determinants of business model design in the software industry?" (2) "What are the basic types and elementary attributes of business models in software firms?" (3) "What are the performance effects of different types of business models in software firms?" In order to answer to the first research question, the study investigated the antecedents of business models through qualitative case studies and explorative quantitative analyses. In particular, based on the findings of the preliminary conceptual and empirical study, the primary empirical study focused on three topical issues in the software industry: the prolific service dominance in software delivery, the growing role of information technology in business, and the openness of innovation activity in software development. These issues were investigated in Papers I-III, respectively.

The first article (Paper I) improves the understanding of collaborative service innovation. Drawing on prior studies of relational and networked value creation, it establishes a value strategy matrix which distinguishes three service innovation strategies: established services with competitive working markets, incremental service innovation targeting value-added offerings, and radical service innovation. This matrix aims to produce completely novel offerings and recognizes that service providers and clients may adopt different service strategies. Through the selected cases, it sheds light on value co-creation and co-capture in different service innovation modes that are familiar in the software business. Some of the cases in this paper represent firms in the secondary software industry, while the other cases represent the primary software industry. This broader scope and inclusion of cases beyond the primary software industry was due to the focus of the journal in which the article is published. The analysis was conducted in view of the generic characteristics of service co-creation. Based on comparison of the results between the primary and secondary software businesses, the different modes of service innovation—client-driven, provider-driven and collaborative co-creation—are suggested to have similar effects on the business model of a firm regarding all software services.

The second article (Paper II) focuses on the influence of information systems on firms' business models. For several decades, researchers have drawn attention to the importance of alignment between business and IS (e.g., McLean and Soden, 1977; Henderson and Sifonis, 1988; Bassellier et al., 2003). Moreover, the business and IT performance implications based on alignment have been demonstrated empirically and through case studies during the last decade (e.g., Chan et al., 1997; de Leede et al., 2002; Irani, 2002; Kearns and Lederer, 2003). In the prior literature, shared knowledge between IT and business managers is established as a precondition of successful business-IS alignment. The second article in this dissertation (Paper II) explores the factors that drive the achievement of such an alignment through strategic IS decision-making process. This paper also makes a contribution by breaking the "business-IS alignment" into various modes that were identified empirically. Interestingly, the paper adds to the understanding of technology orientation as an antecedent to software firms' business models by exploring it not only within a software firm, but among its customers as well. This approach is justifiable as customers' preferences and strategies are considered essential antecedents of market-oriented business model design (Jaworski and Kohli, 1993; Jaworski et al., 2000; Javalgi et al., 2005). In contrast to a purely product-oriented business model, the market-oriented business model is one where the producer, as decision maker, seeks to tailor its business model to the market (Jaworski et al., 2000). With this in mind, the data for the analysis conducted in Paper II were gathered from firms, the contact information for which were obtained from the customer database of a major Finland-based software vendor and software service provider.

The third article (Paper III) explores the key considerations in designing a business model for a firm operating in the field of open source software (OSS). The paper focuses on the special characteristics of OSS business and provides grounds for investigating the business models that embody open source products and components, and organizations engaged in open innovation. The key contribution to the dissertation made by this paper is its investigation of the open innovation paradigm, which seems to have a remarkable influence on business model design. It accomplishes this by accentuating a firm's market orientation and increased utilization of resources that are external to the firm, both of which demand a good deal of flexibility in business model design. In other words, the open approach to innovation emphasizes the freedom that promotes wide utilization and continuous development of innovations, and spurs the exploration of other actors' resources in the community. This finding is consistent with the views of von Hippel and von Krogh (2003), who discuss the use of resources from the perspective of collective action, and of Lundell *et al.* (2006), who analyze open innovation in the context of OSS. The findings also indicate that the distribution of intellectual property within the community requires extroverted attitudes and trust, which are argued to be salient to facilitate collective innovations. Moreover, the results accentuate the flexible and open use of resources (Sanchez, 1995) for the configuration and reconfiguration of appreciably superior customer value propositions. The effects of such openness on the firm's business model are analyzed in terms of strategic incentives, relational complexities, operational priorities, and cognitive exigencies, which are found to be different from those utilized in the closed innovation approach.

To answer the second research question, "What are the basic types and elementary attributes of business models in software firms?" the study focused on the types and characteristics of software firms' business models by using a qualitative case study approach. The fourth article (Paper IV) investigates resources in different types of business models. This study has learned a great deal from the RBV (e.g., Barney, 1991), which tends to define resources rather broadly so as to include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. However, the study relies on the extensions of the RBV, which have sought to distinguish clearly between resources and capabilities by arguing that resources consist of know-how that can be traded, financial or physical assets, human capital etc., while *capabilities* refer to a firm's capacity to deploy resources (e.g., Amit and Schoemaker, 1993). On these grounds, the present study continues the stream of research that views firms as entities that possess heterogeneous capabilities as a function of their activities and search processes (e.g., Cohen and Levinthal, 1990). These capabilities are rooted in the organizational skills and routines that serve as organizational memory to execute repetitively the sequence of productive activities suggested by March (1992). The results of the present study show that both customer and partner relationships are essential resources in themselves and facilitate access to other necessary resources in software business. Hence, the study supports the argument presented; e.g., by Ethiraj et al. (2005) that software vendors' capabilities related to the management of relationships appear to be an essential source of competitive advantage. In doing so, Paper IV distinguishes among different types of businesses by establishing a new business model classification framework, and it analyzes the internal and external resources in different business models. Using two dimensions grounded on the TCE, the classification scheme identifies four business model types: software tailoring, applied formats, resource provisioning, and standard offerings. This classification was indeed valuable during the analysis of the essential characteristics of the software business. Moreover, it has been used in

several other studies that focus on business models (e.g., Westerlund and Rajala, 2006; Rajala and Westerlund, 2008) as well as in graduate teaching.⁶

According to the analysis conducted in the last paper (Paper V), software firms with a service-oriented mindset are likely to focus on customer proximity in their business models. Such behavior is linked to business performance but has a slightly stronger relationship with financial performance than with market performance. Conversely, firms engaged in open innovation seem to focus on product uniformity, meaning that their innovation activity emphasizes the development of products and services that are new to the industry. This reflects their future-oriented performance implications: such companies seem to have better market performance than financial performance. Moreover, technological issues appear to constitute an important antecedent in all types of business models. Yet these may exert different effects in each of these business model types, subject to the mode of business-IS alignment, as discussed in Paper II.

4.2 Theoretical and managerial contributions

This dissertation makes three principal contributions concerning the business models in software firms. First, it formalizes the definitions of firms' business models, especially in the software business. Second, it organizes the extant interdisciplinary research around the changes in software business into a research model that should prove useful to both research and practice. In this respect, it formalizes the business model antecedents in terms of the organization's service orientation, technology orientation, and openness of innovation. Third, the established model offers an explanation regarding how and why the identified industry-level changes affect individual firms' business models, and it shows their respective performance effects. In doing this, the dissertation establishes the contingent role of business models in the determination of firm performance.

4.2.1 Theoretical contributions

The present study makes several theoretical contributions. In the first place, it participates in the discussion on the theoretical underpinnings of business models (e.g., Hedman and Kalling, 2003) and the business model ontology (e.g., Osterwalder, 2004). It does so by establishing a conceptual framework that presents the primary elements of the business models of software firms and analyzes their manifestations empirically. These elements are: the offering, resources, relationships, and the revenue model. In addition, the management mind-set was present in the qualitative

⁶ The framework has been used in the Master's courses on software business in both the Helsinki University of Technology and Helsinki School of Economics.

analyses as part of the present study. The elements were used, for example, to separate different types of business models from each other. In this vein, the performance effects of these different types of business models were analyzed through a quantitative empirical analysis of almost 200 software firms. The data collected and the model developed in the last article (Paper V) provides a consistent setting for analyzing the performance effects of different software business models. The analysis revealed new insights into the influences of industry-level changes on the business models, and ultimately on the performance of software firms. The business model attributes investigated in the first four papers are validated in the fifth paper as relevant determinants of business model performance. These analyses have significant contributions, which are discussed in the next section.

Moreover, the present study contributes to the discussion of services in the software business. The service-dominant logic (Vargo and Lush, 2004 and 2008) describes a significant transition in business in terms of resource use. According to the servicedominant logic, resources are considered either operand or operant (Vargo & Lusch, 2004). It considers the resources in the development and delivery of offerings as operand resources (those on which an operation or act is performed) and operant resources (those that act on other resources). That is, the operand resources are, for example, the physical resources required to make services available to customers, while operant resources, such as skills, knowledge, and capabilities, are the intangible resources of the parties engaged in the collaboration. Supporting these arguments from the service-dominant logic, the present study shows that through inter-organizational relationships, resources are accessed and exchanged through activities that embody all of the tasks required to develop and implement the software and related services.

Nevertheless, the present study suggests that RBV, because of its intraorganizational orientation, does not adequately cover the processes by which resources are transformed into offerings for customers in the software business. Hence, while the RBV typically emphasizes the strategic management related to resource choice or the selection of appropriate resources, the dynamic capabilities (DC) perspective introduced by Teece et al. (1997), and further developed by Eisenhardt and Martin (2000), was found necessary to analyze the process of resource development and renewal. The DC perspective underscores that dynamic capabilities are an essential vehicle in the attempt to bridge the resource gaps by adopting a process approach. That is, dynamic capabilities were found to act as a buffer between firm resources and the changing business environment, thus helping a firm adjust its resource mix and maintain the sustainability of its competitive advantage, which might otherwise erode quickly. Our findings provide support to this view and further suggest that along with the emergence of OSS, software development relies increasingly on resources that are external to the firm. Our findings from the longitudinal MySQL case study show that in the OSS business,

resources are accessed and developed jointly in collaborative relationships between two or more parties, or in a company-community relationship.

This study also contributes to the discussion on open innovation (e.g., Chesbrough, 2006 and 2007) by investigating how firms engage in open source development activities. Furthermore, our results continue the discussion originated by Dahlander and Magnusson (2005) on how firms utilize OSS communities in their business models. While the prior research (e.g., von Hippel and von Krogh, 2003) shows that proprietary software development has taken more open forms and has trended toward open innovation, the present study contemplates the division of open and closed forms of software development. The chief contribution made by the present study to this discussion is its analysis of the differences in strategic incentives, relational complexities, operational priorities, and the cognitive exigencies among these modes of software innovation. Moreover, the OSS literature argues that the OSS business trends toward a more commercial orientation (Fitzgerald, 2006). The present study contributes to the discussion on the performance effects of open innovation in the OSS business by showing the relationships between firms' engagement in open innovation and business model design, and by analyzing the resulting performance effects. Our findings show that openness of innovation in the software business is related to business models that focus on product uniformity, and ultimately on good market performance. However, the findings indicate as well that good financial performance is not an outcome that should be expected in the short term.

In addition, this study contributes to the research on business-IS alignment. The discussion on strategic alignment of business and IS has been salient in the academic literature on information systems. Our study of business-IS alignment (Paper II) provides us grounds to consider IS as operant resources that play an increasingly important role as enablers of business models instead of being a passive operand resource or serving merely as an object of trade in the software business. It asserts that the role of information systems in business models has emerged from the supporting and enabling roles towards a more central role as one of the drivers of business model design. The present study proposes that information systems are essential resources in business model design and implementation. The study takes part in the discussion on business-IS alignment by showing that to achieve strategic alignment, firms must be able to maintain their efficacy in IS decision making. In this context, efficacy means, for example, that the interaction between IS organization and other functions is efficient, and that business and IS managers understand each other's perspectives concerning IS projects. Maintaining efficacy of this type means that managers must at least (1) be aware of the impact of decisions related to information systems, and (2) establish rigorous business impact measures when implementing IS applications and systematically supervise IS application projects relative to business objectives.

4.2.2 Managerial contributions

This work also includes some important practical implications. First, the findings underscore three important factors that affect software firms' business models. Second, the analysis of the generic business model elements and the illustration of their attributes through cases that represent different types of business models may improve overall understanding of the alternatives to business model design in the software industry. Moreover, for executives who need new insights into how to design winning business models, the study suggests that these diverse types of business models require different managerial skills and capabilities, and it reveals the essential capabilities in each type of business model. Thus, to achieve the maximal benefit of the business model choices, executives should acknowledge that different business models call for different resources and capabilities, and they incorporate different potential regarding performance outcomes.

The results of the business model antecedent and performance analysis conducted in this dissertation have profound implications for software entrepreneurs, managers, management consultants, and business educators. The insights gleaned from this research can be used to guide the development of business models that involve service orientation, technology utilization, and open innovation. Moreover, the study suggests the need for strategic flexibility and agile business model development among firms involved in the dynamic software industry, particularly in the field of open source software. In addition, investors should benefit from the frameworks established for business model analysis, including the generic business model elements, such as the firm's offering, relationships, resources, and revenue models, in their attempt to evaluate software firms' business models. Further, the analysis and description of the basic business model types and their elementary attributes presented in Paper IV should assist in investigating a firm's business model.

4.3 Limitations and further research directions

This has been a conceptual and empirical study on the antecedents and performance effects of business models in software firms. Although the present study provides solid evidence of the relationships among the antecedents, business model type, and firm performance, it is not free from limitations. However, the analysis of business model performance offers the basis for future research directions.

First, the investigation in this dissertation is delimited to the primary software industry. Some of the findings may be applicable in related industries or across industries, but many of the premises are different even in the secondary software industry; i.e., in companies that focus on another industry but utilize software as a part of their products or services. Consequently, one must be cautious about generalizing the findings to other industries. Future research should consider the extent to which the findings apply beyond the primary software industry.

Second, as part of this dissertation, the qualitative empirical inquiry was conducted almost exclusively in Finland. There are only two exceptions; one manager of a Norwegian company and one manager from a Danish company were interviewed during the primary study for reliability and validity purposes. In addition, the quantitative survey data were collected entirely in Finland. This may be a concern, if the focus on products and services varies by country. For example, there is some evidence that the Indian software industry differs from the rest of the world in terms of capabilities and the organizations' service orientation (Ethiraj *et al.*, 2005). Therefore, future research is needed to investigate whether the results hold between different geographical and cultural areas.

Another concern is that the present study relies on data derived from senior managers' perspectives and perceptions. Typically, knowledge of strategic orientations and business models are possessed by individuals who belong to senior management. However, it is acknowledged that the phenomena investigated are complex and require multifaceted perspectives. We acknowledge further the role of a broad range of strategists outside the senior management team in organizations, and the potential impact of others within the field of strategizing activities. Moreover, even though traditional strategy research concerns firm performance, some examples also emphasize the significance of potentially multiple strategizing outcomes and their interactions over time. In fact, organization researchers have been participating in a debate on the issues concerned with the establishment and implementation of strategy and strategic change in organizations. Therefore, further research should profit from the knowledge of experts who represent different levels and sections within organizations.

Moreover, this study might have excluded potentially important variables relative to the determinants of both business model type and performance. We acknowledge that potential antecedents to business models in software firms include, for example, economic, psychological, and regulatory factors. However, the present study is delimited to analyzing three firm-level orientations, which are influenced by the environmental factors discovered in the early phases of this study. Moreover, the quantitative empirical analysis focused on two dimensions of business models, customer proximity and product uniformity, and subsequent analyses might demonstrate different results if other dimensions are applied. Hence, future research should benefit from adding other variables to the research model in order to assess which forms and structures are conducive to the creation of winning business models.

Finally, to date, the literature has been silent regarding theories on business model antecedents and performance effects. Therefore, exploratory research methods have been applied in this study to gain insights into and comprehension of the research subject. In general, the research methods employed in this study are more suitable for theory development than theory testing. Moreover, the data in this study is

mainly cross-sectional (with the exception of the longitudinal case study conducted in Paper III). Although definitive conclusions from this research approach should be drawn only with extreme caution, the selection of exploratory methods and component-based structural equation modeling techniques has been a wellgrounded decision in view of the current state of business model research. However, more robust quantitative methods; e.g., covariance-based structural equation modeling, and objective, longitudinal performance data, could be applied next for theory testing. Consequently, there is a call for more research that will further validate the research model established in this dissertation.

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APPENDIX I: PRIMARY DATA

Interviews in the preliminary study:

Firm	Interviewee	Title and background	Date	Place
Benefect	Virve Lähteenmäki	Director of Product Development	Dec 15, 2000	Helsinki
Synera	Kristiina Lähde	Director of Customer Relationships	Jan 9, 2001	Helsinki
Smartner	Ari Backholm	Vice president of Business Development	Jan 29, 2001	Espoo
Popsystems	Patrick Furu	Business Architect	Jan 31, 2001	Espoo
Arrak	Nicklas Andersson	Co-founder and managing director	Feb 2, 2001	Espoo
Smilehouse	Jaakko Hallavo	Managing director	Feb 5, 2001	Helsinki
F-Secure Online Solutions	Kimmo Alkio	Chief Executive Officer of F-Secure Online Solutions	March 5, 2001	Helsinki
Add2Phone	Markku Ottela	Chief Executive Officer	March 15, 2001	Helsinki
Add2Phone	Esa Saukkonen	Vice President, Business Development	March 15, 2001	Helsinki
Opera Software	Jon S. von Tetzchner	Co-founder of Opera Software (with Geir Ivarsøy)	March 19, 2001	Oslo, Norway
SSH	Tatu Ylönen	Founder and major shareholder of SSH	Feb 26, 2002	Helsinki
Nixu	Ilari Pohto	Manager	March 15, 2002	Helsinki
Frends Tech.	Antti Toivanen	Chief Technology Officer	Oct 18, 2002	Helsinki
Frends Tech.	Veli-Pekka Kihniä	Sales director	Oct 18, 2002	Helsinki
Frends Tech.	Juha Kauppinen	Sales manager	Oct 18, 2002	Helsinki
Movial, Helsinki	Jari Ala-Ruona	Chief Executive Officer	Oct 1, 2002	Helsinki
Frends Tech.	Aino-Maija Fagerlund	Chief Executive Officer	March 28, 2003	Helsinki
Frends Tech.	Antti Kiviluoto	Manager, Business Development	March 28, 2003	Helsinki

Firm	Interviewee	Title and background	Date	Place
Grip Studios	Jaakko Lyytinen	Chief Executive Officer	May 12, 2003	Helsinki
Mr.Goodliving	Juha Ruskola	Chief Executive Officer	May 14, 2003	Helsinki
WES	Kimmo Herranen	Director, Business development	May 15, 2003	Helsinki
Fathammer	Samuli Syvähuoko	Head of Games; Co-founder of Fathammer	May 19, 2003	Helsinki
SUMEA	Ilkka Paananen	Chief Executive Officer	Aug 27, 2003	Helsinki
Basware	Hannu Vaajoensuu	Chief Executive Officer	Sep 22, 2003	Helsinki
Sublime Software	Juho Mäyränpää	Director	Sep 29, 2003	Helsinki
Tekla	Heikki Multamäki	Chief Executive Officer	Sep 9, 2003	Espoo
Tekla	Harri Nurmi	VP, Strategic planning	Sep 9, 2003	Espoo
TE Resource Management	Pertti Kettunen	Director	Oct 6, 2003	Espoo

Interviews in the primary field study:

Interviews in the primary field study: (continued)

Conformiq	Antti Laine	Chief Executive Officer	Oct 9, 2003	Espoo
Conformiq	Heli Järvelä	Chief Operations Officer	Oct 9, 2003	Espoo
ESY	Matti Särkkinen	Director (Finance and Administration)	Aug 18, 2003	Helsinki
ESY	Helena Sorri	Director (Customer Relationships)	Aug 18, 2003	Helsinki
Ekahau	Antti Korhonen	President and CEO	May 17, 2004	Helsinki
MySQL	Mårten Mickos	Chief Executive Officer	Aug 16, 2004	Helsinki
MySQL	Mårten Mickos	Chief Executive Officer	Aug 30, 2004	Helsinki
DHI Software	Jørgen Bo Nielsen	Managing Director	Sep 1, 2004	Hørsholm, Denmark
MySQL	Michael "Monty" Widenius	CTO, Co-founder of MySQL	Sep 19, 2004	Helsinki
MySQL	Michael "Monty" Widenius	CTO, Co-founder of MySQL	Oct 20, 2004	Helsinki
Movial	Jari Ala-Ruona	Chief Executive Officer	Sep 8, 2004	Espoo
Movial	Victor Donselaar	Manager	Sep 8, 2004	Espoo
Nokia	Riku Väänänen	Director	Nov 10, 2004	Espoo
Nokia	Michal Pilawski	Manager, Multimedia Business Group	Nov 10, 2004	Helsinki
Movial	Jari Ala-Ruona	Chief Executive Officer	Feb 21, 2005	Espoo
Flander	Mika Heikinheimo	Chief Executive Officer	Mar 7, 2006	Tampere
Movial	Jari Ala-Ruona	Chief Executive Officer	Apr 12, 2006	Helsinki
Icareus	Toni Leiponen	Managing Director	Oct 28, 2006	Helsinki
Icareus	Mikko Karppinen	Technology Director	Oct 28, 2006	Helsinki
MySQL	Bertrand Matthelié	Director of Marketing, EMEA	Dec 12, 2006	Helsinki
Zipipop	Helene Auramo	Chief Executive Officer	May 21, 2007	Helsinki
Zipipop	Richard v. Kaufmann	Creative Director	May 21, 2007	Helsinki
Movial	Jari Ala-Ruona	Chief Executive Officer	Jun 19, 2007	Helsinki
Movial	Niklas Saxen	Business Development Manager	Jun 19, 2007	Helsinki
Saltarello	Lauri Jämsen	Managing Director	Mar 11, 2008	Helsinki
Saltarello	Lauri Jämsen	Managing Director	Jun 2, 2008	Helsinki

Survey data:

Survey type	Theme	Time	Ν
Telephone survey	Business-IS alignment in the context of application service acquisitions	May-June 2005	118
Online survey	Finnish software firms' business models and performance	Jan-Feb 2009	197

APPENDIX II: CASE COMPARISON

Cases	Case 1	Case 2	Case 3	Case 4	Case 5
Characterization	"System software vendor"	"ASP aggregator"	"Product platform provider"	"Software publisher"	"Application service provider"
Target customers	Trade unions and unemployment funds	Telecom operators	Telecom operators and service providers	Software developers	Small and medium sized enterprises
Offering and product uniformity	A parameterized enterprise system software targeted to a small vertical market segment.	An Application Service Provisioning (ASP) platform for enabling online use of third-party products and solutions.	Customizable software solution comprising a connectivity platform and related applications for mobile use of business software.	A software development tool for Internet application development.	An ASP concept comprising tools for building electronic shops in the WWW- service hosted by the provider.
Revenue model	Software license sales. Additional sources of revenue are training, integration projects, and maintenance services.	Revenue sharing with telecom operators providing Application Service Provisioning (ASP) on the ASP platform of the case company.	Application license sales and consultation services to telecom operators. Revenue is collected from up-front fees and usage of the products.	Software developers are provided with a free development tool. Revenue comes from runtime licenses sold to end user organizations.	Time-bound licenses with up- front fees and occasional tailoring services on hourly basis.
Distribution resources and relationships	Direct contact between customers and the vendor's own sales organization.	Telecom operators republish ASP services to their customers based on the platform of the original component manufacturer (OCM).	Direct contact with end user organizations due to limited number of customers and novelty and complexity of the solution.	System integrators producing software solutions make both the target market for the development tool and the distribution channel for end- users' runtime licenses.	Direct sales to SMEs in the local market. New media companies build e-commerce sites for customers using this hosted service.
Customer proximity	Software delivery and integration projects carried out by vendor's own project organization.	The vendor provides technical deployment, readiness, and support services to telecom operators.	Technical sales support plus installation, training, updating, and software integration services.	Online support services for volume segment and "high- touch support," including technical aid, training, and consulting for selected software development firms.	Minimal deployment, tailoring, and support services in addition to the online readiness and maintenance services.

Examples of cases analyzed in the primary field study phase:

APPENDIX III: OUTLINE OF THE INTERVIEWS

The outline of the interviews in the primary field study phase

- 1. Introduction
- Background
- Confidentiality issues
- Permission to record the interview
- History and the current state of the firm
- 2. Business model (general)
- How would you describe your market and the firm's position in that market?
- Describe the business model(s) of your firm?
- Has your business model changed during the years of operation?
- In what areas do you focus for strategy and business development?
- What are the future expectations concerning your firm's business model(s)?
- 3. Business model (specific)

Offerings, R&D, and innovation:

- Describe your main software product/service offerings (standard/tailored).
- How did these main offerings emerge (history)?
- Who would you consider the main source of your product development ideas?
- What role, if any, do your customers play in product development?
- Who are your main R&D partners? Why? What are their roles in R&D?
- The means and extent to which you search for new ideas outside the organization
- Collaboration and information sharing in the development of products and/or services

Marketing and sales:

- Describe the distribution strategy of your company.
- What/who are your target markets and customers?
- Describe your main sales channels (physical/virtual).
- Who are the main software delivery partners? What are their roles (VAR etc.)?
- How did these delivery partnerships emerge?

Resources (technology and capabilities):

- What is the core competence of your firm?

- What is the role of technology in your business and operations?
- What is the impact, if any, of technological changes in your business model design?
- Do you use external knowledge-intensive services in your R&D activity?
- Describe the extent of knowledge-intensive services in your operations and marketing activity.
- What kind of resources do you obtain from your business partners and networks?

Revenue model:

- Present your statement of earnings
- What are your licensing options and pricing principles?
- What and who are the sources of your income?
- Describe your cost structure (investments, financing, labor- or capital-intensive operations)
- 4. Business network (general)
- Describe your business network /value creating network: Who is involved?
 - Intrafirm: key personnel, owners, financiers
 - Interfirm: upstream, downstream, horizontal partners
- What is the goal of the collaboration? How did the network emerge?
- What is your firm's role and position in the network? What are the roles of other participants in the network?
- Describe the collaborative relationships in the network (weak/strong).
- Who is responsible for managing/coordinating the network? How does that show up in practice?
- Who/what are the most important partners/relationships from your perspective? Would you be able to replace these with others? What would be the consequences?
- How would you characterize your future needs concerning the development or management of the network?

5. Other

- In addition to yourself, is there someone else who could provide insight about the business model or networks of your firm?
- Are there any documents (about your firm/products) available that would be useful for our research?
- Are there other important issues about business models or networks that were not included in this interview?

APPENDIX IV: LIST OF ABBREVIATIONS

BMBF	Bundesministerium für Bildung und Forschung (Federal Ministry of Education and Research, Germany)
CEO	Chief Executive Officer
CMV	Common method variance
COTS	Commercial off-the-shelf software
СТО	Chief Technology Officer
DC	Dynamic capabilities
EITO	European Information Technology Observatory
ERP	Enterprise Resource Planning
GOF	Goodness of Fit
GPL	General Public License
HOE	Hierarchy of effects
ICT	Information and communication technology
IS	Information Systems
IP	Internet Protocol
IT	Information technology
MSN	The Microsoft Network
OECD	Organization for Economic Co-operation and Development
OSS	Open source software
P2P	Peer-to-peer
PLS	Partial least squares
RBV	Resource-based view (of the firm)
SaaS	Software-as-a-Service
SBU	Strategic business unit
SEM	Structural equation modeling
SIC	Standard industrial classification
SME	Small and medium sized enterprise
SQL	Structured Query Language
SSC	Services supporting the client
SSP	Services supporting the product
TCE	Transaction cost economics
TOL	Standard industrial classification (Toimialaluokitus)
VAR	Value-added reseller
VIF	Variance Inflation Factor

PART II: ORIGINAL RESEARCH PAPERS

Paper I

Service Innovation Myopia? A New Recipe for Client-Provider Value Creation

by

Kristian Möller, Risto Rajala and Mika Westerlund

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Service Innovation Myopia? A New Recipe for Client-Provider Value Creation

Kristian Möller Risto Rajala Mika Westerlund

e are in the midst of a service-driven business revolution. Innovative service providers such as Google, MySQL, and Skype strive to promote service co-production with customers, as services become the key value drivers for companies. This is evident in the current list of *Fortune 500* companies, in which the share of revenue derived from services has increased considerably over the past few decades. This service-driven revolution has powered an economic boom in which the majority of economic activity consists of services.¹ In light of this revolution, service innovators need new formulas for success. Traditional management thinking addresses each actor's individual competences and competitive advantages in service innovation. This thinking is myopic² in the extreme, as it tends to overemphasize the interests of either the service provider or the client. That is, service innovation myopia is the overemphasis on the service production process from either the clients' or service providers' perspectives. The myopic approach can be harmful because it does not take into account the value of service for both the client and the provider.

Service innovation shapes value creation. Service innovation and collaborative client-provider value creation form a broad domain that can be approached from several disciplinary perspectives. The Resource-Based View (RBV), the popular theory of the firm, is a useful tool for the discussion of value creation. It is driven by the fact that resources, and especially their manifestation as competences,³ are fundamental in creating and capturing value.⁴ However, the intra-organizational view, which dominates the traditional RBV approach,

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is insufficient in examining service innovation. Several authors argue that RBV, because of its intra-organizational orientation, does not adequately cover the processes by which resources are transformed into offerings for customers.⁵ This is paradoxical, as these processes themselves are highly important organizational competences. Moreover, the RBV theory has overlooked the relational perspective, which emphasizes the joint creation and exploitation of resources by the client and the provider.⁶ This is the case in many service innovations, which create value through intense collaboration and complex business models. This challenge reaches across industries but is probably most pronounced in the information and communication technology (ICT) sector, where both business-to-business and business-to-consumer offerings are becoming more service and knowledge intensive.

Our study discusses these limitations of the RBV theory in order to enhance the understanding of service innovation and the role of client-provider collaboration. We present two conceptual frameworks: a generic service innovation framework that clarifies different service innovation approaches; and a client-provider service co-creation framework that reveals the interaction modes

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in service innovation. Through their competences and activities, customers play a key role in the realization of the end-value out of the value potential embodied in a service provider's value proposition. This directs attention from the provider's competences to understanding the clients' resources and capa-

bilities, and it leads to an understanding of the collaboration between client and provider.⁷ The most successful service providers will not be those who focus exclusively on their own capabilities and competitive advantages (e.g., technology) or on their clients' current needs. Quite the contrary, providers that incorporate clients' experiences and capabilities into service co-creation will be strong even in the future.

Clients' and Service Providers' Approaches to Service Innovation

Recognizing the logic underlying value creation and value capturing is key to the development of innovative service offerings and concepts. Drawing on prior studies of relational and networked value creation,⁸ we distinguish three service innovation strategies: established services with competitive working markets; incremental service innovation targeting value-added offerings; and radical service innovation, which aims to produce completely novel offerings.⁹ These strategic modes, described in Table 1, differ considerably in their valuecreation logic by the extent to which they require collaborative multi-party value production and the relative intensity of that collaboration, as well as by their typical business models.

Service Innovation Strategy	Established Service	Incremental Service Innovation	Radical Service Innovation
Company Cases	Dell	Google	MySQL
Value Creation Logic describes the focus and means to create value-adding services	 Well-known and definite value activities and processes focus on service efficiency Relatively high stability and transparency are characteristics of the value creation logic 	 Enhanced activities and processes aim at increased value added through improved efficacy Incremental modifications shape the value creation logic 	 Embryonic value activities and new value creation processes make up novel services with improved effectiveness Emerging systemic innovations break the traditional frames of value creation
Exchange and Relationships Structure describes the nature and the relational complexity of collaboration	 Transactional exchange takes place in primarily unilateral relationships with well-known actors Relational complexity between the actors is typically low as collaboration focuses on existing, well-specified needs 	 The value system consists of both old and new actors that are at least partially known Moderate complexity dominates relationships with clients, whose unmet needs feed service co- development 	 The innovation activity embodies relational exchange in multilateral partnerships High complexity of the relationship structure characterizes emerging networks f service co- producers
Value Capture describes the way in which the provider retains value it has created with the clients and how it is manifested through the qualities of offerings	 Well-defined, typically autonomous market offerings are optimized to serve current needs Value propositions are typically homogeneous across several clients, often forming segmented, modularized offerings 	 Potential benefits of enhanced services based on incremental offering extensions are assessed against current service solutions Modified service components form modular offering portfolios 	 Value propositions are based on emergent services intended to form novel offerings Future orientation causes uncertainty concerning the value capture potential and about the actors that will benefit from the innovation

TABLE I. Characteristics of Generic Service Innovation Strategies

The first service innovation strategy depicts an established service with well-defined and relatively stable value production logic. Generally, these services are produced under intense market-based rivalry requiring providers to focus on operational efficiency. These service offerings presume, and manifest, clear value-creation systems. An example is Dell, whose business is based on a simple concept: selling computer systems directly to customers. Dell's ascent to market leadership is the result of a constant focus on delivering positive experiences to customers by providing modularized, standards-based computing products and services that form homogeneous value propositions for a global clientele. Nearly one out of every five standards-based computer systems sold in the world today carries Dell's trademark. Although Dell's business model was

unique and innovative in the late 1990s, it has since then become rather fixed: its business development underlines efficiency through minor modifications of details. The supplier relationships within Dell's value system are relatively stable and unilateral, which is a distinctive feature of value systems with established services. Dell's value system includes well-known and internationally recognized hardware and software suppliers such as Intel, Novell, and Symantec. At the same time, Dell communicates directly with its customers, mainly via the Internet, thereby practicing transactional exchange.

Incremental service innovation describes a value-creation strategy in which services are employed for the incremental addition of value. The key idea is that through mutual investments and adaptations, a service provider and a client can produce more effective solutions than existing ones. This incremental value-added strategy, so effectively implemented by Google, adds value to the existing market solutions.

Google is widely recognized as the world's best search service provider on the Web. In addition to offering Internet search services to individual consumers, Google provides search services for corporate clients, including advertisers, content publishers, and site managers with cost-effective advertising and a wide range of revenue-generating search-related services. From the beginning, Google's developers recognized that excellence in search services required a new kind of server setup. Google's breakthrough idea was to employ linked PCs to respond immediately to each query. Google's innovation paid off in faster response times, greater scalability, and lower costs. Since then, the incremental development of services based on this innovation has made Google flourish. Google has consistently pursued incremental innovation activity and refused to accept the limitations of existing concepts. This is manifested by continuously bringing out new service applications based on its back-end technology. New areas are explored, ideas prototyped, and service-offering extensions nurtured to make them more useful to advertisers and publishers.

It should be noted that most of these service improvements require that both the service provider and client adapt and develop their respective processes and capabilities. This begs the question: Does this approach to value creation presume a more complex interface between the service provider and the client than that of established services? At the very least, it may involve greater joint coordination of the value activities of both the provider and client.

Finally, radical service innovation describes an approach that pursues value creation through novel service concepts. The developers of these service innovations aim to produce new technologies, offerings, or business concepts as well as their commercialization through advanced services. Such future-oriented value production often involves radical system-wide changes in existing value systems and poses great uncertainty in terms of the value potential and value capture. In contrast to the previous examples that illustrate product innovations relating to service offerings, we take a look at radically new service through a major process innovation. Consider MySQL, the world's leading open-source database software producer. In 2006, its CEO announced that more than 10

million people around the world were using that software. Thousands of these users today are co-producers who design new features and test the software. Even more partners have joined the worknets that get the software up and running in user environments. The new idea is that the source code of the software is freely available to everybody, meaning the software is available to use and/or modify. However, according to the principles of the GNU General Public License (GPL), all derivative works must be made available to the original developers. This licensing principle protects and encourages software co-development and knowledge co-creation among innovators, developers, and clients. Initially, the founders of MySQL were less interested in generating revenue from the software than in increasing the number of users and developers. This has led to a valuecreation system, characterized by a vast number of actors, many of which are unknown to MySQL. Moreover, as the community has reached critical mass, the radical service concept of MySQL enables the company to gain revenue from services provided for corporate clients that wish to ensure the operability and reliability of their mission-critical installations. Emerging service businesses of this kind involve inter-organizational relationship formation that cannot be fully specified in advance. Uncertainty related to value activities, actors, and their capabilities, as well as to the value-potential of the innovation, are inherent features of the value system.

To summarize, service innovation can be described in terms of value creation through established service offerings, creation of value added through incremental service innovations, and the creation of future value through radically new service innovations. Identification of these generic service innovation strategies provides several important insights. One is that the more emergent the service concept, the more complex the interface between the client and service provider. Similarly, the required competences of the client and service provider become more complex when moving on from established services towards radical service innovations. Ideally, value creation is most productive when both the client and the provider pursue a similar strategy. However, the participants' respective strategies are not always congruent. Next, we investigate possible combinations of the service provider's and client's value creation strategies.

Service Co-creation Modes between Clients and Service Providers

At the beginning of 2007, IBM's Jim Spohrer announced, "Service is value co-creation."¹⁰ The purpose of value co-creation is to stimulate change. On the one hand, if the perceived effect of the change is negative for one of the actors, then the service obliterates value from that actor's perspective. On the other hand, if the effect is positive, new or added value is created. This poses a crucial question for CEOs: How does one ensure that the change, either incremental or radical, is positive for both the client and service provider? In spite of the obviousness of this notion, many executives fail to understand the necessities of value co-creation.¹¹ Value creation is more effective if there is strategic



FIGURE I. Basic Interaction Modes in Service Co-Creation

congruence between the client and the service provider. This congruence exists when both the client and the service provider have sufficiently related service innovation strategies.

Most service provision requires a high degree of interaction between the client and service provider, especially in knowledge-intensive fields such as the information services business.¹² Our study of almost 100 industrial firms¹³ shows that providers who have either a strong technology orientation or who wish to create high value-added services are the most willing to enter into close relationships with their clients. In the study, we identify a group of firms that develops innovative service concepts with its clients in order to seek economies of scope. Conversely, we find that providers who focus on operational efficiency, aim at value creation though more distant, transactional customer relationships, companies must first recognize each other's value-creating strategies. Both the service provider and client may pursue service innovation development, as illustrated in Figure 1.

The service co-creation framework is used to analyze service development, focusing on the client-provider interaction modes in service innovation. The modes are classified into three groups. However, not all of the interaction modes are viable. Rather, discrepancies between the participants' strategies make



FIGURE 2. Client-Driven Modes in Service Co-Creation

their realization implausible (i.e., cells 3 and 7). In our analysis, we disregard such modes and explore seven probable interaction modes that may take place in service development.

Client-Driven Modes of Value Co-Creation

Client-driven modes of value co-creation exemplify an unbalanced innovation context (see Figure 2). In these situations, clients' needs and expectations of service innovation exceed the service providers' current offerings. The client starts to negotiate with the provider about the new requirements concerning collaboration for service innovation. If the provider lacks the competences or willingness to develop the competences needed to meet the client's service requests, the client may seek new partners. Recognized dissatisfaction with current services gives service providers a strong incentive to listen to their clients. However, an excessively strong focus on current clients' immediate needs may create myopic innovation activity. It may limit future business potential by reducing service scalability and reproducibility with other clients.

In the case of creation of new service innovations it is sometimes difficult to discern the roles of "customer" and "service provider." For example, the addition of new content and service configurations in Web-based services is grounded on clients' requests. Similarly, the world's third-largest independent software provider, SAP, delivers business solutions to more than 36,000 customers in over 120 countries. While SAP's original enterprise solutions could be characterized as provider-driven, its drive to also cover the needs of SMEs involved a turnaround in its service strategy. In the Internet-based mySAP.com concept, the clients' explicit software needs are the driving force behind the service creation strategy. SAP co-develops and adds service modules to the mySAP.com solution in accordance with clients' requests for an optimal enterprise portal and users' role-specific access to information. Successful client-driven innovation implies a client's ability to demand services and the service provider's ability to meet these requirements in incremental but continuous fashion (see cell 4).

NowPublic is a user-generated social news web site. It is the largest participatory news network in the world, one in which contributors submit written and voice reports as well as photographs and videos about breaking news events. Its clients are innovators that drive the development of the service: they suggest and co-develop the service content and functionality. This form of service innovation is exemplified in cell 8, where client-driven development focuses on those new features important to the users who co-create the service content. The Canada-based company, founded in 2005, now has more than 100,000 "reporters" in 140 countries and almost 4,000 cities. Not all citizenjournalism sites have been as successful as NowPublic: *Time* magazine named NowPublic.com one of the Top 50 web sites of 2007. Similar examples include the Korean-based site Oh My News and U.S.-based citizen journalism sites Newsvine.com and NewAssignment.net. Actually, many novel services based on social media reflect the client-driven approach to innovation.

Service Provider-Driven Modes of Value Co-Creation

Apple iTunes, McAfee, Microsoft, and Nokia have something in common: their business models manifest provider-driven approaches to service cocreation. When service providers design new services they have to realize that it is the benefits that customers derive from the service, not the offering as such, which add perceived value for the clients.¹⁴ That is, clients are motivated by achieving a positive change in their business or lives through the service (see Figure 3). If the service provider's objectives concerning the functionality of the service exceed the clients' ability to use it, the innovation activity does not create extra value for the clients. On the contrary, clients may be reluctant to pay a premium for features they cannot use with their current competences. Technology-based product comparisons have forced software vendors to add a vast number of features and options to their solutions. As a result, most users cannot take full advantage of the new features; they feel pressed to accept them, and often perceive the software as overpriced. Microsoft has reacted to this challenge by providing alternative versions of its Windows Office package, such as the Home and Professional Editions.

Visual Radio, driven by Nokia, is another example of a service providerdriven innovation. The service brings information and interactivity directly to mobile devices through radio broadcasts. On Visual Radio, clients can see



FIGURE 3. Provider-Driven Modes in Service Co-Creation

information about the songs playing as well as biographies or photos of the artists; they can also take polls to influence broadcaster's program content and download ringtones of the songs. Nokia pioneered Visual Radio and continues to develop the service and produce mobile devices on which the service will be available. Hewlett-Packard is responsible for globally marketing, selling, and providing the Visual Radio solution and support to operators and radio stations. Radio stations and mobile operators bring Visual Radio to consumers and develop the content to make it a success.

However, like many other provider-driven innovations, Visual Radio has faced major obstacles to acceptance from both partners and clients. Many users have not really appreciated the features of the new service, and telecom operators have difficulty seeing its business opportunities. As a result, they resist collaboration and commitment to the apparently service provider-driven priorities (see cell 6).

Overall, two characteristics seem to distinguish technology push from market pull. First, service providers are willing to accept business risks related to innovation; and second, technology-oriented innovation activity creates services that would otherwise not exist. Microsoft is a classic case in point. The technology push approach to value creation entails some risks in value co-creation as it does not always meet the clients' expectations. Microsoft's MSN portal utilizes IP-based identification technology in its Hotmail service, which automatically detects users' location to set the language. This option serves the majority of clients by providing added value through automatic recognition of their mother tongue. However, it does not work for users with another language preference. According to our framework, this is an incremental improvement from the service provider's perspective, even if the client opts for an established service (see cell 2).

Yet, service provider-driven technology push may produce major success stories. There are several instances in which a service provider-driven radical innovation strategy has resulted in industry-wide changes. For example, short message services (SMS) emerged as a technical innovation in alerting users to voice mail or technical service calls in mobile devices. However, it quickly became the main messaging method in the global system for mobile communications (GSM) networks and a key source of revenue for telecom operators in Europe.

Service provider-driven innovation activity shows its potential in the case of Apple iTunes, which exemplifies the proactive exploration of new service opportunities (see cell 6). iTunes is a digital media player application that Apple introduced in 2001 for playing and organizing digital music and video files. The program is also an interface for managing the contents on Apple's popular iPod digital media players. The development of these solutions is based on strong technological competences that have been accumulated over the course of Apple's long history in Internet and computing technologies. The actual value of the innovation comes from the services that allow users to connect to the online store to download, purchase, and share digital music, music videos, television shows, games, audio books, podcasts, and feature-length films. On its way to the commercial success of iTunes, Apple has won clients' technology acceptance despite the company's unique technologies and standards. Moreover, Apple has successfully used digital solutions to break the traditional modes of the entire music industry.

A central challenge in the provider-driven modes of service innovation is the risk that clients will not appreciate the new functionalities that are offered or that their lack of competences restricts them from enjoying the targeted benefits from the service innovation. If the service providers fail to assist clients in cocreating the value, they incur the risk of losing the client to a competitor. To meet this challenge, the producer can try to increase the inherent intelligence of its product or system and make it easier for the client to use. This is an important aspect in using ICT services and calls for customer-centric service interface design. In general, strong market sensing capabilities reduce the risks involved in producer-driven service innovation.

Strategic Congruence Stimulates Balanced Modes of Value Co-Creation

Imagine an integrated digital hospital that links people, processes, and technologies to optimize workflow, business operations, and patient care (see Figure 4). Intel's "integrated digital hospital" concept exemplifies a joint-service



FIGURE 4. Balanced Modes in Service Co-Creation

innovation and illustrates the usefulness of balanced client-provider collaboration (see cell 9). Intel has developed a number of mobile communication and computing offerings in the emerging field of health-care information technology and competes in this field through the concept of integrated service.¹⁵ The development of this concept and its components (e.g., electronic medical records solutions; mobile point-of-care solutions enabling access to patient information at the bedside, in labs, and in operating theaters; and secure patient infrastructure solutions) has been accomplished through collaborative projects with research hospitals and clinics in North America and Europe. Intel has been providing mobile communication competence and the hospitals provide expertise in patient care. The lead hospitals involved have benefited from this joint value creation by achieving cost reductions, shorter process times, and higher operational quality. They have also been able to enhance their brand image as innovative, cutting-edge providers of medical services.

Strategic congruence in service innovation pertains to the concept of alignment, which refers to the match, continuity, and synchronization of goals and objectives of the service innovation activity. Congruent value creation strategies imply that both parties pursue a similar strategy focused on established services and incremental or radical service innovations. The benefits are assumed to be clearly manifested in the value proposition, and the client has the competences to use them. Strategic congruence requires the ability to coordinate inter-organizational business processes. Overall, collective innovation activity necessitates cognitive and cultural orientations such as the desire to co-operate, commit to common objectives, and openness and trust in collaboration.

"We are excited that the Internet community has embraced our service and evangelized its benefits, contributing to its rapid success," said Tim Dowling of McAfee, a leading dedicated security technology company with headquarters in California.¹⁶ McAfee offers comprehensive data loss prevention services for Internet users. Their services address data loss perpetrated internally or from external sources. The McAfee SiteAdvisor service concept includes an innovative, safe search-and-surf technology solution that already has more than 38 million Internet users. McAfee has long-term relationships with its clients and other industry leaders to deliver integrated solutions that reduce the cost and complexity of managing security services. The service co-creation strategy builds on close collaboration with clients, including user involvement in creating and maintaining scam alerts and informing users of new security threats. It integrates feedback from individual users and analysis by the development staff to enhance service performance. Although this seems to be the dominant logic in the current digital security services market, McAfee's service concept has been honored with the U.S. Department of Commerce's "Recognition of Excellence in Innovation." Thus, it is an excellent example of established value co-creation, where a balanced service innovation strategy combines both market- and technology-orientation in service co-development (see cell 1).

Another example of strategic congruence in service innovation is the iTV service concept developed by many individual broadband digital TV companies such as TVU Networks. These innovations have changed television broadcast technologies, enabling Internet users to watch television on their desktops, either through a pay-subscription service or through peer-to-peer (P2P) broadcasting. The former allows viewers to choose which individual channels they are willing to pay for, while the latter lets anyone with a PC and a broadband connection distribute or watch live TV online. As television networks struggle to relay content to viewers who have unprecedented options, a technology that lets people watch live TV programs over the Internet, with inserted personalized digital ads, might be attractive. "Anything that lets you see more television benefits the television producers, networks, and advertisers," says Jeffrey Cole, director of the Center for the Digital Future at the University of Southern California. TVU's service offering provides an example of incremental service innovation (see cell 5), as the television networks have experimented with putting up video content of already-aired shows online, but only a few have offered live viewing.

Relational client-provider collaboration creates enthusiasm for win-win situations in service innovation. Skype, the world's fastest-growing Internet communication offering, allows people everywhere to make unlimited voice and video communication for free. "We know from listening to our more than 75 million customers that 30 percent of them are regularly using Skype for their businesses and most of these are small companies," said Niklas Zennström, Skype CEO and co-founder. The service is available in 27 languages and is used in almost every country. Skype's popularity originates in letting people make free Skype calls over the Internet. Its latest service concept promotes an ecosystem that links people willing to sell their expertise or knowledge to people who are willing to buy it. This is consistent with Skype's previous service innovation activity, where user feedback has always been an indispensable part of how the service has evolved and, equally, a part of Skype's popularity. Thus, Skype demonstrates how efficient service co-design requires the use and adaptation of both the service provider's and the client's capabilities. Moreover, Skype services are integrated to both the client's needs and the provider's offering portfolio. It constitutes an example of a balanced mode of a radical innovation (see cell 9) that breaks the century-old institutional traditions of the telecommunication industry.

Table 2 summarizes three service co-creation modes in which either the service provider or client has a dominant role, or in which they collaborate in a balanced way in their service innovation activity.

In brief, the strength of *client-driven collaboration* stems from the service provider's ability to meet the client's immediate and explicit needs. The marketdriven focus on short-term priorities brings immediate revenue streams to the provider, but this shortsightedness constitutes a threat to sustainable competitiveness. Conversely, the strength of provider-driven innovation modes relates to the development of innovations that would not exist without the provider's daring commitment and risk-taking behavior. Moreover, a provider's marketdriving behavior poses a serious challenge for current service production, as it focuses on future business opportunities while voluntarily sacrificing the capture of immediate value. Without adequate market sensing, a myopic producer faces considerable financial risk in customer non-adoption. Finally, in the balanced *mode* of service co-creation, congruent objectives may result in services that meet both the clients' immediate needs and serve as a springboard for future services. The balanced strategy mode enables a combination of the competences of both client and service provider. It seems to offer a better basis for creating more complex novel value-added improvements than what can be achieved through the one-directional approaches.

The Recipe: Managerial Implications for Service Innovators

So what is the new recipe for service innovation? The characteristics of services that the client and the service provider try to accomplish through their exchange relationship influence the value-creation logic and competences required. Nevertheless, service innovation management is a tricky area. The most successful service providers may generally not be the ones that focus solely on technology. Providers that incorporate clients' experience into service innovation, and understand clients' ability to capture value from the service, will be strong even in the future. Radical service innovations are, however, driven by

	Mode of Service Co-Creation			
Charac- teristics	Client-Driven	Provider-Driven	Balanced	
Company Cases	MySAP, MySQL, NowPublic	Apple iTunes, Dell, Google, Microsoft, Nokia	Intel, McAfee, Skype, TVU Networks	
Competitive Superiority	 Value propositions are typically directed toward known clients and their explicit needs through client-driven market pull Customer-centric innovation activity serves existing needs optimally through well-defined market-oriented solutions 	 Technology push in innovation-oriented development of services targets prospective clients The provider-driven development activity may create new innovative services that would not otherwise exist 	 Ambidextrous innovation activity combines both market and technology orientation in service co- development Strategic congruence based on mutual interests enhances current and future value co-creation 	
Relational Complexity	 Strong focus on immediate clients' needs forms a bias in collaborative relationships and reduces service reproducibility Client is sensitive to providers' reluctance to invest in the client-driven innovation, which may affect the service relationship commitment 	 The provider-driven innovation activity poses challenges concerning clients' willingness to commit to the service provider's priorities Pursuing clients to adapt service innovations leads to economic and social burdens, causing friction in relationships 	 Relational client-provider collaboration manifests enthusiasm for win-win situations in service co- creation Highly complex and sometimes contradictory interests in partnership- oriented relationships pose challenges for collective value creation 	
Operational Priority	 Clients lead service co- development activity and challenge providers to adapt their capabilities to meet clients' wants and needs Efficient service co- creation depends on client's ability to exploit provider's resources 	 The service provider is proactive in exploring new service opportunities for the future The service provider is willing to accept business risks related to breaking the traditional frames of conducting business 	 Efficient service co-design requires the utilization and adaptation of both the service provider's and client's capabilities Services are integrated to both the client's needs and the provider's offering portfolio 	
Cognitive Exigency	 Humility and responsiveness to client's conditions epitomize the activity of service providers Clients' confidence in demanding services and externalizing their requirements drives the innovation activity 	 Service providers need courage to prioritize future opportunities over current needs Clients need to be content with the partial fulfillment of current needs 	 The desire to cooperate and commit to common goals is a key requirement for both service providers and clients Collective innovation activity requires openness and trust in collaboration 	

TABLE 2. Modes of Service Innovation Activity: Key Aspects of Co-Creation

technological breakthroughs that may result in discontinuous innovations, potentially driving existing services out of business.

To derive maximum value from service innovations, it is fundamental for managers in the service economy to: identify the *service innovation strategy* of both the client and service provider; understand the risks and rewards of different *service co-creation modes*; and develop the necessary *capabilities, culture, and mindset* for a particular service situation.

- Service Innovation Strategy—A key aspect in service innovation is identifying the value-creation approach and expectations of both the client and service provider innovation.¹⁷ We should recognize the differences between established services and incremental and radical service innovations. The service strategy framework, depicted in Table 1, is a conceptual tool that helps innovators to identify the participants' service innovation strategies. According to the framework, incremental innovation, driven either by the service provider or the client, is based on minor improvements in the current offering and its implementation, focusing on nearfuture needs. These innovations can range from fairly simple autonomous improvements to multifaceted systemic improvements, which may require collaboration from several actors in the value-system. Radical innovations produce completely novel services, breaking the traditional frames of value creation. It is questionable whether they come into existence as a result of a conscious strategy, although they seem to require a strong innovation orientation.
- Service Co-Creation Modes—We need thorough understanding of the risks and rewards of diverse service innovation modes, of the role of clientprovider interaction in the creation and utilization of service innovations, and the differences between provider-driven, client-driven, and collaborative innovation. The service co-creation matrix in Figure 1 illustrates us the match between the client's and provider's service innovation strategies, and it indicates whether one actor leads the service development process or the actors have equal roles in the development activity. In order to be effective, the service innovators should recognize the distinctive characteristics of different service co-creation modes. For example, Table 2 exemplifies that in client-driven service development the service provider faces the risks of lesser scalability of the service and potential lack of long-term business opportunities. Conversely, the provider-driven service development mode may lead to a mismatch between the service innovation and market needs. Hence, service co-creation stipulates a collaborative mindset. In other words, service providers need the vision and courage to go beyond immediate needs and prioritize future opportunities.
- *Capabilities, Culture, and Mindset*—Service innovation, resulting from an intertwined set of innovation activities that the participants control and carry out, is fundamentally based on their resources and capabilities.¹⁸ To understand and manage client-provider relationships in a particular

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service co-creation mode, it is essential to comprehend how both clients and service providers perceive value, as well as their roles and strategies in service innovation. This involves exploring the combined capabilities of the client and service provider as well as identifying the factors that help or hinder the co-production of services. As brought up earlier, the RBV theory emphasizes intra-organizational resources and capabilities. The key point to bear in mind is that the client and the provider derive value from the service through their capabilities.¹⁹ These capabilities influence both participants' value capture potential.²⁰ Identifying and making the most of all participants' capabilities and cultural aspects are assisted by Table 2, which profiles the characteristics and requirements of service innovation modes. In all, developing an ambidextrous culture and mindset that simultaneously focuses efficient service process and strives to create new business is vital for innovative service business.

The result? Designing service-driven business models is a challenging task in the service economy. Business models in the service context should be seen as the manifestation of the respective mindsets of the service provider and the client to value creation, which is based on the understanding of one another's value-creation logic and the goals and activities that make both parties more competitive. The business model construct²¹ is based on the premise that the creation and implementation of any service requires a set of value activities performed by the partners forming a value-creating system.²² We must understand that winning service business models require integrating the value-creation strategies of both the client and service provider.²³ Such novel thinking calls for an understanding of value co-creation in terms of mutual competitive superiority, with attention to the relational complexity, operational priorities, and cognitive exigencies in service-driven business models.

In brief, the more customer involvement the utilization of the service offering requires, the more important it is to acquire a comprehensive understanding not only of the reason why clients are using the service, but also of the processes and competences they employ to render the value for themselves. Besides the client's own role, the relevance of collaborative service innovation is driven by the variety of the competences required in its design and co-creation. Although both client-driven and provider-driven innovation approaches have their indisputable benefits, shouldn't all service innovators benefit from collaborative service co-creation?

Conclusion

Managing value co-creation for service innovations remains one of the most important areas relating to business strategy in the service economy. Our analysis provides the foundations for development of superior service-driven business models. These involve understanding the roles of both the client and service provider and addressing the capabilities required by different modes of value co-creation. Our study extends the RBV by describing the conditions and types of value co-creation and the activities and competences in realizing value. Managers on both sides of the value creation divide require a comprehensive understanding of the attributes of value co-creation strategies that drive, sustain, and support service innovation. Moreover, researchers need to continue developing concepts, theories, and frameworks that capture the challenges and opportunities presented by the modes of service co-creation.

What is required is a unifying framework of approaches to value creation. The value strategy matrix is an abstract conceptual tool and we have treated each basic value approach separately to point out its individual characteristics. In real life, many client-provider relationships can be hybrids, having qualities of two or more value strategies. For example, both the service provider and client can try to drive a value-added strategy without striking a balance. However, the framework offers an invaluable aid for management in designing their client and provider portfolios and in managing individual client-provider relationships.

Notes

- Service innovation is driving global GDP growth. According to the latest available estimates, service sector employees represent 70 percent of the labor force in both the U.S. and Japan—the leading service economies in the world. Moreover, the proportion of these workers exceeds 50 percent in many industrialized nations.
- 2. We introduce the concept of service innovation myopia in order to call for discussion that Theodore Levitt stimulated in the marketing discourse with his seminal work on "marketing myopia." T. Levitt, "Marketing Myopia," *Harvard Business Review*, 38/4 (July/August 1960): 45-56. We see that the current discussion on services, in many respects, bears the same challenges that product marketing had at that time.
- 3. We use the terms "competence" and "capability" interchangeably.
- 4. For the fundamentals of the RBV, see B. Wernerfelt, "A Resource-Based View of the Firm," *Strategic Management Journal*, 5/2 (April-June 1984): 171-180. A retrospective analysis of the RBV is presented by J. Barney, M. Wright, and D.J. Ketchen, Jr., "Resource-Based Theories of Competitive Advantage: A Ten-Year Retrospective on the Resource-Based View," Journal of Management, 27/6 (2001): 625-641.
- 5. For more information on the applications of the RBV, see R.K. Srivastava, L. Fahey, and H.K. Christensen, "The Resource-Based View and Marketing: The Role of Market-Based Assets in Gaining Competitive Advantage," *Journal of Management*, 27/6 (2001): 777-802; R.L. Priem and J.E. Butler, "Is the Resource-Based View' a Useful Perspective for Strategic Management Research?" *Academy of Management Review*, 26/1 (January 2001): 22-40.
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Paper II

Approaches to strategic alignment of business and information systems: a study on application service acquisitions

by

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Approaches to strategic alignment of business and information systems

A study on application service acquisitions

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Abstract

Purpose - Technology-related issues have an increasing impact on business. The alignment between overall business objectives and technology-related decisions, such as decisions on application service acquisitions, resurfaces occasionally in the intense academic discussion on information systems (IS). Prior research indicates that the alignment of business and IS decisions remains a major concern for business practitioners. The purpose of this paper is to analyze the factors that drive the consistency in technology-related decisions and result in diverse modes of business-IS alignment.

Design/methodology/approach - This study investigates application service acquisitions among the top 200 firms in Finland. In this quantitative empirical study, principal component analysis with varimax rotation method is used to examine the companies' drivers for business-IS alignment. Moreover, the firms are categorized using the cluster analysis method.

Findings - This study identifies four factors that drive the achievement of business-IS alignment. These factors are: awareness of the impact and risks of IS decisions, efficacy of IS management, systematic decision making process, and business development orientation of IS management. Moreover, the study identifies four clusters of firms that illustrate diverse modes of business-IS alignment: ad-hoc alignment, business-driven alignment, consensual alignment, and technology-driven alignment.

Originality/value - The value of the study lies in revealing the key factors influencing the alignment of vital IS investments and the overall business strategy. The study identifies four clearly different approaches to business-IS alignment. Moreover, the paper suggests that business-IS alignment stems from several factors, including the collective development of strategies that reflect the combined knowledge of business and IS managers.

Keywords Information systems, Business administration, Finland, Corporate strategy, Strategic alignment, Technology led strategy

Paper type Research paper

Introduction

The strategic alignment of business and information systems (IS) has been a consistent [©] Emerald Group Publishing Limited 1238/265 theme in the academic and business literature for decades. The issue of alignment has

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been well known and documented since the late 1970s. It has grown in importance as companies link business and technology in light of dynamic business strategies and continuously evolving technologies. Strategic alignment has the potential to aid an organization in leveraging its investments in IT resources (Avison *et al.*, 2004; Byrd *et al.*, 2006). Several alignment models have been offered, the best-known of which is the strategic alignment model (SAM) developed by Henderson and Venkatraman (1990, 1991). Yet achieving strategic alignment remains a major concern for business executives. For example, Luftman *et al.* (1999) call for more research on how to achieve and sustain the harmony between business and IS and on the impact of alignment on the firm. This theme has re-emerged at the beginning of the 21st century along with the business critical decisions concerning application service acquisitions. These decisions refer to situations where software is acquired as a service.

Traditional business development strategies have failed to take full advantage of IS. Prior research argues that business-IS strategic alignment facilitates the business effect of IS and that contextual factors affect business-IS alignment (Campbell *et al.*, 2005; Kearns and Sabherwal, 2007). Moreover, Luftman *et al.* (1999) claim that the appropriate application of IS can drive or enable business strategy. However, many firms still see information technology as a "cost center" or an "expense" rather than as an enabler or driver of business value (Luftman *et al.*, 1999). Although firms facilitate new business through information technology, they tend to emphasize cost-efficiency and basic functionality in the acquisition of information system applications. Conversely, Byrd *et al.* (2006) argue that the firm can increase revenues and profits not by investing more in IS but by better aligning IS and business strategies.

Several frameworks have been proposed to assess the strategic alignment regarding the role of IS as a competitive weapon. However, they have neither provided concepts nor yielded empirical evidence on how to achieve the desired level of alignment. Indeed, little research has validated or described the factors that drive strategic alignment. Moreover, there is insufficient understanding of the relationships among contextual factors, planning behavior, and drivers of business–IS alignment. In addition, firms have taken different approaches to alignment. Thus, our study does not suggest yet another alignment model, but instead, presents an explorative analysis of the achievement of business-IS alignment. More specifically, in this study, we explore the drivers and modes of strategic alignment by analyzing firms' application service acquisitions. Extant studies focus on the application development portfolio and planning for individual IS projects (Kearns and Sabherwal, 2007). We think that a study of decisions concerning acquisitions is reasonable, as firms increasingly acquire IS applications as services instead of developing and implementing them by themselves.

The paper is structured as follows: after this introduction, we explore business-IS alignment. Then, we describe the methodology of our empirical study and present our findings. Finally, we conclude the study by discussing the results and their implications.

Business-IS alignment

Improving strategic alignment is one of the most important IS management issues. Strategic alignment coordinates the relationship between the business domain and the IS domain of an organization. The discussion of strategic alignment considers the

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strategic fit between strategy and infrastructure as well as the functional integration between business and IS. It is often discussed in the context of strategic information systems planning (SISP). Although based on similar aspects, strategic alignment and SISP are fundamentally different: SISP addresses the process of coordinating the business domain and the IS domain, and alignment represents the result of that process (Haglind and Cheong, 2001). Furthermore, the strategic alignment perspective emphasizes the benefits of IT, which can be achieved once the IS applications are in use (Galliers, 1999). According to Haglind and Cheong (2001) the concept of strategic alignment emerges in the discourse among business managers, whereas the concepts related to SISP are more familiar to CIOs.

Strategic alignment is commonly defined as the implementation of IS in the integration and development of business strategies and corporate goals. It is also:

- the extent to which the IS strategy supports, and is supported, by, the business strategy (Luftman *et al.*, 1993); and
- the degree to which the IT mission, objectives, and plans support and are supported by business mission, objectives, and plans (Reich and Benbasat, 1996).

The strategic alignment model of Henderson and Venkatraman (1991, 1993) implies that effective and efficient utilization of IS requires the alignment of IS and business strategies. That is, strategic alignment is based on the relationship between strategic fit and functional integration. According to Henderson and Venkatraman (1991), strategic fit is the ability to make decisions concerning a company's market positioning based on external and internal environment conditions. Moreover, the concept of strategic alignment replaces a traditional functional linkage model of IS planning with one that requires a highly integrated strategic management process. However, Henderson and Venkatraman have developed their conceptual model of strategic alignment in response to a rapidly changing business environment. This reflects the view that business success depends on the linkage of business strategy, IS strategy, organizational infrastructure and processes, and IS infrastructure and processes (Burn and Szeto, 2000). In this thinking, it is obvious that investment decisions are an essential part of the implementation of IS strategy, and have a clear business impact. Weill (1992) found that transactional IS investment exhibited a positive relationship with performance and that strategic IS investment had a negative relationship with performance. This is connected to the IS productivity paradox discussed in the 1990s, which questioned the contribution of IS expenditure to the bottom line. Recent work on the value of IS has been much more encouraging (Byrd et al. 2006).

Does the SAM provide sufficient support for investment decisions? Weill and Broadbent (1998) built on it a theory that recommends how companies should invest in technology infrastructure to support business strategies. However, their modified model lacks criticism on the basics on which the original strategic alignment model is built. As Smaczny (2001) points out, their idea requires a well thought through strategic planning process that allows for the inclusion of IS. Interestingly, the technology infrastructure investments are the most difficult investments to justify in today's companies. On the one hand, the business landscape is changing very quickly. On the other hand, technology infrastructure investments are substantial and have to be utilized for extensive periods of time to pay for themselves. Therefore, congruent with Smaczny (2001), the question to be answered is: if there is no time to use the Approaches to strategic alignment

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traditional strategic planning frameworks, can we use the strategic alignment model to guide IS investments that support and are supported by business objectives?

Maturity of alignment is subject to management orientation and capabilities

Luftman et al. (1999) identify two important enablers of alignment: IT managers' participation in the creation of business strategies, and, definition and support of effective IT governance processes. Symons (2005) points out that after 20 years of making IT and business strategy alignment a top priority, little progress appears to have been made, implying that many companies remain in the immature phases of strategy alignment. The strategic alignment maturity model developed by Luftman (2000) illustrates the characteristics of the alignment at different levels of maturity. The maturity model is presented in Table I.

Several contextual characteristics of the external environment, the organization, and the IS function are believed to affect strategic IS development. Strategic IS applications seem to be facilitated by a turbulent and information-intensive industry, a strong link between top management and IS, a competent IS department, and the existence of systems upon which the strategic application may be based (Sabherwal and King, 1995).

A strategy that responds rapidly to a chaos environment is required. Smaczny (2001) points out that a traditional approach to strategic alignment requires the separation of business and IS strategy and then their synchronization. Such an alignment model requires a separate synchronization of business strategy, IS strategy, operational business plans, and IS plans. According to Smaczny (2001), this is

	Stage	Maturity	Description		
	0	Non-existent	There is a complete lack of any effort to align IT and business strategy. IT functions in a purely supportive role		
	1	Ad hoc	There is evidence that the organization recognizes the need to align IT and business strategy. However, there are no standardized processes. There are fragmented attempts, often on a case-by-case basis within individual business units		
	2	Repeatable	There is awareness of alignment issues across the enterprise. Alignment activities are under development, which include processes, structures, and educational activities. Some strategy alignment takes place in some business units but not across the entire enterprise. Some attempts are made to measure and quantify the benefits		
	3	Defined process	The need for IT and business strategy alignment is understood and accepted. A baseline set of processes is defined, documented, and integrated into strategic and operational planning. Measurement criteria are developed, and activity is monitored. Overall accountability is clear, and management is rewarded based on results.		
Table I.	4	Optimized	There is advanced understanding of IT and business strategy alignment. Processes have been refined to a level of external best practices, based on results of continuous improvement and maturity modeling with other organizations. External experts are leveraged, and benchmarks are used for guidance. Monitoring, self-assessment, and communication about alignment expectations are pervasive		
maturity model	Source: Adapted from Luftman (2000); modified by Symons (2005)				

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unrealistic. The model will not be able to handle the amount of communication that is required in a fast changing business environment. Perfect communication required in this model is not even possible where the internal and external environments, change continuously and sometimes very chaotically (Smaczny, 2001). The strategic alignment model, because of its synchronization overhead, will not be flexible and responsive enough to deliver the desired outcomes.

Decision making reflects the mode of alignment

Systematic decision making fosters alignment. Strategy researchers representing different schools of thought have emphasized rational, political, and incremental decision-making processes. The rational school of thought is rooted in economics. It includes analysis and planning models of decision making (Sabherwal and King, 1995). Moreover, it focuses on activities such as examination of the company's strategy, assessment of its strengths and weaknesses, and the collection of information about the environment. This has been the dominant school of thought in IS research, which has emphasized comprehensive analysis, review of the business strategy, review of the existing IS application portfolio, and prediction of future industry and technology trends (Sabherwal and King, 1995).

Haglind and Cheong (2001) argue that strategic alignment is a matter of coordination. This means that rigorous decision making is essential in achieving more mature levels of business-IS alignment. Closer alignment should indicate a closer working relationship between IT and business managers. According to Byrd *et al.* (2006), this should lead to the development of more effective systems, especially long-term strategic systems. Similarly, they claim that alignment of IS and business strategy should facilitate more rational investments in information technology and reduce improvident spending (Byrd *et al.*, 2006). Moreover, the nature of the strategic decision making process is widely assumed to depend both on the topic of the decision and the context in which the decision is made. Sabherwal and King (1995) point out that strategic decision making is influenced by several contexts and stakeholders: the external environment, the internal or organizational forces, the top management, and the IS organization.

A better understanding of the strategic IS decision-making process is needed for several reasons (Sabherwal and King, 1995). First, the benefits of the timely development of potentially strategic systems along with the consequences of falling behind a competitor who develops such a system first, make this an important topic. Second, the potential benefits are difficult to evaluate and there is little prior experience on which to base the decision. Third, these systems require significant resources and are therefore quite risky. Fourth, it is difficult to evaluate whether the competitive advantage can be sustained or whether greater benefits would accrue to firms that copy the system later. Finally, the decision process may be quite complicated, being influenced by diverse groups, including top management, users, and vendors (Sabherwal and King, 1995).

Centralization of decision making has been mentioned as critical for IT executives. Kearns and Sabherwal (2007) define the centralization of IS decisions as the extent to which the IS decisions and responsibilities are made by a centralized IT organization, not by the users. Moreover, Sabherwal and King (1995) point out that the organization's size may affect strategic IS decision making. In small organizations, top Approaches to strategic alignment

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executives may participate actively, but in large organizations they may delegate active participation to others and contribute only indirectly. Large size may also lead to greater planning (Sabherwal and King, 1995). According to this view, decision making is more systematic in large organizations than in smaller firms. However, despite of the size of the organization and the level of centralization of IT management, successful decision making requires the awareness of the impact of decisions. In business-IS alignment this refers to the awareness of the impact and risks of IS decisions. They are mainly realized in combination with other organizational factors (Byrd *et al.*, 2006). For example, risks include strategic threats concerning deliberate activities of IS providers to exploit clients or excessive dependency on providers (Aron *et al.*, 2005). Recently, these issues have resurfaced along with the decisions pertaining to application service acquisitions, which are explored empirically in the following sections.

Methodology and empirical data

For the purposes of our research, we conducted a survey of firms' application service acquisitions. A set of quantitative data was collected through a telephone survey. The survey was conducted over a two-month period in 2005 and was addressed to the Chief Information Officers (CIOs) and business unit managers among the top 200 companies in Finland measured by annual turnover. This provided the sampling frame. We excluded governmental organizations and companies that belong to multinational conglomerates with IS management outside of Finland. The final sample comprised 146 firms. We initially contacted 292 potential respondents in these firms by email. These included 146 CIO's and an equal number of business unit managers. Of these potential respondents, 118 persons finally answered to the telephone survey, which yielded a response rate of 40.4 percent. The respondents comprised 65 CIOs and 53 business unit managers. The firms in our sample represent well the top 200 firms in Finland as illustrated by Table II.

The survey contained six groups of questions that addressed both the application service acquisitions and the business-IS alignment. All items were measured on a five-point Likert scales ranging from "strongly disagree" (1) to "strongly agree" (5). The factor analysis method was used to examine the companies' drivers for business-IS strategic alignment. There are several views on the minimum number of cases required for the factor analysis. Hair *et al.* (2006, pp. 112-113) recommend that the minimum absolute sample size is 50, but 100 or larger would be preferable. Generally, an adequate number of cases range from 100 to 300 (Gorsuch, 1983; Hatcher, 1994; Hutcheson and Sofroniou, 1999; Norušis, 2005, p. 400). Also, as a general rule, there should be at least five times as many observations as the number of variables to be analyzed (Bryant and Yarnold, 1995; Hair *et al.*, 2006, pp. 112-113). In the data of the present study consisting of 118 cases and 13 variables this subjects-to-variables ratio

Category	Turnover (million euros)	п	Percentage
Among 1-50 largest companies Among 51-100 largest compani Among 101-150 largest compar f firms in Among 151-200 largest compar Total	$\begin{array}{ccc} 1,005\text{-}29,267\\ \text{es} & 421\text{-}1\ 004\\ \text{ties} & 277\text{-}420\\ \text{ties} & 190\text{-}276\end{array}$	29 32 26 31	24.6 27.1 22.0 26.3

Table II. Distribution of firms in our sample by size

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equals 9.08. Thus, it is likely that the results from our analysis based on the PCA have sufficient explanatory power.

In order to rely on the results of the analysis, the required test values for the goodness of the method were investigated. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy tests whether the partial correlations among variables are small. Large values for the KMO measure indicate that using a factor analysis for the variables is an adequate method, and a value greater than 0.50 is considered acceptable (Hair *et al.*, 2006, pp. 114-115). The KMO was 0.70 in the present study and thus exceeded the recommended level. In addition, the Bartlett test of sphericity is significant (p = 0.00), indicating that sufficient correlations exist among the variables to proceed. Thus, both KMO measures and Bartlett test showed that the sample met the criteria for factor analysis. Finally, to conform to the assertions of Costello and Osborne (2005) concerning the exploratory factor analysis, principal components analysis (PCA) with varimax rotation was used.

The firms were further categorized using the cluster analysis method. The objective of cluster analysis is to group objects based on their characteristics so that there is a greater similarity among units within groups than there is among units in different groups (Klastorin, 1983, p. 92; Everitt, 1993; Hair *et al.*, 2006, pp. 555-628). In short, cluster analysis is an exploratory data analysis tool which sorts objects into groups so that the degree of association between two objects is maximal if they belong to the same group and minimal if they do not (Saunders, 1994). Cluster analysis begins by formulating the clustering problem and by defining the variables on which the clustering will be based (Hair *et al.*, 2006, pp. 555-628). In the present study, these variables were established through the preceding exploratory factor analysis.

The choice of the clustering procedure relies on K-means reassignment method, which splits a set of objects into a selected number of groups by maximizing between-cluster variation relative to within-cluster variation (Punj and Stewart, 1983; Steinley, 2006). In a non-hierarchical clustering such as this method, the number of clusters has to be determined in advance. The analysis was performed with a number of clusters ranging from 2 to 5. The four-cluster classification has balanced distribution of cases, and it seems to provide a viable choice where within-cluster distances are fair. Moreover, the resulting four-cluster solution could be easily interpreted and turns out to be theoretically interesting.

Findings

In this section, we present the results of the exploratory factor analysis and the subsequent clustering of the companies based on the identified factors.

Factors reflecting drivers of firms' business-IS alignment

The factor analysis revealed four underlying patterns that are identified as drivers for firms' business-IS alignment. The choice of the number of factors to use was determined by both theoretical considerations and the number of factors with eigenvalues in excess of one. As a result, four factors accounting for 58 per cent of the variance were extracted. The results of the factor analysis and the interpretation of factors are presented in Table III.

To summarize, the firms in our data describe their drivers for business-IS alignment:

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•,=	Awareness of the impact and risks of IS decisions	Factor 1	
	Risk of excessive dependency on application providers is a key hindrance to the acquisition of IS applications	0.769	0.608
	Risk of the loss of control is a key hindrance to the acquisition of IS	0.750	0.569
162	applications		
102	Security threats are considered a major hindrance to the acquisition of IS applications	0.713	0.548
	Efficacy of IS management	Factor 2	
	Our business managers and IS managers understand each others' perspectives concerning our IS projects	0.826	0.766
	Interaction between our IS organization and other functions is efficient and works well	0.805	0.688
	Our IS management can sufficiently influence the acquisition of IS applications Systematic decision making process	0.578 Factor 3	0.400
	We systematically supervise our IS application projects	0.750	0.664
	We set rigorous business impact measures when acquiring IS applications	0.723	0.569
	Our acquisition of IS applications complies with a prescribed decision making process	0.654	0.520
	Our IS decision making process accommodates cost pressure	0.459	0.394
	Business development orientation of IS management	Factor 4	
Table III.	Our IS management certainly supports our business strategy	0.741	0.626
Factor loadings and	Our IS projects are seen as business development projects	0.728	0.570
interpreting the factors	Information systems are key enablers of new business opportunities	0.527	0.588
Table III. Factor loadings and interpreting the factors	We set rigorous business impact measures when acquiring IS applications Our acquisition of IS applications complies with a prescribed decision making process Our IS decision making process accommodates cost pressure <i>Business development orientation of IS management</i> Our IS management certainly supports our business strategy Our IS projects are seen as business development projects Information systems are key enablers of new business opportunities (1) awareness of the impact and risks of IS decisions;	0.723 0.654 0.459 <i>Factor 4</i> 0.741 0.728 0.527	2.0 2.0 2.0 9.0 2.0 2.0

- (2) efficacy of IS management;
- (3) systematic decision-making process; and
- (4) business development orientation of IS management.

These four factors derived from our analysis are distinctive by their essence. In sum, they demonstrate the drivers of strategic business-IS alignment in large firms.

Clusters of firms representing different modes of alignment

After identifying the different strategies through the factor analysis, these standardized variables were subjected to K-means cluster analysis. The purpose was to identify the diverse modes of business-IS alignment. The result of clustering was a four-group solution that can be logically interpreted in terms of firms conducting business-IS alignment. ANOVA results indicate that "Awareness of the impact and risks of IS decisions" (F = 18.01, df = 3, p = 0.00), "Efficacy of IS management" (F = 7.81, df = 3, p = 0.00), "Systematic decision making process" (F = 14.89, df = 3, p = 0.00), and "Business development orientation of IS management" (F = 21.32, df = 3, p = 0.00) were significant contributors to the cluster solution. The final cluster centres are presented in Table IV.

According to our analysis, there are four distinct modes which firms adopt in relation to business-IS alignment. The clusters are interpreted as follows:

- (1) ad-hoc alignment (Group 1);
- (2) business-driven alignment (Group 2);

- (3) consensual alignment (Group 3); and
- (4) technology-driven alignment (Group 4).

The characteristics of these clusters are discussed in more detail below.

Group 1: Ad-hoc alignment

The firms in the first cluster reflect the lack of systematic decision making process on IS applications. That is, IS projects and application acquisitions are not systematically managed and monitored. Moreover, the decision making concerning applications does not comply with cost pressure even if required for business objectives. The business managers and IS managers fail to understand each others' perspectives thus sometimes advocating disconnected agendas in the IS projects. Under these conditions, the interaction between the IS organization and business units is perceived as inefficient and dysfunctional. Typical of business-driven alignment is that managers are aware of the risks of excessive dependency on providers, the loss of control, and security threats. However, IS management pursues business-oriented behavior. Group 1 reflects that alignment of business and IS exists occasionally irrespective of systematic approach to decision making.

Group 2: Business-driven alignment

The second cluster shows that in a business-driven alignment, risks related to IS decisions such as excessive dependency on application providers, the loss of control, and security threats do not hinder the acquisition of IS applications. Because of their strong business development orientation, IS managers certainly support the firm's business strategy. Moreover, in business-driven alignment, IS projects are deemed business development projects and key enablers of new business opportunities. In Group 2, business strategy is the driving force of the alignment. This notion is congruent with the strategic alignment model suggested by Henderson and Venkatraman (1993).

Group 3: Consensual alignment

Firms in the third group convey systematic decision making. That is, their IS application projects are systematically planned and supervised with rigorous business impact measures. Moreover, they are flexible in accommodating cost control if needed. This implies not only reactive behavior on business needs rather proactive business development orientation of IS management. In these firms, IS management supports the business strategy and facilitates new business opportunities. Congruent to this, the risks and impacts of IS decisions are well-known. Characteristic of the consensual

	Group 1 (<i>n</i> = 20)	Group 2 (<i>n</i> = 24)	Group 3 (<i>n</i> = 37)	Group 4 (<i>n</i> = 34)	
Awareness of the impact and risks of IS decisions	0.420	- 1.302	0.515	0.038	
Systematic decision making process Business development orientation of	-0.783 -1.267	-0.096	0.566	-0.214 0.144	Table IV. Cluster centers of firm
IS management	0.313	0.512	0.526	-1.157	groups

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approach, the managers of business units and IS organization hold similar views on application decisions and understanding of one another's needs. This is maintained through effective interaction between the IS and other functions. Moreover, in Group 3, IS management is influential in the acquisition of IS applications.

Group 4: Technology-driven alignment

In the fourth cluster, IS organization, is considered an island within the firm. It lacks the business orientation and is thus unable to contribute to the business strategy. In these firms, information system projects have other objectives than business development. Congruent to this, information systems are not key enablers of business opportunities. However, this may be a result of exiguous interaction between IS managers and business managers, and the absence of understanding each other concerning the IS projects. In Group 4, firms' decisions concerning IS follow systematic decision making process.

Discussion and conclusions

The objective of our study was to analyze the achievement of business-IS alignment. Based on our empirical data, we explored the alignment by analyzing decisions pertaining to application service acquisitions. We identified four factors that drive the achievement of strategic alignment in the top 200 Finland-based firms: awareness of the impact and risks of IS decisions, efficacy of IS management, systematic decision making process, and business development orientation of IS management. We then clustered identified four modes of business-IS alignment:

- (1) *ad-hoc*;
- (2) business-driven;
- (3) consensual; and
- (4) technology-driven.

These four modes reflect clearly different approaches to strategic alignment.

Our results have theoretical and managerial implications. First, we find that decisions concerning vital IS investments, such as application service acquisitions, reveal both the firm's mode of alignment and its underlying drivers. Business-IS alignment derives from the collective development of strategies that reflect the combined knowledge of business and IS managers. Kearns and Sabherwal (2007) argue that greater business-IS strategic alignment contributes to increased business effects of IS by improving the quality of IS project planning and reducing the number of implementation problems in IS projects. Thus, the positive effect of strategic alignment is two-fold: perceived success of IS investments and increased business performance. Moreover, consistent with prior literature (e.g. Henderson and Venkatraman, 1991; Kearns and Sabherwal, 2007), greater strategic alignment may facilitate the identification of the gap between current and future states of the organization, and the identification and prioritization of IS projects that would reduce this gap. Thereby, it enables IS project plans to be more tightly integrated with business plans and strategies. IS managers need to continue to focus on the systematic decision making process and the recognition of the potential impact and risks of IS decisions as the key antecedents of business-IS alignment.

Clearly, research on strategic alignment is far from complete. Although we arrived at new insights on the drivers and explicit modes of business-IS alignment, our study has

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limitations. First, we explored strategic alignment only in large firms. However, it has been suggested that decision-making is conducted more systematically in large organizations than in smaller firms. This notion suggests that the results may be different in small firms. Second, we focused on application service acquisitions. Yet, the decision-making is context-dependent and may vary by the subject concerned. This notion provides potential avenues for further research. Future studies should cover all areas of IS management and analyze alignment also in small and medium-sized companies.

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Paper III

Strategic Flexibility in Open Innovation: Designing Business Models for Open Source Software

by

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Strategic Flexibility in Open Innovation

Designing Business Models for Open Source Software

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Abstract

Purpose – This paper explores how market orientation facilitates the strategic flexibility of business models grounded in open innovation. We suggest that the new paradigm of open innovation may impact a firm's adaptability and responsiveness under conditions of environmental flux. However, extending innovation capacity by opening the innovation process poses major challenges for firms. The aims of this study are (1) to explore the characteristics of open innovation activity; and (2) to contemplate the role of strategic flexibility in the design of business models based upon open innovation.

Design/methodology/approach – The study draws upon a qualitative research approach through a longitudinal case study in the field of open source software (OSS). Our empirical case illustrates how an OSS firm utilizes signals in its environment to flexibly alter its business model.

Findings – A business model that embodies open innovation raises dilemmas between open and closed innovation paradigms. However, our case highlights that an ambidextrous approach that combines market orientation with the principles of open innovation increases profitability, shortens time to market through effective market access, and enhances innovation capability.

Research limitations/implications – Our results have profound implications for industrial marketers, managers, management consultants and business educators. They can use the insights gleaned from this research to guide the development of business models that involve open innovation. The results indicate that firms involved in open innovation need reactive strategic flexibility to cope with the environmental diversity and variability. However, this study analyzes a single case in the field of OSS and one should be cautious when generalizing the findings.

Originality/value – This paper improves the understanding of the relationship between flexibility and market orientation. It combines two areas that have previously been discussed separately: market orientation and open innovation.

Keywords – Open innovation, Business models, Market orientation, Strategic flexibility Paper type – Research paper

Introduction

Market-oriented strategic flexibility is a key driver of business model performance (Guo, 2002; Javalgi et al., 2005). According to Harrigan (1980), strategic flexibility can be seen as a firm's ability to redeploy its assets without friction. Moreover, Aaker and Mascarenhas (1984) conceptualize it in terms of a flexible resource pool and a diverse portfolio of strategic options, through which strategic flexibility enables firms to manage uncertain and fast-occurring conditions effectively. Sanchez (1995) similarly defines strategic flexibility in the context of product competition as comprising the flexibility inherent in product-creating resources (resource flexibility) and flexibility in using these available resources (coordination flexibility). Furthermore, Shimizu and Hitt (2004) perceive strategic flexibility as an organization's capacity to identify major changes in the external environment (e.g., the introduction of disruptive technologies), quickly commit resources to new courses of action in response to those changes, and act promptly when it is time to halt or reverse existing resource commitments. Finally, Javalgi et al. (2005) describe market-focused strategic flexibility as a firm's intent and capacity to generate firm-specific real options for the configuration and reconfiguration of appreciablysuperior customer value propositions. This is apparent in the profit-seeking business behavior related to proprietary innovations. In our investigation of strategic flexibility in the context of open innovation, we lean on the conceptualizations of Harrigan (1980), Aaker and Mascarenhas (1984), Sanchez (1995), Shimizu and Hitt (2004) and Javalgi et al. (2005).

The open innovation approach, as an alternative to proprietary innovation development, is of particular interest to many industries today (Wu and Lin, 2001; Paulson *et al.*, 2004; Bonaccorsi *et al.*, 2006). Even though its foundation can be linked to the traditional concept of collective action (Olson, 1965), open innovation has recently emerged as a novel, major cultural and economic phenomenon. The concept's recurrence has been especially observable in the field of open source software (OSS) since the mid 1990s (Stallman, 1999, Faldetta, 2002). It has resulted in many popular and freely-distributed innovations, such as the Linux operating system for microcomputers and Apache server software for web applications. However, according to recent research literature (Massey, 2005; Ducheneaut, 2005; Goth, 2005; Fitzgerald, 2006), the OSS movement is transforming from its philosophical and idealistic socio-technical origins into more commercial forms. Simultaneously, the principles of open innovation are advancing innovation activity in a variety of fields, ranging from the music industry to literature and academic publishing. Because of the prominence of open innovation in the field of OSS, it offers an interesting research domain.

Literature on market orientation has traditionally examined firms in a closed innovation context that assumes that commercial actors are the originators and owners of innovations (e.g., Sandvik and Sandvik, 2003). Conversely, open innovation activity assumes that users are innovators who are actively seeking and developing solutions to meet their own needs, and that firms are actors pursuing benefits from collectively-created innovations (Dahlander and Magnusson, 2005). We believe that this paradigm revolutionizes the fundamental axioms of market orientation. However, open innovation has not received sufficient attention in prior literature on market orientation. In this study,

we focus upon the market-orientation and strategic flexibility of a firm operating within the field of OSS. This is a challenging task, because the open source software business still is a poorly understood phenomenon, and there is no single framework that explains the antecedents of business models based upon open innovation (Chesbrough, 2006). The aims of this research paper are (1) to explore the characteristics of open innovation activity; and (2) to contemplate the role of strategic flexibility in the design of business models based upon open innovation.

The remainder of the paper is organized as follows. After this brief introduction, we first describe the characteristics of open and closed innovation activity. Second, we review the concept of market orientation and discuss the antecedents of business models in the open source software context. Third, we analyze a single empirical case and establish a conceptual framework for the role of strategic flexibility in designing business models grounded in open innovation. We conclude by discussing the implications of our findings.

Open and closed approaches to innovation

Open innovation builds upon the collective design and production of goods and knowledge. It enables an organization to leverage new potential for creating and capturing value (Chesbrough, 2006). However, the concept of open innovation remains ambiguous for many researchers and business practitioners alike (Feller and Fitzgerald, 2002). There is concern over whether the distributed models of innovation, involving several autonomous actors, are difficult to control, manage and commercialize. Conversely, closed innovation has institutionalized itself as the dominant mode of innovation. Whereas the pros and cons of the closed mode of innovation are well-known, the characteristics of the open mode of innovation are not. Open innovation often may be examined too narrowly; for example, from the perspective of opening intellectual property rights (IPR). However, it is more than merely acquiring intellectual property created by others. A comparison of the two modes is presented in Table 1.

The competitive advantages of the two innovation approaches are illustrated through the concept of strategic incentives. The closed innovation model emphasizes the benefits of being first to market. In the closed approach, client-centric innovations are designed to meet explicit current or future market needs. Conversely, prior research suggests that, within the open innovation approach, superior business models are considered better than the aim to enter the market first (Chesbrough, 2003). Moreover, the development of innovations in the open model emerges from participants' implicit needs. In general, the actors that subscribe to the principles of open innovation approach see that freedom promotes wide utilization and continuous development of innovations (Chesbrough, 2006). The 'freedom' here refers to the freedom of use and further development of innovations.

	Mode of innovation			
Dimensions	Closed	Open		
Strategic incentives	 Closed innovation development stresses the benefits of being first to market Client-centric innovations are designed to meet explicit market needs Major technological discontinuities coexist with closed innovation activity 	 Building better business models is better than getting to market first The development of innovations emerges from participants' implicit needs Freedom promotes wide utilization and continuous development of innovations 		
Relational complexity	 Both in-house development and intentionally-formed business networks characterize innovation development Governance focuses on managing software development with in-house developers Proprietary innovation activity poses challenges to clients' willingness to accept innovations, and creates both economic and social burdens, causing friction in relationships 	 Users predominantly co-produce innovations in informal and self- organizing social networks that comprise the innovation platform Co-operation is managed by influencing and guiding collective innovation activity over temporal-spatial and socio- cultural distance, even though interests sometimes are contradictory Routine communication is asynchronous, through the Internet 		
Operational priorities	 Commercial actors prioritize business opportunities by identifying clients' explicit needs R&D investments are central enablers in exploring new innovations Innovation development is intrinsically based on controlling clearly outlined and organized business processes 	 Innovation activity prioritizes the development of solutions devoid of the push for business potential Exploration of other actors' resources in the community drives innovation Operation is founded upon seeking collaboration and consensus, instead of hierarchical supremacy and power 		
Cognitive exigencies	 An introverted approach to the control of knowledge is intended to ensure the potential for future revenue Safeguarding against IPR infringements is an inherent feature in copyright thinking Innovators need courage to prioritize future opportunities over current needs 	 Distribution of intellectual property requires an extroverted attitude and trust, which are salient in bringing forth collective innovations Copyleft thinking is applied to promote continuous innovation development The desires to co-operate and commit to common goals are key requirements for actors in development communities. 		

Table 1 Characteristics of the closed and open modes of innovation activity

Relationship management is a challenging task in innovation activity. The concept of *relational complexity* depicts the distinctive issues related to the governance of innovation activity within the two distinctive approaches. In the closed innovation model, both in-house teams and well-defined, intentionally-formed inter-organizational networks (Gadde and Mattsson, 1987) dominate the development of innovations. In the closed

model, governance focuses upon managing software development with in-house developers. Conversely, co-operation is managed by influencing and guiding collective innovation activity over temporal-spatial and socio-cultural distance, even though interests sometimes are contradictory (Brito 2001; Faldetta, 2002). Lundell *et al.* (2006) also point out that, in the open innovation mode, users predominantly co-produce innovations in informal and self-organizing social networks that comprise the innovation platform. Moreover, communication, for the most part, is asynchronous and conducted via the Internet.

Different innovation modes emphasize different *operational priorities*. These priorities are exemplified by the actions taken to foster competitive advantage. With the closed innovation approach, commercial actors characteristically prioritize business opportunities by identifying explicit market needs. Hence, R&D investments are central enablers in exploring new innovations. In the closed innovation mode, the development of innovations is intrinsically based upon controlling clearly outlined and organized business processes. Conversely, open innovation activity may prioritize the development of solutions even without the push for immediate business potential. Exploration of other actors' resources in the community is a key activity in open innovation development (von Hippel and von Krogh, 2003; Lundell *et al.*, 2006). Moreover, open innovation activity is founded on seeking collaboration and consensus, instead of hierarchical structures and power in decision making.

Cognitive exigencies vary between the innovation approaches. That is, different innovation cultures pose diverse requirements for the intellectual mindset of business practitioners. For example, Bonaccorsi *et al.* (2006) explain that the closed innovation approach is intended to control knowledge, in order to ensure the potential for future revenue. Fitzgerald (2006) adds that safeguarding against IPR infringements is an inborn feature in this kind of copyright thinking. In the closed innovation model, innovators need courage to prioritize future opportunities over current needs, so as to succeed in the long-term. Conversely, Stallman (2002) and Bonaccorsi *et al.* (2006) argue that 'copyleft' thinking, which is one of the principles of the open source movement, contributes to open innovation by promoting continuous and collective innovation. However, the distribution of intellectual property to bring forth collective innovations is seen as requiring an extroverted attitude and trust in the other actors in the community. Furthermore, extending innovation capacity by opening the innovation process requires market-focused thinking, based upon the awareness of and attention to signals emanating from the environment.

Market orientation

Market orientation has been discussed widely in the academic literature. One of the fundamental propositions of marketing theory is that the effective implementation of market orientation results in superior competitive advantage (Jaworski and Kohli, 1993). Javalgi *et al.* (2005) also see market-focused strategic flexibility as potentially providing organizations with the necessary structure for long-term survival and prosperity. Javalgi *et al.* (2005) define the concept of market orientation as follows:

A market orientation involves customer orientation, competitor orientation, inter-functional co-ordination and two decision criteria – long-term focus and profitability. A market orientation is valuable because it focuses the organization on continuously collecting information about target customers' needs and competitors' capabilities, and using this information to create continuously superior customer value.

Kohli and Jaworski (1990) define market orientation as "the organization-wide generation of market intelligence pertaining to current and future customer needs, dissemination of intelligence across departments, and organization wide responsiveness to it." Even though, previously, other terms have been used - terms like 'marketing orientation' and 'market driven' (e.g. Kohli and Jaworski, 1990; Webster, 1988) - we treat the construct using the market orientation concept. Several authors define this construct as an aspect of organizational culture (Narver and Slater 1990; Deshpandé and Farley, 1998; Han *et al.*, 1998). Narver and Slater (1990) point out that this culture comprises three behavioral components: customer orientation, competitor orientation, and inter-functional coordination.

Customer orientation is an inseparable part of market orientation. Market-oriented firms generate information on changes in customer needs and their markets. Traditionally, market-orientation describes such actions as listening to customers and delivering solutions to satisfy customer interests and wants (Slater and Narver, 1994; Menguc and Auh, 2006). Information-generation activities include market scanning, customer ordering systems, and feedback collection on delivered products. Kohli and Jaworski (1990) note that market-oriented firms follow specific and identifiable routines and processes, such as generating information about customers through monitoring and assessing their changing needs and wants, disseminating that information throughout the firm, and revising business strategies to enhance customer value.

Competitor orientation emphasizes the actions of other actors in the market. It takes competitors' moves into account, by sharing information about competitive forces to deter market positional erosion (Day and Wensley, 1988; Day, 1994; Peteraf and Bergen, 2003; Menguc and Auh, 2006). Coordinated responses to competitors' actions and overall market changes are implemented continuously by market-oriented firms. Jaworski *et al.* (2000) emphasize that, although customer orientation is important, market-orientation means understanding competitive offerings and threats, as well as overall changes in the market environment. Golann (2006) supports this view, saying that, in addition to understanding perspectives and changes in customer needs, companies must analyze competitors and global factors that might affect future customer needs.

Inter-functional coordination and strategy development are key issues in market orientation. After collecting and sharing market intelligence, the market-oriented firm is expected to respond by changing product designs and customer services to fit the needs of different customers and market segments. According to this point of view, key indicators of market orientation include the organization-wide acquisition of market information, followed by its interdepartmental dissemination. Golann (2006) emphasizes that cross-functional collaboration and coordination of the activities among departments are critical to successful market orientation. This coordination eases the implementation

of product design and service changes. In particular, it assists firms in responding when customer needs change rapidly (Jaworski *et al.*, 1993; Golann, 2006).

In addition to the aspects identified by Narver and Slater (1990), we suggest that partner orientation is an important aspect of market orientation. Partner orientation refers to any business activity that emphasizes collaboration beyond organizational boundaries. This view is supported by e.g., Lee and Tsai (2005) who recognize the role of firms channel partners in their market orientation. Along with the rise of networks, it has become important to conducting business. Degree of openness and level of involvement in participative decision-making both influence a company's commitment to and involvement in innovative activities (Damanpour and Evan, 1984; Lee and Tsai, 2005). Furthermore, according to Kanter (1983), these factors improve information flow and communication within the partner network. In the context of open innovations, a partner network is composed of a community with numerous actors, including both users and developers. Characteristic of OSS innovation activity are new forms of power sharing: the originators of innovations transfer their power based upon proprietary and intellectual rights to potential co-developers, so as to benefit from the innovation capacity of the OSS community. Power sharing and knowledge sharing with partners foster the momentum acceptance of new ideas (Kanter, 1983; Van de Ven, 1986).

In addition, as market orientation refers to a firm's attentiveness and responsiveness to external environments, it has clear implications with respect to strategy formulation and, therefore, the realized strategy type (Matsuno and Mentzer, 2000). Market orientation may affect long-term strategy formulation, by emphasizing immediate market initiatives. In this vein, market orientation may result in a short-term strategic focus at the expense of a firm's long-term business performance. However, an ambidextrous approach that combines market orientation with the principles of open innovation may reverse this effect, by enhancing innovation capability and fostering the acceptance of new innovations. Market-orientation in the closed innovation environment enables a firm to understand market needs by listening to its customers. In open innovation activity, users are active and integral actors in the innovation process, and understanding the values and drivers of the whole OSS community becomes essential. In this setting, it is vital to reveal whether and how a specific commercial activity is possible in the community. This poses new premises for the development of firm business models.

Business Models in the field of OSS

In many respects, research on business models rests upon strategy discussion and draws upon strategic concepts and issues (Osterwalder, 2004; Morris *et al.*, 2005; Rajala and Westerlund, 2007). The literature on strategic management is rich with approaches to analyzing the components that form the business model of a firm. In their analysis of business models, Tikkanen *et al.* (2005) conceptualize the tangible, objectively-existing structures and processes, as well as the intangible, cognitive meaning structures at the level of business organization. These cognitive aspects of management, information sharing, and participation in communities are the foundation for an individual actor's action, and for the development of the whole community. In this respect, motives for participation and values in operation within the community are the key cognitive drivers

for business model development. In this context, cognition refers to a faculty for the human-like processing of information, applying knowledge and changing preferences.

The open source software phenomenon has been transformed towards a more commercial form (Fitzgerald, 2006). This transformation originated in customers' willingness to pay the going rate for the whole product, in terms of support. The OSS field has faced changes also due to large companies - like IBM, Oracle and Computer Associates, which had previously focused on proprietary solutions - turning to open source solutions (Kenwood, 2001). As an explanation for this transformation, Goth (2005) argues that, by promoting the OSS movement, these large companies expand the sales of their high-value middleware, hardware solutions and services. Consequently, as Bonaccorsi *et al.* (2006) point out, open source-based business should be seen as a competitive struggle between alternative business models in the software industry, in a way that is similar to business based upon proprietary software. Koenig (2004) identifies as many as seven business models based upon OSS: (1) optimization; (2) dual licensing; (3) consulting; (4) subscription: (5) patronage; (6) hosted applications; and (7) embedded applications. Many of these are based upon gaining revenue from sources other than software license sales.

Often the focus of open innovation activity is a collectively-created value proposition. *Value proposition* or *offering* as a component of the business model has received increasing attention in the literature (Hedman and Kalling, 2003; Osterwalder, 2004; Morris *et al.*, 2005). The whole product concept addresses the complexity of value proposition, by recognizing product-related services as an indistinguishable component of the offering (Kenyon and Mathur, 2002). The product-service utility that is provided by the firm to the customer represents the complete set of tangible and intangible attributes embodied in the offering provided. Hence, offerings may consist of a basic value proposition and its value-added extensions, such as complementary components and services (Bowen and Ford, 2002). Thus, to increase the use and sale value of the offering, software products typically require essential service components.

Resources form a key element of the business model of a firm. The resource-based view of the firm (RBV) accentuates the essence of resources in core competencies (Selznick, 1957; Prahalad and Hamel, 1990). Moreover, the capabilities of a company reflect its success in combining these resources to perform activities through internal and external relationships (Hart, 1995; Håkansson and Snehota, 1995). Open innovation activity builds upon the exploration and combination of resources that are distributed across the community and its actors. Moreover, the community itself becomes a key resource with a potentially huge capacity for innovation, based upon actors' heterogeneous skills and capabilities. Because many of the valuable resources in OSS communities are important mediators when attempting to access their innovation potential.

The centrality of *relationships* is characteristic of open innovation. Timmers (2003) argues that, in the design of network business models, the focus shifts from creating value through internal activities to creating value through external relations. He identifies these relationships within the innovation network as an important element in the development and commercialization of innovations. Actors perform different tasks and assume diverse

roles within the innovation network. There is a plethora of network relationship types. Ritter *et al.* (2004) identify the main types as a firm's supplier, customer, complementor and competitor relationships. However, this categorization is most applicable to the closed mode of innovation. The actors, as well as their roles and activities, are more complicated in open innovation activities.

Profit aspiration is a key driver of any business. In the recent research literature on the software business, a revenue model is seen as an inseparable element of business models (e.g. Pateli and Giaglis, 2004; Rajala and Westerlund, 2007). Profit aspiration describes the ways in which a company captures value and transforms it into revenue. Discussion of revenue models in the context of OSS has traditionally been difficult, because the cost structure that exists within the open innovation mode is radically different from that which exists in closed innovations. Moreover, the unconventional logic of open innovation leads to novel revenue structures that differ from those that are observed in a closed innovation system. The most salient issue is the free distribution of the results of the innovation activity promoted by the OSS movement. Despite the fiery debate on the rationale of freedom of software since the emergence of the open source software movement, there are also favorable attitudes towards earning money (Raymond, 2001) and, more generally, towards profit-oriented behavior based upon OSS.

In addition, licensing and copyrights are unavoidable issues in all innovation-based business models. We see the restrictiveness of licensing policy as an antecedent of business potential. In open innovation, these issues are characterized by 'copyleft' thinking, which concerns the extent of the intellectual property that can be released, all the while enabling initiators to benefit from the innovation. The OSS philosophy allows a multitude of choices for the ownership of intellectual properties and for the potential to use, modify and distribute software (Perens, 1999). This provides ground for potential tensions between OSS developers, users and profit-oriented firms. Although the *General Public License* (GPL) is the most common license in the field of OSS (Lerner and Tirole, 2005), some have claimed that it calls for the strictest regulations for reciprocity (Wu and Lin 2001). In other words, it purports to provide the original developer with access to all derivative outcomes related to the innovation.

Case MySQL

We investigated the impact of market orientation on flexibility by means of a longitudinal case study. Our empirical study was conducted from 2003 to 2007. The case, MySQL Ab (later MySQL), was selected on the basis of the following criteria: (1) the company relied on open innovation development; and (2) its business model was both verifiably successful in economic terms and exemplified strategic flexibility. The data included five interviews with the senior managers of the company, and an extensive set of secondary data including company documents, web blogs, Internet sources, and journal and magazine articles. The interviews with the senior managers' experiences. The interviews lasted from two to three hours and were transcribed for further analysis, where the data was coded and structured into five phases that illustrate open innovation activity, market orientation

and business model design in MySQL. A longitudinal single case setting provides us with a reasonable method to analyze the multi-faceted phenomenon of strategic flexibility in open innovation.

MySQL combines market-oriented and innovative thinking in their OSS business

MySQL develops and provides innovative open source-based database servers and tools. The company has rapidly grown into a leading database software provider, with more than 10 million users worldwide. The software serves both corporate and individual users, and is used by major Internet services like Yahoo! and Wikipedia. The software is developed continuously, in collaboration with the global open source software community. The source code of the software is freely available to use and modify. However, according to the open source philosophy, all derivative works when distributed must also be open source. That is, their source code must be accessible to other programmers, including the original developers. This principle protects and encourages software co-development and knowledge co-creation among innovators, developers and users. Thousands of partners in the MySQL ecosystem continue to develop the innovation. Throughout its existence, the company has exhibited the capacity to flexibly adapt its business model, according to both market orientation and signals relating to trends and values of the open innovation movement, thereby benefiting from the unique opportunities of the open source revolution. We have divided the history of MySOL into five time periods.

Shaping the open innovation: early 1980s-1995

The first period is rooted in the early 1980s. A group of three boundary-spanning experts from Nordic countries synchronized their efforts to develop a software solution that would meet their common needs. They shared and applied ideas and knowledge about database programming, which became the cornerstone of the MySQL database software innovation. The following quotation from the chief technical officer of MySQL depicts how personal intellectual capital related to technology development was combined through social networking of the key individuals.

Before establishing MySQL, we already shared our solutions between guys with similar needs. --- It is of benefit to share and to support the free dissemination of information between any relevant actors. (CTO, MySQL, 2004)

Later, they determined that a large group of potential customers have similar needs. The developers oriented themselves towards partnering, in order to meet these generic needs in the market. This open atmosphere and knowledge-sharing culture between the innovation originators provided a sound base for expanding the team of developers into OSS-oriented communities. In the mid 1990s, the number of relationships multiplied by means of the rapid increase in Internet communities, and because of the institutionalization of the OSS movement.

Along with the emergence of the Internet, there occurred recurring needs to get data out of databases in different web programming projects. For me, the development of an SQL

interpreter became necessary and I pondered whether someone else had similar needs. I joined a colleague from -- to develop a generic database solution. (CTO, MySQL, 2004)

Although the development of the software became more distributed, the collaboration between the originators, based upon personal relationships, can be seen as one of the key determinants of success in the early stages of innovation development. In addition to sharing technical knowledge, these key developers discussed ways to advance the involvement of users in the development work. They identified the opportunity created by user involvement in the co-production of innovations in informal and self-organizing social networks that comprise the innovation platform.

Systemizing the chaos: 1995-2000

The second period connected MySQL with the worldwide OSS community. The MySQL product development was set in motion in 1995 to allocate the original developers' resources more systematically to the advancement of the software. The originators of the innovation took a bold risk, releasing their intellectual property to the worldwide user community under a license that even then had many features of the General Public License (GPL), established in 2000, which later became a primary license agreement in the field of OSS. After the release of the software under this license, MySQL database solution emerged as the most popular open source database product in the world.

We found a trouble-free license format which we used to publish our database product on the Internet with its source code for the first time in 1996. (CTO, MySQL, 2004)

Connecting to the global OSS community through the release of software under GPL enabled the creation of a large user base, which included a number of active users that provided input for the innovation process. Gathering user feedback to improve the software was promoted by freedom of use, in contrast to competitors' proprietary software development and distribution. Listening to users was characteristic of MySQL's way of software development. User experiences spear-headed the development process and the flaws of the software were discussed openly with users and developers:

Get the latest beta and start trying out its new features --- please report your bugs to us --- You know, we hate bugs. (CTO, MySQL, 2004)

In addition to exploiting short-term business opportunities, the operational priority of the innovation activity centered upon a more long-term development of superior solutions. Exploration of the resource capacity embedded in the community was of help in this pursuit. The MySQL case further illustrates the benefits of proactive dissemination of information. The original innovators' attitude towards information sharing encouraged the participants to share crucial knowledge and information, which aided the firm in managing distributed innovation development.

Boosting the community: 2001-2003

The primary reasons for developers to share their intellectual property with the open source community were to enlarge the user base and recruit potential programmers to support ongoing development of the software. From 2001 to 2003, the company experienced a sizeable increase in the number of users of its database software. During this period, the business also grew in economic terms.

We started by not focusing on profits at all. Instead, we focused on boosting the use of the software. The vast community of MySQL users and developers is what drives our business. (CEO, MySQL, 2006)

Initially, it seemed that the founders of MySQL were more interested in increasing the number of users and developers than in generating revenue from the software. However, since the establishment of the company in 2001 it was obvious that the founders planned to make money with the software. Their actions were focused on ensuring the rapid growth of the user base:

We would never have gained 5 million users to our database product without acting actively according to the principles of the open source software community. Since we first released our software under an open license, we have gathered feedback --- development ideas, problem descriptions and solutions --- and responded to all possible initiatives from the user community to develop the product with the skillful individuals using the product. (CTO, MySQL, 2006)

The open source community is a very important asset for MySQL. The company strives to maintain an ongoing dialogue to obtain feedback from users. Collective software development and user commitment are promoted by emphasizing community feedback and respecting OSS philosophy. The company showed its strong customer orientation by adapting its operation to the needs and values of the OSS community to boost the use of the software.

Establishment of the revenue model based on dual licensing in 2001 was intended to meet the needs of both private end-users and business customers. Dual licensing means that users may choose to use MySQL products according to the principles of the open source license, or under a commercial license. Under the open source license, users may download the software for free and modify, integrate and distribute it, as long as the modified applications remain open and available for redistribution. The commercial license is made available for organizations that do not want to release the source code of their modified applications.

Balancing two worlds: 2004-2005

In 2004 and 2005, MySQL continued its rapid growth and achieved remarkable growth figures as a professionally-managed for-profit company. The business was based upon commercial license sales, but included also service agreements with organizations whose employees have deployed the freely-distributed MySQL software. The operation of MySQL continued the evolution of a social activity of enthusiastic programmers into a large-scale business driven by profit aspirations. Balancing the open innovation culture

characterized by freedom with the interests of business customers adopting open source solutions became a challenge:

-- Now we need to balance between the two cultures: the open source community where some key individuals hate all commercial stuff, and the business environment including banks etc., where we need the credibility of a commercial software vendor (CEO, MySQL, 2004)

Communication within the OSS community was another challenge. Given the temporal, geographical and socio-cultural distance among participants, which is characteristic of open source communities, virtual communication and coordination were the primary methods of managing innovation activity. Distributed development was supported by inter-functional coordination and continuous communication with the community through e-mail, web seminars, blogs and workshops. The company invested systematically in professional management resources to manage its growing for-profit business.

Moreover, the company faced social pressure over its licensing policy. Due to pressure from the OSS community towards more open forms of software licensing, the company maintained its licensing policy to show respect for the freedom-driven OSS culture. Simultaneously, the company contributed to the successful fight against the initiative to allow software patents in Europe. The ability to accommodate the counteracting forces during this period demonstrates the firm's strategic flexibility.

Period	Open innovation activity	Market-oriented behavior	Impact on business model
-1995	• A peer group of boundary- spanning individuals from different organizations share and apply ideas and knowledge	• Members of the peer group orient themselves towards partnering, in order to meet generic customer needs in the market	• Relationships among the key developers are established and initial business ideas discussed
1995-2000	• Originators of the innovation take an extroverted initiative by releasing their intellectual property to the worldwide user community under the General Public License	• Gathering user feedback to improve the software is promoted through freedom of use, in contrast to competitors' proprietary software development	• The company is founded in 1995 to allocate resources, in order to promote the offering and achieve a large user base comprising future clientele
2001-2003	• Collective software development and user commitment are promoted by emphasizing community feedback and respecting the OSS philosophy	• The company expresses strong customer orientation by adapting its operation to the needs and values of the OSS community, to encourage more widespread use of the software	• MySQL establishes a hybrid revenue model by dual licensing its software to meet the needs of both private end-users and business customers

Table 2: Market-oriented OSS business model transformation of MySQL

2004-2005	• Balancing the open innovation culture characterized by freedom with the interests of business customers adopting open source solutions becomes a challenge	• Distributed development is supported by inter- functional coordination and continuous communication with the OSS community through e-mail, web seminars, blogs and workshops	• Professionally-managed for-profit activity is based upon service agreements with organizations whose employees have deployed the freely-distributed MySQL software
2006-	• The firm contributes to the convergence of OSS and proprietary software towards OSS 2.0 by developing novel forms of business, based upon open innovation	• Operation reflects increasing business partner-orientation, by promoting the LAMP stack solution bundle consisting of leading OSS technologies and brands	• The business model builds upon online support and service subscriptions, software licenses and franchise of the MySQL brand to partners providing value-added offerings

Reinventing for the future: 2006-

MySQL often is hailed as the "champion" of the next generation of open source software companies. With approximately 50,000 daily downloads of software (in 2006) through the MySQL Web site and partners' operating system distributions (and approximately 75,000 in 2009), the company has disseminated over 100 million copies of its database software. The business relies upon partner-orientation. Its open innovation activity contributes to a solution bundle of leading OSS technologies and brands, in which MySQL database software is an acknowledged component. Looking at financial figures, the firm's annual growth rate was at 85-100%, with a turnover of 30 MEUR in 2005. However, the managers are not resting on their laurels:

I worry that we get caught in our own success and forget to reinvent ourselves. We have such a strong culture in the company that without realizing it we are sometimes saying "but that's not our way of doing things" and then we miss out on some new opportunity. CEO, MySQL, 2006)

The competitive incentives and motives of MySQL are manifested in its innovative business orientation. The service concept of MySQL enables the company to gain revenue from services provided for corporate clients who wish to ensure the operability and reliability of their mission-critical installations. The business model builds upon online support and service subscriptions, software licenses and franchise of the MySQL brand to partners providing value-added offerings. It contributes to the transformation of the whole OSS field towards a convergence of OSS and proprietary software, and to novel forms of business where revenues increasingly come from commercial services. The design of new business models requires a deep understanding of both the open innovation development culture and the market-focused business culture.

Propositions on strategic flexibility in open innovation

Through an abductive process in the analysis of the theoretical concepts and empirical findings grounded in the data collected in the longitudinal case study, we establish propositions on the role of strategic flexibility in the design of a business model based upon open innovation. With abduction, we refer to the parallel processing (Dubois and Gadde, 2002) of the conceptual world based on the prior literature, and, the analysis of our own empirical inquiry. The emphasis of the process is on the empirical data and its interpretation. Simultaneously, we have familiarized ourselves with prior research on strategic flexibility, market orientation and business models in the context of open innovation.

The context of open innovation, in which innovation development emerges from participants' implicit needs, differs drastically from the closed innovation context. The open approach to innovation emphasizes the freedom that promotes wide utilization and continuous development of innovations, and spurs the exploration of other actors' resources in the community. This finding is consistent with the views of von Hippel and von Krogh (2003), who discuss the use of resources from the perspective of collective action and of Lundell et al., (2006), who analyze open innovation in the context of OSS. Moreover, the distribution of intellectual property within the community requires extroverted attitudes and trust, which are argued to be salient to bringing forth collective innovations. Our case reflects the strategic flexibility similar to literature in terms of a firm's ability to redeploy its assets without friction (Harrigan, 1980) by means of a flexible resource pool and a diverse portfolio of strategic options (Aaker and Mascarenhas, 1984). Moreover, our case accentuates flexible and open use of resources (Sanchez, 1995) for the configuration and reconfiguration of appreciably-superior customer value propositions (Javalgi et al., 2005). Its business model is characterized by strategic incentives, relational complexities, operational priorities and cognitive exigencies that are different from those utilized in the closed innovation approach. Hence, these findings give rise to our first proposition:

Proposition 1: A firm's involvement in open innovation activity influences its strategic flexibility.

According to Johnson *et al.* (2003), customer-orientation based upon identifying, analyzing, and answering to customers' needs, and competitor-orientation that includes generating, disseminating, and using information about competitors, are fundamental in the interplay of market orientation and market-focused strategic flexibility. Kanter (1983) and Van de Ven (1986) point out that power sharing and knowledge sharing with partners foster the creation and acceptance of novel ideas, sharing which is crucial to strategic flexibility. Moreover, Pattikawa *et al.* (2006) argue that firms' capability and willingness to acquire technology is of essence in building solutions to answer and meet the new needs of users. In the data, the customer, competitor, partner, and technology sensing was found to be fundamental in business renewal. On this basis, we submit the following proposition:

Proposition 2: A firm's market orientation impacts its strategic flexibility regarding environmental change.

Strategic flexibility requires awareness of the innovation development context and the market environment. According to Shimizu and Hitt (2004), the decision-making process involved in maintaining strategic flexibility has three stages: paying attention to feedback (attention); collecting and assessing data objectively (assessment); and initiating and completing changes in a timely fashion, even in the face of uncertainty (action). In this case, the balance between the culture of the open source community and the commercial interests of the business environment has been manifested through commitment to the community. However, the firm simultaneously altered the business model to produce outcomes that maximize potential benefits and minimize losses. These notions give rise to the following proposition:

Proposition 3: Strategic flexibility enables major changes in the business model of a firm, by quickly revising offerings, committing resources, and adjusting relationships and the revenue model to novel courses of action, in response to environmental flux.

These propositions are illustrated in Figure 1 in conjunction with the theoretical constructs discussed in this paper. The model illustrates the dimensions of open innovation activity and market orientation, and their effect upon firms' strategic flexibility influencing the design of its business model. Open innovation activity is discussed herein through strategic firm-level incentives for innovation, relational complexities in the innovation activity, operational priorities, and cognitive exigencies faced by actors in the innovation collaboration. In the model, market orientation covers the themes discussed widely in the marketing literature (i.e., firm's customer orientation, competitor orientation, partner orientation). In this paper, we also discuss technology orientation. We understand strategic flexibility in line with the marketing literature as defined in the introductory section of this paper. In our case, we identify it from the perspectives of awareness of the changes in the environment, attention of the values and trends behind the change, and through assessment of the available options. Moreover, the perspectives include actions regarding the resource allocation and resource access. Our case manifests the firm's response to these changes in the business model of the firm through adjustments of the relationships with the community and the revenue model.



Figure 1. A conceptual model and suggested propositions of the study

Figure 1 presents a conceptual model on the interrelationships among open innovation, market orientation, strategic flexibility and the business model of the firm. In the model, strategic flexibility mediates the relationships between the open innovation activity antecedents and the business model of a firm, and between market orientation and the business model. The concept of strategic flexibility is composed of awareness, attention, assessment and action. Comparable constructs for the strategic flexibility have been proposed in the classical marketing literature providing views on a structure of objectives and a series of steps in decision making or agility in regard to external stimulus. For example, the popular hierarchy-of-effects (HOE) models for marketing communications, like AIDA (e.g., Cramphorn, 2006) and DAGMAR (Colley, 1961), emphasize stages such as awareness, attention, interest, comprehension, desire, and action in decisions. The business model of a firm, as expressed herein, covers the elements of offering, resources, relationships and the revenue model.

Discussion and Conclusions

This paper discusses a firm's strategic flexibility in the context of open innovation. The premise of the paper is that engagement in open innovation activity has remarkable effects on the business model of a firm. Moreover, adaptation to these effects requires strategic flexibility. Our study supports the notion of strategic flexibility by Johnson *et al.* (2003), which states that, in an ever-changing environment, a firm's ability to change directions quickly and reconfigure strategically, particularly with regards to products and markets, becomes crucial if it is to succeed and achieve a sustainable competitive advantage. The results of this research show that market orientation in the field of open source software entails both listening to the desires of the OSS community and responding to the needs of customers who seek value for their money. The case of MySQL illustrates that a firm operating in the field of open source software requires proficient adaptation to community values. Simultaneously, the firm needs to commend

itself to clients and the business network of commercial partners. Such an ambidextrous approach increases profitability through effective market access, shortens time to market by releasing semi-finished product for co-development with the user community, and enhances innovation capabilities by mobilizing community resources.

Moreover, OSS firms need to co-opt market orientation and the principles of open innovation to achieve strategic flexibility. Importantly, the results suggest that the strategic flexibility of a firm influences its capacity to design competitive business models grounded in open innovation. Our longitudinal case analysis depicts several market-oriented changes in the business model of the firm. These changes have been crucial for the firm's success. As an implication, we suggest that the need for strategic flexibility within a firm involving open innovation exceeds that of firms' relying merely upon closed innovation. Such flexibility is *conditio sine qua non* for firms' business model design in the field of open source software.

One limitation of this study, which may serve as a guide for further research, should be noted. Our empirical study analyzed only a single case. Nevertheless, the study case is a company that is widely acknowledged as an icon in the history of successful commercial OSS firms. Many growing businesses can learn from their experiences. Consequently, we believe that these findings may be applied in a larger context. However, we admit that strategic flexibility in open innovation is a multifaceted phenomenon. Diverse premises, such as the emphasis on products and services and available licensing options, even within the field of OSS, may require a given firm to have multiple levels of responsiveness and strategic adaptability. Moreover, because this study focuses exclusively on the field of OSS, which emphasizes the sharing rather than the patenting and selling of inventions, we are cautious about generalizing our findings to other contexts of open innovation. Thus, we call for more research on strategic flexibility and business model design, composed of a greater number of empirical observations that represent the heterogeneity of businesses grounded in open innovation.

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Paper IV

Business models – a new perspective on firms' assets and capabilities

by

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Business models – a new perspective on firms' assets and capabilities

Observations from the Finnish software industry

Risto Rajala and Mika Westerlund

Abstract: Network-intensive business behaviour and specialization in core competencies have increased the importance of utilizing resources beyond company boundaries. In recent years, resource exploration and exploitation have attracted increasing attention in the literature on interorganizational exchange and strategic networks. However, resources have not been sufficiently analysed in connection with types of business models. In this study, the authors focus on key assets and capabilities from the entrepreneur's business model perspective. Taking theories of interorganizational exchange and the resource-based view of the firm as the basis, key assets and capabilities are identified in four different types of business models in selected software companies. The key findings indicate that there is a significant difference in the emphasis on internally and externally obtained resources between different types of business models.

Keywords: business models; resources; assets; capabilities; strategic networks; software

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In recent years, software entrepreneurs have been faced with the globalization of competition, increased pace of innovations and fragmented customer needs. In responding to these challenges, companies have focused on their core competencies, which in turn has required more network-intensive business behaviour. As a result of specialization, companies need to acquire knowledge outside of their own area of expertise in order to create and deliver competitive value propositions to their customers. This development has led to increased efforts to develop essential assets and capabilities through networks, especially in highly knowledge-intensive fields such as the software business. The establishment and management of value-creating networks and strategic navigation in the network environment form a major challenge to software entrepreneurs.

Firms' resources, or assets and capabilities as we call them, have attracted an increasing amount of attention in recent literature (Teece *et al*, 1997; Rosenbröijer, 1998; Sallinen, 2002; Tuominen, 2002; Möller and Törrönen, 2003). In our study of resources in connection with businesses of different types, we draw on the industrial network theory (Håkansson, 1982; Powell, 1990; Gulati, 1998; Achrol and Kotler, 1999; Möller and Halinen, 1999), transaction-cost economics (Williamson, 1975, 1985) and the resource-based view of assets and

capabilities (Rosenbröijer, 1998; Hooley *et al*, 1998; Möller and Svahn, 2003).

Interorganizational theories of transaction and interaction and the resource-based view of the firm were selected as the theoretical lenses through which to view our topics of study:

- the business-model perspective grounded on transaction-cost economics and the resource-based view of the firm was used to further understanding of the kind of assets and capabilities firms attempt to create in different business contexts; and
- (2) the network approach based on the industrialinteraction and network theories, in conjunction with the resource-based view of the firm, was applied in our analysis of the development and acquisition of assets and capabilities both internally and through relationships in business networks.

Despite the emerging literature on resources in the network context (eg Möller and Törrönen, 2003), assets and capabilities have not been given sufficient attention with regard to different business models. Given the wide variety of ways of conducting business in the software industry, we have classified software business models in four categories on the basis of previous literature. There is evidence that relationships and collaboration in business networks vary in different businesses (Wilkinson and Young, 1994; Ford et al, 1998, pp 70-72; Cannon and Perreault, 1999). Furthermore, Håkansson and Snehota (1995, pp 180-181) point out that different types of businesses embody different approaches to developing assets and capabilities. Hence our objective is to study the development of resources, ie assets and capabilities, within value-creating networks with a view to executing various types of software business models. In formal terms, we aim to determine what kinds of assets and capabilities are essential to different business models in the software industry, and to identify which of them are developed internally and which are obtained externally.

In its analysis of assets and capabilities in connection with different business models, this study draws on theories of interorganizational exchange and different forms of relationships. The reviewed approaches include transaction cost theory, the interorganizational resourcedependence theory, the resource-based view of the firm, and theories of industrial networks and interaction.

The transaction cost approach

Transaction cost economics (TCE), first presented by Coase (1937) and further developed by Williamson (1985), provides us with some attributes for the exploration of market *versus* hierarchical mechanisms for analysing strategic dependencies. However, it has attracted some criticism due to the fact that it deals with polar forms of buyer–seller relationships – markets and hierarchies – and because of its inability to explore adequately all available governance structures, repeated transactions and the dynamic evolution of governance and transactions, for example (Ring and Van de Ven, 1992). The transaction cost approach identifies three different attributes of exchange that are pertinent to different governance structures:

- the *frequency* with which transactions occur focuses on the type and degree of interorganizational exchange: Dwyer and Oh (1988) also explain that transactional exchange typically involves single short-term events with a distinct beginning and end;
- (2) the *uncertainty* to which transactions are subject; and
- (3) the *asset specificity* involved in supplying products and services.

The first two provide us with the support to identify and describe the various business relationships used to classify different types of business models, and the third concerns the resources essential to different businesses. From the perspectives of our study, the limitation of the transaction cost approach is its strict focus on the transaction and the view of the extremes between markets and hierarchies. It also focuses on the assets of actors, but does not consider their capabilities in relationships, which are essential in our study.

Resource-related approaches

The interorganizational resource-dependence theory takes a step further from the transaction cost approach by giving the external perspective on how resources are developed and acquired by a firm. As Pfeffer and Salancik (1978) point out, it is a perspective that is based on the uncertainty created by the environment regarding the future of the firm and the role of resources in controlling this uncertainty. This view focuses on the interorganizational activities of actors in which resources are exchanged or shared. Correspondingly, it focuses on the internal perspective in the maximization of output from resources (Prahalad and Hamel, 1990). The resource-based view of the firm originated from the work of Penrose (1959) and was further developed by Wernerfelt (1984). According to Penrose (1959), bundles of resources that are activated in different ways lead to incoherent performance and heterogeneous outputs in different organizational settings. Furthermore, Ariño and de la Torre (1998) point out that the increasing complexity of markets makes it difficult for firms to have all the necessary resources in their

possession to compete effectively. These resourcerelated approaches provide us with a basis on which to identify key resources in different types of business models. They deepen our understanding, especially of how resources are applied and combined by a firm, and take inimitable assets as a basis for the creation of sustainable capabilities (Hart, 1995; Gabrielsson, 2004, pp 94–99).

The industrial-network and interaction approaches

Both the industrial-network and interaction approaches emphasize relationships as dynamic processes of exchange between actors in an industrial market. The study of the exchange and development of heterogeneous resources is of central concern in these approaches (Håkansson, 1982). The interaction theory focuses on the focal actor's direct relationships, whereas the industrial-network approach extends the focus to indirect relationships. Analysis of both of these relationships makes it possible to gain a more comprehensive view of networks, and provides us with a basis for analysing value creation among multiple actors. Valuecreating networks are defined in recent literature as a set of relationships between firms involving multiple twoway interaction in bringing increasingly complex products and services to the market (eg Aldrich, 1998; Parolini, 1999; Bovet and Martha, 2000).

In order to understand industrial networks and how value is created within them, we need to consider the fundamentals of relationships. Håkansson and Johanson (1992) identified the underlying fundamental elements of networks as actors, resources and activities. According to them, actors perform and control activities that are based on control over resources, and develop relationships with each other through exchange processes. Activities occur when actors combine, develop, exchange or create resources by utilizing other resources in the network. Ford et al (1998) point out that the resources of one company are likely to become oriented towards a specific use and will be tied to the resources of other companies. Given their emphasis on the fact that interdependence between companies in terms of resources and activities influences business strategy, we assume that it also affects business models as a manifestation of strategy. Essential resources may, in many cases, be physical and tangible assets, but it is more common for companies to be tied to each other through intangible knowledge resources (Ford, 2002). The industrial-network and interaction approaches provide us with a basis on which to identify the actors and activities related to the acquisition and development of resources.

Methodology

We analysed the key resources of selected software companies using the business-model concept as a means of structuring the research. We used a qualitative research approach incorporating multiple-case-study methodology comprising structured interviews and observations for the collection of primary data, as suggested by Yin (1994). Our field-study process ran over an 18-month period from April 2002-September 2003, during which time we conducted semi-structured interviews with senior management in the selected case companies. Representatives of the senior management were selected as the key informants due to the sensitivity and nature of the information we were seeking. Given our research questions, they were seen as viable sources of information in the critical evaluation of the representativeness and validity of the data. The interviews with senior management were recorded and transcribed. In addition to conducting our intensive field study, we collected an extensive set of secondary data on the companies, comprising internal documents, brochures, bulletins and annual reports, presentation material, reviews and Websites. We also reviewed the relevant literature on theoretical approaches to interorganizational exchange and relationships. This concept-centric focus enabled us to establish a classification scheme for categorizing different types of software business models.

For our comparative cross-case study, we selected six independent software vendors, using company size and the identified type of business model as selection criteria. The companies represented each type of business-model category according to our previously constructed classification. For reasons of commercial confidentiality, the names of the companies remain undisclosed. The sample included software companies with between five and 500 employees, described as small and medium-sized enterprises on the international scale. The motive for choosing case companies with different types of business models was to provide a solid basis for a cross-case analysis that would reveal whether (and what kinds of) differences existed in the assets and capabilities of different software businesses. Our empirical observations included 158 identified resource items in the six case companies. Analysis of the data was conducted by coding the resource items identified in the interview transcriptions. The observations were further grouped into 20 principal categories, the incidences of which were analysed according to the four identified business-model types. To ensure the reliability of the findings, the data were analysed independently by two researchers and verified through comparison of the results.

Conceptual framework

In order to identify resources in different business settings, we considered perspectives on assets and capabilities, and the concept of the business model. We drew on the above-mentioned literature to establish a classification scheme that would enable us to distinguish between different types of software businesses. Furthermore, we identified the key characteristics of particular types of business models.

Perspectives on assets and capabilities

The assets and capabilities of a firm are among the central issues in understanding and analysing its business. This accentuates the essence of resources in core competencies (Selznick, 1957; Prahalad and Hamel, 1990), as they are generally seen as firm-specific property that is subordinate to the core competencies. However, literature on resources lacks consistency in terms of the terminology used. Some authors divide firm-specific resources into assets and capabilities (eg Barney, 1991; Durand, 1997; Hooley et al, 1998), whereas others (eg Rosenbröijer, 1998; Gabrielsson, 2004) distinguish between resources and capabilities. We chose the former, which is compliant with the view of Metcalfe and James (2000), who define tangible and intangible assets as physical and non-physical resources, and capabilities as intangible knowledge resources.

The concept of capabilities was later extended to incorporate dynamic capabilities (eg Teece *et al*, 1997; Sallinen, 2002; Möller and Svahn, 2003) in an attempt to distinguish their know-how role from their know-that role. The development of capabilities in the industrialnetwork perspective is not limited to a firm's relationships and resources, and is also linked to its strategy (Håkansson and Snehota, 1995; Gadde and Håkansson, 2001; Holmen *et al*, 2002; Sallinen, 2002). According to this view, capabilities vary according to the business strategy and the value-system configuration.

The capabilities of a company reflect its success in combining resources to perform activities through internal and external relationships (Håkansson and Snehota, 1995; Rosenbröijer, 1998). In addition to being an important intangible company asset, a firm's network offers access to the assets and capabilities of other network actors (Foss, 1999; Gulati *et al*, 2000; Chetty and Wilson, 2003; Möller and Törrönen, 2003; Möller and Svahn, 2003). As some of the resources in business networks remain inimitable, it is interesting to identify those that are essential in diverse business models, and to analyse how they are developed and acquired.

Furthermore, Möller and Törrönen (2003) and Möller *et al* (2005) suggest that it is useful to describe value

production through a continuum expressing the level of complexity involved and the time horizon of value realization, and that the emphasis on capabilities varies in different value systems. Möller et al (2005) make a distinction between more general business capabilities and the capabilities required to orchestrate strategic relationships and networks. This seems to be a useful approach to exploring capabilities in complex value systems, which are bound to time and the evolution of networks. Foss (1999) and Metcalfe and James (2000) also found that resources varied according to differences in the configuration of value-creating networks embodied in diverse businesses. We assume that, in addition to analysing capabilities in connection with the value-system continuum, it would be worthwhile analysing both assets and capabilities in connection with different business models. From the literature reviewed above, we identified different approaches to analysing capabilities, eg organizational v managerial capabilities (Möller and Törrönen, 2003) and static v dynamic capabilities (Teece et al, 1997; Sallinen, 2002; Möller and Svahn, 2003). Consequently, we offer here a complementary research approach involving the analysis of internal and external resources (ie assets and capabilities) in connection with different types of software business models.

The business-model concept

The concept of the business model in the literature on information systems and business refers to ways of creating value for customers, and to the way in which a business turns market opportunities into profit through sets of actors, activities and collaboration. Research on business models rests in many respects on strategy discussion and draws on strategic concepts and issues. Despite the confusion in the terminology related to strategy and business models, previous research has achieved a consensus on their position as a conceptual and theoretical layer between business strategy and business processes (Osterwalder, 2004; Morris et al, 2005; Tikkanen et al, 2005). The business-model construct includes some elements of business strategy, and aims at describing the architecture of business as a manifestation derived from strategy (Osterwalder and Pigneur, 2002; Rajala et al, 2003; Morris et al, 2005). It has also been defined as an abstraction of business (Seddon and Lewis, 2003), which characterizes revenue sources and specifies where the company is positioned in its value-creating network in a specific business.

The essential elements of different business models are defined in different words by various researchers (eg Osterwalder and Pigneur, 2002; Bouwman, 2003; Rajala *et al*, 2003; Hedman and Kalling, 2003; Morris *et al*, 2005; and Osterwalder, 2004). Many of the studies identify a number of elements that are characteristic of different business models. To sum up the discussion, we identified three elements in all of the studies we reviewed. These elements, expressed in different words, are:

- (1) value propositions or offerings;
- (2) various assets and capabilities as resources needed to develop and implement a business model; and
- (3) the revenue logic (including sources of revenue, price-quotation principles and cost structures) that is characteristic of a particular business.

In addition, some of the studies (eg Timmers, 2003; Osterwalder, 2004; Morris *et al*, 2005) emphasize relationships with other actors. Timmers (2003) points out that, in the context of business models, the focus shifts from creating value through internal activities to creating value through external relations, and the number of relationships multiplies. We identified these relationships as part of the value-creating network (including the network structure, the purposes or intentions of the network, and the actors' roles and relationships).

Classification of different types of business models in the software industry

We established a preliminary classification scheme to structure the analysis of our empirical data. The analytical diversity of transaction cost economics (TCE) was clearly advantageous for our classification purposes. As mentioned above in the context of the theoretical perspectives of this study, TCE investigates a broad range of exchange-related issues including vertical integration and interorganizational relationships (Rindfleisch and Heide, 1997). On the other hand, the theory of industrial networks and relationships (eg Ford et al, 1998) provides us with a dimension along which to distinguish between different types of businesses in terms of buyer-seller relationships. With regard to defining the strategic choice for the company to differentiate in business markets, Ford et al (1998) propose the consideration of three essential issues:

- (1) the company's market scope or customer portfolio;
- (2) the benefits that it provides to each; and
- (3) how the company organizes itself to achieve effectiveness and efficiency, which in turn affects its ability to deliver these benefits at acceptable costs.

Hence, we need a dimension in our classification scheme reflecting interorganizational relationships in terms of the level of involvement in customer relationships. Similarly, Ford *et al* (2003) consider buyer–supplier relationships in terms of involvement, in which low-involvement relationships are handled with limited coordination, adaptation and interaction. On the other hand, the high-involvement approach includes more coordination and adaptation, which create interdependency.

In addition to focusing on attributes such as uncertainty and risks that affect the type of relationships in the value-creating network of a business model, the TCE approach also considers the frequency of transactions and the similarity of an offering, ie the object of the transaction, for multiple customers. Thus, we aimed at distinguishing businesses according to the homogeneity of their offerings for multiple customers. Hayes and Wheelwright (1979) studied the match of product and process structures in connection with transaction circumstances. They identified the following:

- low-volume-low-standardization products implemented as one-of-a-kind;
- (2) multiple products-low volume;
- (3) a few major products with higher volumes; and
- (4) high-volume-high-standardization commodity products.

Apte and Vepsäläinen (1993) adapted the principles of TCE to the integration of product strategy and distribution strategy with a view to establishing a continuum for distinguishing between products in the two-dimensional analysis of product and distributionchannel compatibility. The resulting continuum distinguishes between complex, modular and standardized products. All of the above-mentioned studies support our selection of homogeneity of offering as a dimension of our classification scheme to distinguish between different types of business.

On the basis of the reasoning presented above, we established two dimensions on which to classify software business models: the level of involvement in customer relationships and the level of homogeneity (ie standardization) of an offering for multiple customers. This classification produced four generic types of models, as described in Figure 1.

The Type I model is described as 'software tailoring'. A high degree of involvement in customer relationships and a low level of homogeneity of offerings characterize the businesses in this category. Typical offerings embody tailored software solutions designed to meet customer-specific needs. Customer relationships are based on close collaboration between the software vendor and the clients, and typical value realization includes a high proportion of direct consultation between the vendor and the customer(s). We understand that the core competences within business models of this type emphasize the ability to understand and meet



Figure 1. A classification scheme for identifying different types of business models.

customer-specific needs. Examples of businesses in this category include tailored software providers and IT consulting firms.

The Type II business model is referred to as 'applied formats', with a high degree of involvement in customer relationships and a high level of homogeneity of offerings. The total offerings are typically based on a uniform core solution, but are modified for customers by adding modular components. In these cases, the modification is sometimes carried out by value-adding resellers (VAR) acting as software integrators of the system solutions. We recognize that the ability to understand and meet customers' needs in narrow segments is a distinctive core competence in business models of this kind. An example of businesses in this category is represented by enterprise resource planning (ERP) system providers such as SAP.

The Type III models were labelled 'resource provisioning', characterized by a fairly low degree of involvement in customer relationships and a low level of homogeneity of offering. Businesses in this category usually aim at serving the needs of several customers. The needs are typically met with solutions that are conducted through one-off production in customerspecific projects. This presents a major challenge in terms of business performance, as the product or service offering is typically semi-finished and based on a set of components, middleware or a product platform. Such offerings do not add value to customers as such, but are used as parts of more comprehensive value propositions. Due to the nature of the offerings in this category, businesses increasingly aim at component reusability. We assume that the core competences in these business models are related to the ability to understand and address technology-specific needs. Examples of

businesses in this category include new media companies and game-component providers.

Type IV in our classification embodies 'standard offerings', or businesses that seek large numbers of customers and economies of scale through a high level of homogeneity of offerings. A common characteristic of businesses in this category is that the offering is composed of a uniform core product, a modular product family or standardized online service. Another characteristic is that they typically exhibit a low degree of involvement in single customer relationships. The business models comprise various models of direct and indirect mass distribution, eg online distribution and diverse distribution-partner networks. We presume that the core competences are typically related to the ability to serve the common benefits of multiple customers. Examples include commercial off-the-shelf software (COTS) vendors and software as a service (SaaS) providers.

Table 1 summarizes the key characteristics of the identified business-model types classified according to the dimensions of degree of involvement in customer relationships and the level of homogeneity of offering for multiple customers. The core competencies are described as the essential ability of a business to add value for its customers. Company core competencies are identified in some other studies (eg Prahalad and Hamel, 1990) mainly as activities embodied in the value-chain model. Our classification scheme is used to identify and analyse the key assets and capabilities related to the particular types of business models represented by our case companies.

Empirical findings

In the empirical part of the study, we identified key resources in different business models, and distinguished the assets and capabilities that were developed internally from those that had been obtained from external sources. These assets are typically acquired through relationships with other actors in business networks. External resources may be both purchased and non-purchased, acquired or accessed through collaboration with other actors. These external capabilities often seem to be related to the core competencies of another actor, and thus may remain the property of the provider. Due to space limitations, we present the discrete cases in our multi-case study in table format. A brief description of the case companies is given in the Appendix.

Some of our cases pursue distinct businesses simultaneously and therefore have several identifiable business models. In our classification scheme, Type I, software tailoring, is represented by Case D, which is

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Business-model type	l 'Software tailoring'	II 'Applied formats'	III 'Resource provisioning'	IV 'Standard offerings'
Nature of offering	A typical offering is based on tailored, customer- specific solutions	Typical offerings embody customized solutions, based on a uniform core of several solutions or separate modules	The offering is based on a set of components, middleware or a product platform	Homogeneous offerings are based on a uniform core product, a modular product family or standardized online service
Customer-relationship construct	Customer relationships embody one-off production in close relationships	Customer relationship through value-adding resellers	Customer relationship through an internal hierarchy	Customer relationship through a wide distribution network including online distribution
Core competence	Ability to understand and meet customer- specific needs	Ability to understand and meet customers' needs within narrow segments	Ability to understand and meet technology- specific needs	Ability to serve common benefits of multiple customers

Table 1. Key characteristics of the diverse types of business model.

the largest corporation among our cases. Type II, applied formats, is exemplified by Cases C, D, E and F, and Type III, resource provisioning, by Case B. Finally, Type IV, which embodies standard offerings, is represented by Cases A, B and D. Thus, there are one to three cases in each business-model category.

Type I: Software tailoring

Internal assets and capabilities in this category included the production and consultation resources needed in both project implementation and sales. Hooley *et al* (1998) also included human resources as part of these assets, the skills of which we identify as capabilities. Mastering the customer's business was identified as an essential internally developed capability in tailored software project business. Furthermore, customer needs and logistic processes were particularly emphasized in the cases that fell into this category. These findings are consistent with those of Möller and Törrönen (2003), who identified understanding the customer's business logic, and the ability to propose major suggestions leading to business improvements, as specific indicators of this capability.

External assets and capabilities that were obtained through relationships with other actors in this category included assets related to management procedures such as project-management methodologies and systems. The essential capabilities acquired through networks included technological knowledge and projectmanagement skills.

Type II: Applied formats

Internal assets and capabilities consisted of human resources and the skills needed in systems development,

which is reasonable given the fact that this type of business requires sophisticated resources to develop commercial solutions involving complex and multilayered information systems. The ability to develop technological solutions for narrow segments was identified as a key internal capability in the cases within this category, and insight into specific solution domains and market segments was also important. This finding is consistent with what is reported in the literature on business strategy (eg Porter, 1980) in terms of focus strategies of businesses specializing in narrow customer segments.

External assets and capabilities in this category included software-deployment assets developed and obtained through networks promoting the successful implementation, integration and mobilization of information systems. Technological knowledge related to the selected solution domains and system-integration capabilities were also identified as key capabilities acquired through relationships with actors in networks.

Type III: Resource provisioning

Internal assets and capabilities in the case companies within this category, as with those in the softwareproject business, primarily comprised resources related to production and consultation. The companies were generally seeking efficiency through operations management, which was identified as an important internally developed capability. Technological capabilities related to the development and composition of offerings also emerged as key internal capabilities.

External assets and capabilities in this category were distinct from those in other categories, and focused on operating facilities obtained through networks. These

Business-model type	l 'Software tailoring'	II 'Applied formats'	III 'Resource provisioning'	IV 'Standard offerings'
Internal	-			-
assets	Production and consultation resources	Systems-development resources	Production and consultation resources	Product-development and marketing resources, products and technology, IPRs and brands
Internal capabilities	Capability of mastering customers' business	Development of technological solutions in narrow segments	Operations management and technological capability	Production, network management, technical innovation and marketing capability
External				
assets	Management procedures and systems	Software-deployment networks	Operating facilities	Distribution networks
External capabilities	Project-management skills & methods and technological capabilities	Technological knowledge of new domains and systems- integration capabilities	Production- and process-improvement capabilities	Market sensing, business-innovation and network- development capabilities

Table 2. Identified key assets and capabilities in different business-model types.

included server hotels, service hosting and Internet service provisioning facilities, and have been identified in the literature (see eg Hooley *et al*, 1998) as operations and systems. On the other hand, production- and process-improvement capabilities were generally obtained from other network actors. We share the view of Möller and Törrönen (2003), who identified technical specifications, flexibility and quality as indicators of such capabilities.

Type IV: Standard offerings

Internal assets and capabilities were strongly related to product development and marketing. They included both tangible and intangible resources, such as products and technology, human resources, brands, intellectual property rights and databases. This finding is consistent with those of earlier studies (eg Durand, 1997; Teece *et al*, 1997; Hooley *et al*, 1998). Capabilities related to production and technical innovation, and those related to marketing and network management, were mainly developed internally.

External assets and capabilities were identified mainly in distribution and supply networks, which contain both tangible and intangible elements and form the major asset obtained through partners. Furthermore, market-sensing, business-innovation and networkdevelopment capabilities were, for the most part, acquired from other actors. On the basis of our observations, the necessary network-development and network-management capabilities seemed to be subject to the actor's position in the network. Therefore, we offer the thought that network management could be considered as the management of networks and management in networks, depending on the actor's position in the value-creating network. This is consistent with the view presented in an earlier study by Möller and Svahn (2003).

A summary of the identified assets and capabilities is presented in Table 2. The literature features other descriptions of assets and capabilities in connection with different vendor types and business contexts (eg Sallinen, 2002; Gabrielsson, 2004, pp 100–102). However, they have not been analysed in terms of specific business-model types.

Discussion and conclusions

In this study, we analyse the essential assets and capabilities in different types of business models. Identification of the resources in different business contexts is important from the entrepreneur's perspective for the development and management of business. In order to distinguish between different types of business models, we establish a classification scheme based on two dimensions: the degree of involvement in customer relationships and the level of homogeneity of the offering for multiple customers. Our scheme produces four distinct categories of business models. In our preliminary assumptions we suggest that business models of the same type share a similar emphasis on key resources. Furthermore, we assume that they differ from other categories in a way that provides a rationale for analysing the variety of key resources in the different types of business models.

Based on the classification framework, we identify and analyse business models in the empirical study in categories that describe different entrepreneurial situations. It is noteworthy that entrepreneurs may face several types of business models during the business life-cycle. In this sense, we consider any business model as an impermanent situation that changes over time with the development of the business. Thus, we recognize that businesses evolve dynamically and that the business model of a firm represents the business at a specific point in time.

In terms of entrepreneurial implications, the major outcome of this study is to provide tools with which to identify different types of business models and to support the exploration of essential resources within them. The conceptual framework brings a contribution to the understanding of the software industry, because it enables the recognition of typical characteristics of different businesses. On the basis of the discussions with the management of our case companies, we argue that this kind of classification framework assists entrepreneurs and managers of companies to identify the key characteristics of their business compared with other businesses. Furthermore, the reported findings are of help to entrepreneurs and managers in the evaluation of required resources in their current or targeted business models. By describing and analysing resources in particular types of business models, this study supports this evaluation by providing a basis for analysing the need for resource acquisition in the development and transformation of business models.

Our empirical findings illuminate the differences in resources within different business-model types. Based on our findings, relationship management and marketing skills are regarded as essential in all business models and they should not be undervalued in any type of business. However, our analysis brings out significant differences in the emphasis on internally and externally obtained resources between different types of models.

First, business models embodying a high degree of involvement in customer relationships and a low level of homogeneity of offering are identified as 'software tailoring' in our classification framework. Key internal resources in this business are related to marketing skills as well as to the ability to understand and meet customer-specific needs. Furthermore, resources obtained from external sources in this business are related to operations management and development of technological capabilities.

Second, business models with a high level of involvement in customer relationships and a high level of homogeneity of offering are identified as 'applied formats' business in our framework. Based on our empirical findings, we recognize that essential internal resources in these businesses include systems development resources and the ability to understand and meet customers' needs in narrow segments. In our data we also recognize that the key capabilities acquired from external sources are related to improving knowledge in new solution domains.

Third, business models embodying a low degree of involvement in customer relationships and a low level of homogeneity of offering are labelled as 'resource provisioning' business. According to our empirical findings, key internal assets in this category are related to streamlined operational (development and delivery) processes. Furthermore, in addition to relationship management and marketing skills, the focus of the identified internal capabilities in these businesses is on operations management and technological capability. At a more generic level, we interpret key internal resources in these businesses to be related to operational efficiency. The resources obtained from external sources are related to the development of this internal efficiency.

Finally, business models constituting a low degree of involvement in customer relationships and a high level of homogeneity of offerings are identified in our framework as 'standard offerings' business. The key internal resources are related to marketing skills and product and technology development. In these businesses, key resources obtained from external sources are related to market and network development.

By way of theoretical implication and a contribution to the existing literature, our study suggests that key resources in different business models should be examined by analysing the way they are developed and obtained either internally or externally. Our preliminary classification scheme was found to be feasible in the analysis of different types of software businesses by structuring the empirical study, although we do recognize that there are yet other ways of categorizing software business models. This classification helped us to focus on the key characteristics in different types of businesses based on two previously selected dimensions. Our empirical analysis provided feedback to our preliminary framework by revealing that the dimension of collaboration with customers required specification, and we refined it to represent the degree of involvement in customer relationships in the final classification.

One identified limitation of the current study was that the sample was collected in a relatively narrow geographical area around the capital of Finland. It would be interesting to discover whether the findings would be different in other geographical or cultural areas. Moreover, we focused on small and medium-sized enterprises. Other studies (eg Gulati *et al*, 2000; Möller *et al*, 2005) have shown that the scale of business is linked to network structures and the allocation of resources, and the results of research conducted by Chetty and Wilson (2003) suggest that the types of

assets and capabilities and the ways in which they are achieved depend on the network configuration.

The network concept still abounds with aspects to be taken into consideration when determining how companies create essential resources and obtain them through networks. These include more detailed resource analysis related to changes in business models and examination of the dynamics of key assets and capabilities in the transition of a business-model type. Due to limitations of scope, these issues will be addressed in a future study.

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Appendix

Table A1. Summary of the cases.

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Case	Age (years)	Personnel	Nature of offering	Customer-relationship construct	Business- model type
Case A	40	>100	Model-based software products for narrow segments such as building and construction, and energy supply	Distribution through partners in different international market areas. The operations of these partners are facilitated by the company's internal network of country offices	IV
Case B ₁	~20	>200	Commercial off-the-shelf enterprise software	Multiple customers through a network of distribution partners, including value-added resellers, marketing partners and business consultants	IV
Case B ₂	~4	<30	Semi-finished integration platform for electronic business solutions	Implementation of customer-specific solutions for multiple customers in transactional relationships	III
Case C	5	<50	Software service based on an automated model-based test generator	A multidimensional network structure that incorporates various strategic partners	II
Case D ₁	35	>500	Human- and financial-resource management solutions with related services and process consulting	Customer relations mainly through the company's own sales departments and consultant partners	I
Case D ₂	10	<100	Enterprise resource-management system solutions for SME customers	Distribution through the company's own sales departments and group business units, and marginally through resellers	II
Case D ₃	~3	<50	Third-party solutions, software products and application service provisioning for small enterprise customers	Direct sales, complementary product or service partners and online application service provisioning	IV
Case E	35	>100	Development, delivery and maintenance of information-system solutions for statutory pension insurance companies	Intensive partnerships with customers to provide them with customized information- system services and solutions	II
Case F	5	<50	Video-streaming and content-mastering software and related services for DigiTV producers	Primary customers also act as distribution-channel partners and mediators in new markets	II

Paper V

Antecedents to and Performance Effects of Software Firms' Business Models

by

Risto Rajala

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Department of Business Technology

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ANTECEDENTS TO AND PERFORMANCE EFFECTS OF SOFTWARE FIRMS' BUSINESS MODELS

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Abstract

This study examines the antecedents to and performance effects of software firms' business models. Based on a structural equation modeling of data gathered from almost 200 firms in the software industry, the study shows that firms' service orientation, technology orientation, and open innovation engagement explain a significant amount of the variation evident in their business models. In addition, the study shows that business model focus has significant implications for firm performance. Notably, software firms' service orientation is found to be positively related with their customer proximity-focused business models. The findings indicate that such business models have a significant positive impact on firms' financial performance and slightly weaker, yet significant impact on their market performance. Moreover, firms' engagement in open innovation activity is seen to foster their product uniformity-focused business models. Such business models are found to have a direct and positive effect on firms' market performance. This study makes three principal contributions. First, it formalizes the definitions of an organization's service orientation, technology orientation, and open innovation engagement. Second, it establishes a model that explains how and why these factors antecede individual firms' business models and shows their respective performance effects. Finally, the analysis of business model performance offers the basis for future research directions.

Keywords: Service orientation, Open innovation, Information technology, Business Model, Performance, Software.

1 Introduction

A business model focus manifests a firm's strategic choices. Moreover, industry level changes have been found to have strong effects on firms' business models. In many technology intensive industries, such as the software business, the topical drivers of such changes include the prolific role of services in business (Vargo and Lusch, 2004 and 2008; Dong *et al.*, 2008), the increasing value of information in competition (e.g., Ponssard 1976; Cachon and Fisher 2000) and, thus, the increasing effect of information technology on business (Barua *et al.*, 2004; Melville *et al.*, 2004). Furthermore, the emergence of open innovation activity as an alternative to proprietary innovation development (von Hippel and von Krogh, 2003; Paulson *et al.*, 2004; Bonaccorsi *et al.*, 2006) calls for novel business models in the software industry.

Previous research literature found that a viable business model is necessary for advantageous innovation, valuable service, and good performance (e.g., Engelhardt, 2004). Although the business model concept has received increasing attention in the literature (Morris *et al.*, 2005; Shafer *et al.*, 2005; Zott and Amit, 2008), little is known about how a firm's business model focus affects its performance. The complex problem of linking the business model to organizational performance is informed by the insights of multiple theoretical paradigms, including the resource-based view of the firms (Barney, 1991; Wernerfelt, 1994) and transaction cost economics (e.g., Williamson, 1985). However, the absence of a unified theoretical framework has led to a fractured research stream with many simultaneous but non-overlapping conversations.

The objectives of this paper are: (1) to investigate how three firm-level responses to the changes in the industry, operationalized as service orientation, technology orientation, and openness of innovation, affect the business models of software firms; and (2) to discuss the relationship between a business model focus and firm performance. Thus, the study examines business models from the focal firms' perspective by examining their focus on either customer proximity or product uniformity. Moreover, the effects of the business model's focus on firms' financial and market performance are analyzed.

The present study proposes a connection between the antecedents to business models – service orientation, role of information technology and engagement in open innovation – and firm performance. The model suggests that the focus of the business model adopted by software firms mediates these relationships. We thus seek to develop a conceptual model that is based not only on a single theory, but also on the theoretical discourses that are suitable for analyzing the complexity of

business models and firm performance. Ideally, it would have a robust logical formulation, while enabling the study of the rich contextual processes associated with managing software business models to achieve improved business value.

In the next section, we formalize the concepts of service orientation, technology orientation, and openness of innovation as business model antecedents. Moreover, by drawing on the literature, hypotheses are formulated on the effects of these antecedents on software firms' business models. Further, the effects of different business models on firm performance are hypothesized. Thereafter, we present our research design, measures, data analysis, and the key results. Finally, we conclude the paper by discussing the findings and implications for future research and practice.

2 Theoretical Background and Hypotheses

2.1 Firms' service orientation is a combination of service strategy and service-centric organization

The concept of organizational service orientation (Lytle, Hom, and Mokwa, 1998) has intrigued scholars and business executives alike. To investigate the effect of service orientation on a firm's business model, it is important to examine the factors that influence this at the organizational level. This study distinguishes between two different dimensions of organization level service orientation: strategy and organizational structure.

Service strategy. Prior research has examined the strategy dimension of service orientation by assessing the extent of an organization's service orientation in its business strategy (Berthon et al., 1999; Mathieu, 2001; Antioco et al., 2008) and marketing strategy (Homburg et al., 2002). The research on service marketing strategy draws upon the firm's market orientation (Jaworski and Kohli, 1993) and customer orientation (Narver and Slater, 1990; Gouthier and Schmid, 2003). Notably, the literature has reached a consensus in which a service-centric strategy provides a more holistic and long-term approach to customers than does a product-oriented strategy. Furthermore, Mathieu (2001) conceptualizes a service provider's strategy in terms of providing services supporting the products (SSP) and services supporting the client's actions (SSC). Vargo and Lusch (2004) and Dong et al. (2008) underscore that such a strategy manifests either a goods- or service-centered logic in business. Gummesson (2008) and Maglio and Spohrer (2008) argue that a fundamental principle of service-dominant strategy is that value is the outcome of co-creation between service providers and their clients. However, some authors (e.g., Grönroos and Ravald, 2009) emphasize that service strategists should view the customer as the value creator and a service provider as

a value facilitator. They claim that value created by the customer is exchanged for value created by the firm, with service providing a mediating factor in the process. Similarly, Blazevic and Lievens (2008) and Cova and Salle (2008) suggest that service providers' customer orientation and value co-creation describe firms' approach to service development as part of their service strategy.

Service-centric organization. Service orientation has been examined in terms of an organization's structure, climate, and culture (e.g., Lytle *et al.*, 1998; Schneider *et al.*, 1992). Sinkula *et al.* (1997) show that customer service processes influence organizational attributes such as organizational structure and design. In addition, Bowen *et al.* (1989) submit that the management of effective service organizations relies on climatic and cultural mechanisms such as shared service norms and values. In the customer service processes of service-oriented organizations, learning processes are shown to be decisive drivers of performance (Sinkula *et al.*, 1997). Goldstein *et al.* (2002) add that service components represent "a combination of processes, people skills, and materials that must be appropriately integrated to result in planned or designed service." Antioco *et al.* (2008) point out that the resources needed to support service delivery, and the resulting complexity of the overall service offerings, create functional interdependencies that require effective management.

Thus, the literature gives rise to an understanding that firms' service orientation augments customer proximity and facilitates product uniformity-focused business models. From these notions it follows that:

- H1a: Software firms' service orientation is positively related to their customer proximity-focused business models.
- H1b: Software firms' service orientation is positively related to their product uniformity-focused business models.

2.2 Technology orientation is about focusing exogenous and endogenous technological change

The expanding use of information technology stimulates innovation in business practices and organization models. The organizational learning literature (e.g., March, 1991; Auh and Menguc, 2005) suggests that technology orientation can take two distinctive forms: technology exploration and exploitation. That is, firms either emphasize exploration in seeking effectiveness in new business development or exploitation in seeking efficiency of operation (Gupta *et al.*, 2006). However, prior research on strategic information systems has shown that a narrow focus on technology as a source of competitive advantage is misguided and misleading (Piccoli and Ives, 2005). Hence, this study focuses on technology

orientation through its two dimensions: the endogenous context and exogenous environment.

Endogenous context. Technology orientation within an organization is about refinement, choice, production, efficiency, selection, implementation, and execution in information systems resource development. It is focused on the use and refinement of existing knowledge and technologies in order to strengthen the excellence of the present operation (Levinthal and March, 1993). Products and services that result from improved processes are likely to satisfy their customers and lead to increased revenues, and ultimately to improved firm performance (Benner and Tushman, 2003). However, Matthyssens et al. (2009) argue that firms with an exploitation mindset are bound to existing relations, structures, and behavior that hinder the introduction of new concepts. Incremental technological innovations and those designed to meet the needs of existing customers are exploitative and build upon existing organizational knowledge. Moreover, Von Hippel (1988) suggests that process innovators often need to work closely with external partners to develop new technologies. Davidson and Davis (1990) argue that information technology is driving a shift in business models from mass production to mass customization.

Exogenous environment. Turnbull et al. (1996) discuss technologies as resources that are developed in interaction with the external environment, e.g., with innovation partners. They distinguish product technologies, which consist of the ability to design products and services, from process technologies, which comprise the ability to manufacture or produce these products and services. Relationships with the environment and explorative technology orientation are crucial under the conditions of technological uncertainty (Paladino, 2008). Technology exploration refers to firms' ability to capture resources through activities characterized by search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation (March, 1991). These arguments support the hypothesis that explorative technology orientation is associated with business models that focus on customer proximity. In addition, Katila and Ahuja (2002) suggest that exploration plays a key role in creating new knowledge, which results in completely new products. In this vein, explorative technology orientation can be present in business models that focus on product and service innovation. Hence, it is rational to suggest that:

- H2a: Software firms' technology orientation is positively related to their customer proximity-focused business models.
- H2b: Software firms' technology orientation is positively related to their product uniformity-focused business models.

2.3 Openness of innovation stands for organizational and product-related openness

The widespread popularity of the Internet has led to a drastic increase in the number of open source activities and new open source software (OSS) projects (Lerner and Tirole, 2002). Pittaway et al. (2004) maintain that more than ever, innovation development refers to the creation and management of strategic relationships and alliances with other organizations. Inter-organizational collaboration is a hallmark of contemporary innovation activity (Hinterhuber 2002). It is often claimed to be the source of distinct competitive advantage to both small and large companies (Borch and Arthur, 1995; Gulati et al., 2000), as innovation networks and communities allow firms to exploit external resources and develop their own capabilities (Hung, 2002). Likewise, Reichstein and Salter (2006) argue that innovators often rely on many different external sources of knowledge. However, engagement in open innovation poses a challenge for firms participating in such collaboration: learning from partners in order to maximize the effectiveness and efficiency requires transparency in the partnership, but excess leakage of information in the partnership may dilute the firms' internal sources of competitive advantage (Mohr and Sengupta, 2002). In the present study, the aspects of openness in innovation activity are investigated through organizational openness and open source products and components.

Organizational openness. Having an open organization increases the crossfertilization and cross-functional support of ideas (Aiken and Hage 1971). In such an organization, there is a willingness to collaborate across organizational units and acquire knowledge outside the organization. Furthermore, it is noted that increased openness reduces fear and therefore encourages new ideas and risk taking (Scott and Bruce, 1994). Open source innovation offers an interesting means of organizing software development. OSS projects are exemplars of a "soft" mode of governance (Schultze and Orlikowski, 2001), as open source innovation is based on online communication; i.e., the Internet, which has been described by Vujovic and Ulhøi (2008) as an e-R&D networking tool for openness and teamwork and for decentralized linkages and knowledge flows. Since OSS projects are based on online communication, cooperation, and coordination, they can be characterized as virtual organizations or communities. This kind of innovation activity, which is focused on creating publicly available software, relies largely on a community of voluntary contributors (i.e., software developers and users). Vujovic and Ulhøi (2008) emphasize that the transfer and sharing of knowledge in such a community involves various kinds of social interaction. Vujovic and Ulhøi (2008) argue that tighter intra- and inter-organizational linkages increase efficiency by streamlining the handoffs between activities, thus accelerating delivery times.

Open source products and components. The soft mode of governance introduced by (Schultze and Orlikowski, 2001) is made possible by two interrelated and mutually reinforcing features of software production-modularization and distribution-in which coordination is supported by an extensive exchange of information during product development (Bonaccorsi and Rossi, 2003). Modularity as a general structuring principle is recognized from organization theory that dates to the early literature on technology design (Simon, 1962; Alexander, 1964). Vujovic and Ulhøi (2008) argue that when applied to software, it allows a rather loosely managed and structured approach to production. In such a setting, software developers can work on different modules independently and exchange experiences together. Moreover, they can benefit from the innovation capacity of a larger group of developers in problem solving. Sanchez and Mahoney (1996) argue that such modularized production leads to modular organizations. Shared files and lists make contributions to software development visible, and thus reveal the organization of contributions to some extent. Shared information, such as component libraries, user support, technical discussions, and announcements, are assumed to make knowledge dissemination easier and facilitate learning from the project (Kessler, 2003). In this way, the Internet provides planning and organizational resources as well as cost-effective communication and distribution systems that are used in both product development and customer-specific system implementations. The following hypotheses are suggested:

- H3a: Openness of innovation has a positive relationship with software firms' customer proximity-focused business models.
- H3b: Openness of innovation has a positive relationship with software firms' product uniformity-focused business models.

2.4 Business model focus affects firm performance

According to Cox and Mason (2007), a crucial question in business model focus is the question of standardization versus adaptation. Regarding the nature and purpose of offerings provided by software firms, and following Mathieu (2001), who distinguishes services supporting the product (SSP) from services supporting the client's actions (SSC), we note the distinction between offerings provided in support of the product uniformity-focused business models and those in support of the client's actions in the customer proximity-focused business models. Thus, the first aspect in measuring an offering is its homogeneity or similarity across several transactions. This is a central issue in transaction cost economics (TCE) (Williamson, 1985), which argues that economies of scale are realized by increasing the number of similar offerings. Alternatively, the potential economies of scope are related to close integration (i.e., conducting more business between the seller and buyer).¹

2.4.1 Business models focusing on customer proximity

Some business models aim to create new types of transactions with customers; i.e., by increasing the total number of transaction types. If this is pursued by focusing on a small number of customers, it also strengthens the focal firm's bargaining power in its customer relationships vis-à-vis other business model stakeholders (Zott and Amit, 2008). The current consensus in the industrial marketing literature suggests that firms benefit from building long-term relationships with their customers instead of focusing separately on each transaction (Sheth and Parvatiyar, 1995). Hence, it can be argued that economies of scope exist when for all outputs X and Y, the cost of joint production C(X,Y) is less than the cost of producing each output separately C(X) + C(Y). This applies to all types of offerings and transactions, even in enterprises and organizational entities processing knowledge related to software. In terms of transaction cost economics (TCE), the economies of scope accrue if cost savings result when different offerings are joined into a single buyer-seller transaction (Williamson 1985, 112):

(1)
$$C(X,Y) < C(X) + C(Y).$$

In the case of software related services, this model represents a situation outlined by Lovelock (1991), in which the nature and recipient of services, the relationship between the firm and customers, and the level of service customization (Reich and Huff, 1991), represent an intense relationship between the seller and the buyer, a high degree of customization, and an emphasis on people as providers and recipients (Mathieu 2001). From the literature focused on market orientation (Narver and Slater, 1990; Jaworski and Kohli, 1993; Deshpandé *et al.*, 1993), we have learned that customer orientation is linked to business performance, but in a complex way that requires myriad capabilities. Although empirical research has been inconsistent in its support of the claim that customer orientation strengthens business performance, the study by Zhu and Nakata (2007) strengthens the notion that customer orientation contributes to performance. In view of this, it is hypothesized that:

H4a: Software firms' customer proximity-focused business models have a direct and positive relationship with their market performance.

¹ Scale economies accrue when cost savings are realized by homogenous objects in multiple transactional relationships. Economies of scope accrue if cost savings result when heterogeneous objects are joined in a single buyer-seller transaction (Williamson 1985, 112).

H4b: Software firm's customer proximity-focused business models have a direct and positive relationship with their financial performance.

2.4.2 Business models focusing on product uniformity

In the business model type characterized by standardized product/service offerings, innovation focus can be laid on developing uniform products, uniform service processes (Apte and Vepsalainen, 1993), or both. A great deal of business literature emphasizes the scale advantages of firms (e.g., Barnard and Ehrenberg, 1990). These studies describe the multiple advantages enjoyed by large-scale offerings; i.e., offerings that are provided to a larger target group instead of single or small groups of clients within narrow customer domains. However, scale economies are not only founded on adding new customers, but also having more loyal customers in terms of repeat purchases. Zott and Amit (2008) show that efficiency-centered business models aim to reduce transaction costs for all transaction participants. According to Williamson (1985, 112), scale economies accrue when cost savings are realized by providing similar offerings in multiple transactions:

(2)
$$C(X1+X2) < C(X1) + C(X2).$$

Uniform software product/service offerings range from dedicated domain-specific software to a standardized online service. Lucas *et al.* (1988) define a dedicated software package as one that offers a solution to the user's information processing problem; the package is dedicated to some particular function like transaction processing or production planning. Empirical research has indicated that a firm's propensity to enter exploration and exploitation alliances and networks is related to the resource endowments of the firm (Park *et al.*, 2002). The importance of possession of or access to key resources in the network becomes obvious when firms aim to develop new products and business concepts. Radically new innovations or those for emergent customers or markets are exploratory, since they require new knowledge or departures from existing skills (March, 1991; Levinthal and March, 1993). Hence, the following hypotheses are suggested:

- H5a: Software firm's product uniformity-focused business models are positively related to their market performance.
- H5b: Software firm's product uniformity-focused business models are positively related to their financial performance.

Firm performance has been studied along with a wide variety of managerial issues, such as strategy types (Miles and Snow, 1978), customer orientation (Narver and Slater, 1990; Jaworski and Kohli, 1993), and innovation orientation (e.g. Siquaw *et al.*, 2006). Demsetz (1973) suggests that firms with higher market share gain efficiencies that translate into greater profitability. This logic forms the premise

for positing that market performance precedes and influences financial performance. Furthermore, empirical studies have cited market performance as a likely antecedent of financial performance. In a meta-analysis of determinants on firm performance, Capon *et al.* (1990) found that market share, sales growth, and quality of products and services are positively tied to financial performance. In another study, Szymanski *et al.* (1993) learned that market share is a significant contributor to profitability. Based on these conceptual and empirical studies, it is reasonable to suggest that:

H6: Firms' market performance is positively related to financial performance.



Figure 1. The conceptual model of the study and established hypotheses.

3 Methodology and data

For the purposes of the study, an online survey of software firms' strategies, business models, and innovation approaches was conducted in 2008-2009. The empirical inquiry was administered to virtually all software firms in Finland. The procedure to acquire the contact information for all firms in the sampling frame was threefold. First, the names and contact information of firms that belong either to the Association of the Finnish Software Entrepreneurs or the Finnish Software Business Cluster were obtained from these societies. Second, the names and e-mail addresses of the senior managers of these firms were collected from the companies' Web pages in May-August 2008. Third, the preliminary set of firms was completed using the standard industrial classification of Statistics Finland, selecting all firms in the category of software consultancy and supply (TOL 2002-722) in January 2009. The final set included all identifiable firms in the sampling frame, and the missing contact information was completed by consulting the nationwide electronic telephone catalog. The total sample consisted of potential respondents in 1355 firms. The average number of selected potential respondents

in all firms was two. The respondents were recruited via e-mail where an invitation and a link to the survey were included in the message body. The questionnaire yielded 197 usable responses from 179 firms. Thus, the yielded scope of the survey equates to 13.2 %, which is considered acceptable in online surveys targeted to nationwide whole sampling frames covering all firms in the selected industry.

Following the standard industrial classification (SIC; Dun and Bradstreet), firms in the sample were classified according to the number of employees into micro firms (fewer than 5 employees); small firms (5-19 employees); small to medium-sized firms (20-99 employees); medium-large firms (100-499 employees); and large firms (500 or more employees). Using this classification, the distribution of firms in the sample is shown in Table 1.

Table 1. Distribution of firms in the sample by size (n=197)				
Category	Frequency	Percent	Valid %	Cumulative %
Fewer than 5 employees	45	22.8	23.0	23.0
5-19 employees	67	34.0	34.2	57.1
20-99 employees	48	24.4	24.5	81.6
100-499 employees	17	8.6	8.7	90.3
500 or more employees	19	9.6	9.7	100.0
Total	196	99.5	100.0	
Missing	1	.5		
Total	197	100.0		

The majority of firms in the sample are considered small to medium sized in terms of the number of employees. In addition, 25% of the firms had an annual turnover of less than 0.5 million euros (MEUR), 50% of the firms had annual turnover with less than 1.8 MEUR, and 75% with less than 8 MEUR. The turnover of the largest firm was equal to 4,500 MEUR. The distribution of turnover in the sample is consistent with previous research on the Finnish software industry (e.g., the yearly Finnish software business survey 2002-2008).

3.1 Variables

Multi-item scales were used to measure all constructs. The survey addressed service orientation, technology orientation, engagement in open innovation, business model focus, and firm performance. All items were measured on a five-point Likert-type scale (1="strongly disagree" to 5="strongly agree"). The scales for service orientation and business model focus were developed for this study on the basis of a literature review and interviews with the industry experts and senior

managers in software firms. Conversely, the items for technology orientation, openness of innovation activity, and firm performance were drawn from the literature; however, the wording of the questionnaire was modified slightly in order to fit the context of software firms (see Appendix 1 for the survey scales).

Dependent variable. The dependent variable is firm performance. In the analysis, this is investigated in terms of market performance and financial performance. Market performance (MPERF) is a reflective construct that consists of three items drawn from prior literature (Deshpandé et al., 1993; Jaworski & Kohli, 1993; Kandemir et al., 2006). The items measure firms' market performance (during the recent three years) in terms of market share (y_7) , changes the firm has induced in the market (y₈), and growth relative to competitors (y₉). Financial performance (FPERF) is a formative construct which consists, ex officio, of two items that are used commonly in the extant research literature to investigate firms' economic success (during the last three years): improved profitability (y10) and increased product/service sales (y11). Because objective measures of individual firms' performance relative to their competitors are not available, we rely on the respondents to provide the perceptual measure. However, even though information regarding the dependent and independent variables comes from the same respondents and a common method bias exists, we do not believe that the bias would have a remarkable influence on the analysis. The issue of potential bias is discussed later in the section on empirical analysis.

Independent variables. The independent variables include three second-order constructs that capture firms' service orientation (SERVOR), technology orientation (TECHOR), and openness of innovation activity (OPENNESS). SERVOR is a second-order construct that uses two reflective indicants. One of them is a first-order construct that captures a firm's service strategy (SERVSTRAT). Its four reflective indicators (adapted from Homburg *et al.*, 2002) encompass the importance of services in a firm's marketing strategy (x1), the extent to which a firm's solutions are sold as services (x2), the importance of services as a source of competitive advantage (x3), and the salience of services in the way the firm responds to its customers' needs (x4). The other first-order construct in service orientation is service structure (SERVSTRUC). Its three reflective indicators, newly established for this study, address the perceptions on how well the organization's structure supports the realization of services (x5), how service-centered the organization culture is (x6), and how well the company's information systems support the service activity (x7).

Gatignon and Xuereb (1997) and Zhou *et al.* (2005) have studied the extent and forms of technology orientation in terms of the development and use of sophisticated technologies. In this study, TECHOR is aggregated from two first-order constructs which describe technological issues that are endogenous and

exogenous to the firm. Consistent with Gatignon and Xuereb (1997) and Zhou *et al.* (2005), the items that capture endogenous technology orientation (ENDOTECH) include those that measure the readiness to develop new technologies (x_8), technological knowledge (x_9), as well as the preparedness to offer advanced technologies compared to competitors (x_{10}). In addition, the extent to which the company culture encourages the development of technological innovations (x_{11}) is measured. Moreover, following Jaworski and Kohli (1993) and Desarbo *et al.* (2005), we encompass exogenous technology orientation (EXOTECH) through the following reflective indicators: technological changes provide remarkable opportunities to actors in the industry (x_{12}), many novel product ideas in the field have arisen from technological breakthroughs (x_{13}), and the extent to which the products and/or services in the business comprise state-of-the-art technology (x_{14}).

Bonaccorsi and Rossi (2003) and Dahlander and Magnusson (2008) have studied the forms and effects of firms' engagement in open innovation in the field of open source software. Consistent with He and Wong (2004), who distinguish the objectives and structures designed for efficiency of operation from those designed for the exploration of innovation, our model of firms' engagement in open innovation (OPENNESS) distinguishes organizational openness from that of software development. Organizational openness in innovation activity (OORG) is conveyed by asking respondents about the extent to which the company culture encourages the search for new ideas outside the organization (x15), organizationwide elaboration and testing of ideas (x16), the willingness of personnel to innovate with people outside their own unit (x17), and experience-based perception of openness as a factor to accelerate development (x18). Moreover, the openness of the software product (OPROD) is investigated by asking respondents about the extent to which collaboration and information sharing are present in the development of their companies' products and/or services (x19), the use of open source software (OSS) components as part of the firm's products (x_{20}) , and the salience of OSS development in the company's business.

Intermediary variables. The intermediary variables encompass business model type. To this end, we identify the customer proximity and product uniformity-focus in business models, and analyze their effects on firm performance. Narver and Slater (1990), Jaworski and Kohli (1993), and Deshpandé *et al.* (1993) developed scales which, in whole or part, are the most prominent assessments of customer orientation. Following their scales and that of Theoharakis and Hooley (2008), the three reflective indicators of customer proximity-focused (CUSTFOCUS) business models embody customer participation in the solution development work (y_1), the density of collaboration with clients in the development work (y_2), and the extent to which the company has focused on enhancing current customer relationships (y_3). Similarly, consistent with Tether

and Tajar (2008) the three reflective indicators for the product uniformity focus (STDFOCUS) in business models include the extent to which the company focuses on the development of new products and services (y₄), building success based on the development capabilities for new products and/or services (y₅), and the ambition to develop products and services that are new to the industry (y₆). In this vein, the intermediary variables include aspects related to both exploration and exploitation, as innovations are often classified by whether they address the needs of existing customers or are designed for new or emergent markets (Benner and Tushman, 2003).

3.2 Scale validity and reliability

The present study uses Wold's (1982) method of partial least squares (PLS) to estimate parameters. To assess the reliability and validity of the constructs, composite reliability values (ρ_c) and average variance extracted values (ρ_v) were examined for each first-order latent variable. Construct reliability was assessed using the composite reliability analysis suggested by Fornell and Larcker (1981). It can be written using the calculation formula:

(3)
$$\rho_{\rm c} = \frac{\left(\sum \lambda_i\right)^2}{\left(\sum \lambda_i\right)^2 + \sum \operatorname{var}(\varepsilon_i)}.$$

where λ_i is an individual factor loading and $var(\varepsilon_i)$ is its error variance. All composite reliability values were above the recommended level of .70 (Fornell and Larcker, 1981). A complementary measure to composite reliability is the average variance extracted, which is useful in examining convergent validity. Average variance extracted is the average variance shared between a construct and its measures (Hulland, 1999), and the equation is defined as:

(4)
$$\rho_{v} = \frac{\sum \lambda_{i}^{2}}{\sum \lambda_{i}^{2} + \sum \operatorname{var}(\varepsilon_{i})},$$

where the ρ_v is computed as the total of all squared standardized factor loadings. It shows directly the amount of variance captured by the construct in relation to the variance due to measurement error. In our study, all constructs exceeded the recommended .50 benchmark (Diamantopoulos and Siguaw, 2000).

Overall, the composite reliability values and average variance extracted values indicate that the scales perform adequately. In addition to these two measures, the means, standard deviations, Cronbach's alphas for internal consistency, and correlations for the constructs are presented in Appendix I. The customer proximity-focused business model construct (CUSTFOCUS) had the lowest coefficient value (α =.65) in the data set. Yet a Cronbach's alpha that is equal to or

greater than .60 is considered acceptable, as both the composite reliability value (.80) and average variance extracted value (.57) indicate that the construct performs well—although we would generally prefer a stronger standard of $\alpha >$.70. It should be noted, however, that the reliability measure available in Cronbach's alpha is non-robust and is extremely sensitive to violations, as a single observation can have a significant impact on this coefficient (Christmann and van Aelst, 2006). Hence, we consider it in proportion to other reliability measures.

Discriminant validity; i.e., the extent to which different constructs diverge from each other, was assessed by examining the correlation matrix of the constructs. According to Fornell and Larcker (1981), satisfactory discriminant validity among constructs is obtained when the square root of the average variance extracted is greater than corresponding construct correlations. This implies that the variance shared between any two constructs is less than that shared between a construct and its indicators. For each pair of constructs, the square root of the average variance extracted exceeded their correlations. Thus, all constructs meet the criterion, which supports their discriminant validity.

In addition, to address common method variance (CMV) which can be problematic when both dependent and independent variables are measured in the same survey, the Harman's one-factor test was used. The factor analysis revealed that there were five factors with an eigenvalue greater than 1, and no single factor dominates the explanation of the total variance. The first factor explains 19% and together, the five factors explain 65% of the total variance. Thus, according to the criterion presented by Podsakoff and Organ (1986), CMV is unlikely to be a concern in the present study.

Furthermore, the Variance Inflation Factor (VIF) values were computed for the endogenous regressors of the formative construct (FPERF) as suggested by Myers (1986) and Mason and Perreault (1991). These values provide an indication of the linear associations among regressors that might lead to multicollinearity problems. If any VIF value exceeds 10, Myers (1986) suggests that there may be cause for concern. The calculated VIF value for the regressors (VIF=1.213) is below 10, which does not suggest a problem with multicollinearity in the model.

3.3 Second-order constructs

PLS enables scholars to investigate models at a higher level of abstraction (Lohmöller, 1989), which is useful in estimating complex models (Chin, 1998). For this purpose, Wold (1982) suggests the repeated indicators (i.e., the hierarchical component model) method for measuring second-order constructs, which is useful in estimating complex models (Chin, 1998). That is, all indicators of the first-order constructs are reassigned to the second-order construct. Consequently, the
manifest variables are used twice: for the first-order latent variable ("primary" loadings) and for the second-order latent variable ("secondary" loadings) as suggested by Wetzels *et al.* (2009). Following Jarvis *et al.* (2003), such a model is a total disaggregation, second-order factor model. It has a series of first-order latent factors with reflective indicators. These first-order factors are themselves reflective indicators of an underlying second-order construct.

According to Hulland (1999), researchers need to think about whether it is more correct to consider the underlying construct as causing the observed measures (i.e., a reflective relationship) or of the measures as causing or defining the construct (i.e., a formative relationship). A prerequisite for the repeated indicators approach is that all indicators of the independent first-order and the second-order factors should be configured as reflective. Thus, in contrast to the formative dependent construct (FPERF), all items included in our model as independent variables were configured as reflective indicators (Fornell and Larcker, 1981; Haenlein and Kaplan, 2004). Moreover, according to Diamantopoulos *et al.* (2008) the second-order latent variable should be used as exogenous variable, because its variance is explained by its indicators and, otherwise, the specification of an additional source of variation (i.e., an antecedent construct) would be conceptually questionable. In our model, the second-order constructs of SERVOR, TECHOR, and OPENNESS are considered exogenous variables as suggested by Diamantopoulos *et al.* (2008).

4 Empirical analysis and results

The data in the present study were analyzed and hypotheses examined through partial least squares (PLS) structural equation modeling using the SmartPLS 2.0 developed by Ringle *et al.* (2005). PLS path modeling is a component-based SEM approach that does not require multivariate normal data and places minimum requirements on measurement levels (Hulland 1999; Tenenhaus *et al.*, 2005). Moreover, the use of the PLS method is typically recommended in situations in which there are no stable, well-defined theories to be tested in a confirmatory research setting, the research model includes reflective and formative constructs, or the sample size is small (Haenlein and Kaplan, 2004). In addition, Barclay *et al.* (1995) suggest that PLS is viable for analyzing predictive research models that are in the early stages of theory development, as is the model in the present study. Because PLS considers all path coefficients simultaneously and estimates multiple individual item loadings in the context of a theoretically specified model rather than in isolation, it helps to avoid biased and inconsistent parameter estimates for equations.

Baumgartner and Homburg (1996) suggest a three-step procedure for a rigorous analysis of data in structural equation modeling. First, in line with (Kaplan, 1990), they emphasize the importance of ensuring that there are no coding errors, that variables have been recoded correctly if necessary, and that missing values have been accounted for properly. Second, they suggest that it is helpful to investigate possible distorting influences introduced by the presence of a few influential outliers. Finally, they posit that it is crucial to examine the approximate normality of the data and to take corrective action if this assumption is violated, since most estimation methods assume that the data come from a multivariate normal population. Following these guidelines, the data were coded and cross-checked for both the type of the variable and content of the cases. Missing values were marked and treated in the analysis by the SmartPLS algorithm. An exploratory factor analysis was then conducted in SPSS 16.0 with principal component analysis and Varimax rotation. The factor analysis provided support for the hypothesized constructs as they emerged as clear factors from the data. Only variables with absolute coefficient values exceeding .50 within the constructs were accepted for the structural equation analysis.

The hypotheses were examined with full-sample using t-tests (df=517). First, estimates of the standardized regression coefficients for the paths in a structural equation model were generated. Then, the bootstrap procedure was used to approximate the sampling distribution of an estimator by resampling with replacement from the original sample, which is necessary to derive valid t-values. Following Davidson and MacKinnon (2000), the analysis was conveyed using 1,000 bootstrap replications. The structural equation model and the results of the analysis are shown in Figure 2.



Table 2 lists the results for the hypotheses. As predicted in hypotheses H1a, a software firm's service orientation (SERVOR) has a positive relationship with the customer proximity-focus of the business model (CUSTFOCUS) (β =.43, t=6.80, p<.001). However, contrary to our hypothesis H1b, its service orientation does not have a statistically significant effect on the product uniformity focus (STDFOCUS) of business model (β = -.11, t=1.84, p<.001). Conversely, the results of the analysis suggest that a software firm's technology orientation (TECHOR) advances both its customer focusing business models (β =.18, t=2.40, p<.05) and standard offering-focused business models, (β =.35, t=4.86, p<.001). Hence, the analysis provides support to hypotheses H2a and H2b. Against our hypothesis, a firm's engagement in open innovation activity (OPENNESS) does not have a significant effect on customer-focused business models (β =.11, t=1.51, p<.132). Hypothesis H3a is thus not supported. However, engagement in open innovation has a significant positive effect on standard offering-focused business models (β =.11, t=1.51, p<.16, p<.001).

Table 2. Results of hypotheses testing (n=197, bootstrap samples=1000, df=517)						
H#	Relationship	β	<i>t</i> -value	<i>p</i> -value	Support	
H1a	SERVOR \rightarrow CUSTFOCUS	.43	6.80	<.001	Yes	
H1b	SERVOR \rightarrow STDFOCUS	11	1.84	.066	No	
H2a	TECHOR \rightarrow CUSTFOCUS	.18	2.40	.017	Yes	
H2b	TECHOR \rightarrow STDFOCUS	.35	4.86	<.001	Yes	
H3a	OPENNESS \rightarrow CUSTFOCUS	.11	1.51	.132	No	
H3b	OPENNESS \rightarrow STDFOCUS	.37	5.16	<.001	Yes	
H4a	CUSTFOCUS \rightarrow MPERF	.16	2.49	.013	Yes	
H4b	CUSTFOCUS \rightarrow FPERF	.22	3.66	<.001	Yes	
H5a	STDFOCUS \rightarrow MPERF	.32	3.78	<.001	Yes	
H5b	STDFOCUS \rightarrow FPERF	.03	.44	.660	No	
H6	MPERF \rightarrow FPERF	.53	10.26	<.001	Yes	

Furthermore, firms' business model types have significant effects on firm performance. Supporting our hypotheses, CUSTFOCUS advances both a firm's market performance (MPERF) (H4a) (β =.16, t=2.49, p<.05) and financial performance (FPERF) (H4b) (β =.22, t=3.66, p<.001). Moreover, a firm's focus on product uniformity (STDFOCUS) has a significant positive effect on its market performance (MPERF) (β =.32, t=3.78, p<.001), thus supporting hypothesis (H5a). Yet the analysis shows no significant relationship between a firm's focus on standardized offerings and its financial performance (FPERF) (β =.03, t=.44, p=.660), which contradicts our hypothesis H5b. Finally, the analysis reveals that

market performance has a significant positive effect on financial performance (β =.53, t=10.26, p<.001). Table 2 summarizes the results. Nevertheless, there is a statistically significant difference between individual customer proximity-focused business models (CUSTFOCUS) and product uniformity-focused business models (STDFOCUS). Customer focus has a direct positive effect on a firm's financial performance (FPERF) (β =.22, t=3.66, p<.001), while it has a slightly weaker, yet positive effect on firms' market performance (MPERF) (β =.16, t=2.49, p<.05). Conversely, standard offering focused business models have a statistically significant effect only on a firm's market performance (MPERF) and not on its financial performance (FPERF).

The explanatory power of the model for the dependent construct was measured by using the squared multiple correlations value (R^2) suggested by Hulland (1999). In the present study, the independent constructs were able to explain 14% of the variance in market performance (MPERF) and 36% of the variance in financial performance (FPERF), which is considered good for this kind of analysis. PLS path modeling includes no proper, single goodness of fit measure (GoF). However, to conclude our structural analysis, we calculate the goodness of fit (GoF) of the model using the global fit measure for PLS by Tenenhaus et al. (2005). By taking the square root of the product of the variance extracted of all constructs with multiple indicators and the average R² value of the endogenous constructs, we can calculate a fit measure ranging between 0 and 1. The measure was calculated using the second-order constructs and the dependent construct. According to the categorization by Cohen (1988) and using .50 as a cutoff value for communality (Fornell and Larcker, 1981), the GoF criteria for small, medium, and large effect sizes are .10, .25, and .36. In the present model, the GoF is .43, which indicates a good fit of the model to the data.

5 Discussion and Conclusion

This study investigates the determinants of business model performance by integrating firms' service orientation, technology orientation, and openness of innovation into a structural equation model. The analysis provides evidence of the connection between these business model antecedents and their effects on software firms' business model focus. In other words, firm-level orientations regarding the service dominance, technological dynamics, and open innovation in the software industry have significant effects on software firms' business models and, ultimately, on the firms' performance. In particular, the findings indicate that service orientation, technology orientation, and engagement in open innovation have remarkable influences on firms' business model focus.

The results support the conclusion that technology plays a significant role in the contemporary software business. First, Congruent with Vujovic and Ulhøi (2008), it can be concluded that open innovation fosters the development of software offerings. Second, information technology plays a key role in supporting customer service-focused business models. Moreover, the results show that the business model focus affects firm performance. High customer proximity seems to have a direct positive effect on firms' financial performance, whereas it seems to have a slightly weaker, yet positive effect on firms' market performance. These findings represent something of a contrast to the findings of Zhu and Nakata (2007), who found that customer orientation is related to market performance, and that market performance is associated with financial performance. Our findings give rise to critical concerns against their chain effect in line with the notions of Macdonald (1995), who suggested: "The firm which would take getting close to the customer seriously must consider the degree to which it can, should, and will integrate with its customers' activities, and probably with those of others in the market." Conversely, high product uniformity; i.e., focus on standardized offerings, seems to have a statistically significant effect only on firms' market performance and not on their financial performance. However, market performance has a strong positive relationship with financial performance, which suggests that the findings are obtained through a cross-sectional survey, where the performance effects were encompassed over a three-year period. That is, the results should be valid, at least in the short-term.

The study makes an important contribution to the literature on business models. First, it establishes the constructs of service orientation, technology orientation, and openness of innovation activity as business model antecedents that explain a significant deal of the variation in software firms' business models. Second, it investigates the contingent role of business models in the determination of firm performance. In doing so, the study extends the scholarly inquiry into business model focus as a contingency factor that impacts firm performance. Whereas the traditional focus in the literature on firm performance has been on the firm's strategy or administrative structure, the analysis of the present study is centered on the types of business models expressed in terms of customer proximity and product uniformity. Hence, the study contributes to the literature on business models and offers the basis for future research directions.

This work also has some valuable practical implications. One obvious piece of advice is the need for business managers to become more conscious of their business model focus and its impact on firm performance. Ultimately, the focus on supporting customer actions through customer proximity seems to be associated with both good financial performance and good market performance. At the same time, its relationship with market performance is slightly weaker than the relationship with financial performance. Conversely, the focus on product uniformity, or standardization for productivity, seems to be associated with good market performance in terms of increased market share, growth, and the firm's ability to induce changes in the market. Yet it does not seem to augment short-term financial performance. However, according to prior studies, the focus on product innovations may have more long-term effects, which were not revealed in this study.

Regarding the limitations of the present study, the empirical analysis was limited by a population derived from a rather small geographical area with a relatively homogenous cultural background. Furthermore, the data used in the analysis were cross-sectional. Future research is therefore needed to investigate whether the results hold between different geographical and cultural areas and with objective, longitudinal performance data. Moreover, future research should use confirmatory analyses to validate the results.

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Antecedents to and Performance Effects of Software Firms' Business Models

ů	onstruct correlations and d	lescriptiv	e statis	tics of I	neasur	es (n=1	97)								
ŭ	onstruct	Mean	SD	Ρ	β	α	1	2	3	4	5	9	7	8	9
1	SERVSTRAT	3.91	.86	.74	.92	.88	(.86)								
2	SERVSTRUC	3.83	77.	.64	.84	.71	69.	(08.)							
З	ENDOTECH	3.65	.82	.70	<u> 06</u> .	.86	.03	60.	(.84)						
4	EXOTECH	3.80	<i>TT.</i>	99.	.86	.75	.19	.19	.63	(.82)					
2	OORG	3.58	.79	.63	.87	.81	.17	.27	.54	.37	(.80)				
9	OPROD	3.50	1.00	.67	.86	.76	.17	.21	.36	.39	.51	(.82)			
2	STDFOCUS	3.76	.81	.65	.85	.73	.02	.03	.53	.41	.53	.38	(.81)		
8	CUSTFOCUS	3.92	.72	.57	.80	.65	.46	.42	.21	.37	.27	.29	.13	(.75)	
6	MPERF	3.30	.95	.71	88.	62.	.21	.12	.31	.20	.28	.14	.34	.20	(.84)
10	FPERF*	3.48	.83	n/a	n/a	n/a	.21	.20	.17	.23	.27	.11	.24	.33	.58
11	SERVOR ⁺ (1-2)	I	I	.84	.91	88.	I	I	ı	ı	ı	ı	ı	ı	I
12	$TECHOR^{+}$ (3-4)	I	ı	.81	06.	.87	ı	ı	ı	ı	ı	ı	ı	ı	ı
13	OPENNESS [†] (5-6)	I	I	.75	.86	.83	I	I	I	I	I	I	I	I	I
Not et a	te: SD = standard deviation; $\rho_v = i$ <i>l</i> , 2005); square root of ρ_v on diag	average va gonal (in p	riance ex arenthese	tracted; ρ (s); * = fo	c = comp rmative (osite relia construct;	ability; C t = seco	ronbach' ond-order	s alpha (o construc	$(t) = ((\Sigma_{h \neq t})$	rov(x _h , y	(h'))/var	Σ _h x _h))(<i>p</i> /(9-1)) (Ten	enhaus

Appendix I – Construct correlations and descriptive statistics

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Appendix II – Scale items

Construct and Item	Loading	Weight	
SERVOR			
SERVSTRA	AT ª		(Homburg, Hoyer and Fassnacht, 2002)
\mathbf{x}_1	.82	.29	Our marketing strategy emphasizes the importance of services
x ₂	.85	.28	Our solutions are increasingly sold as services
x ₃	.85	.29	Services constitute an important source of competitive advantage in our industry
\mathbf{x}_4	.91	.30	We increasingly respond to customer needs through services
SERVSTRU	JC ª		
X 5	.85	.44	Our organization structure supports well the realization of services
x ₆	.81	.43	Our organization culture is service-centered
\mathbf{x}_7	.73	.38	Our company information systems support the service activity well
TECHOR			
ENDOTEC	CH ª		(Gatignon and Xuereb, 1997; Zhou et al., 2005)
X 8	.86	.29	Our company is among the first to develop new technologies
X 9	.81	.28	Compared to other companies (in the industry), we possess substantial technological knowledge
X 10	.89	.32	Compared to our competitors, we offer advanced technologies
X 11	.79	.30	Our company culture encourages the development of technological innovations
EXOTECH	a		(Jaworski and Kohli, 1993; Desarbo <i>et al.</i> , 2005)
X 12	.81	.39	Technological changes provide remarkable opportunities to actors in our industry
X 13	.80	.36	Many novel product ideas in our field have arisen from technological breakthroughs
X 14	.84	.47	Products/services in our business comprise state-of-the-art technology
OPENNES	s		
OORG ^a			(Cummings, 1965; Pierce and Delbecq, 1977; Scott and Bruce, 1994)
X 15	.78	.30	Our company culture encourages the search for new ideas outside our organization
X 16	.79	.30	Our organization enables an organization-wide elaboration/testing of ideas
X 17	.79	.31	Our personnel are willing to innovate with people outside their own unit
X 18	.83	.35	Our company has learned that openness speeds up the development and acceptance of new ideas

Construct and Item	Loading	Weight	
OPROD ^a			
X 19	.76	.43	Collaboration and information sharing are imperative in the development of our products/services
X 20	.83	.37	We make use of open source software or OSS components as part of our products
X 21	.87	.42	Open source software development is an essential factor in our business
Business m	odel type		
CUSTFOC	US ª		(Mod. from Narver and Slater, 1990; Theoharakis and Hooley, 2008)
\mathbf{y}_1	.75	.37	Our customers participate in our solution development work
y ²	.73	.34	The development work is carried out in close collaboration with clients
у3	.78	.60	During the last three years, to what extent has your company focused onenhancing current customer relationships
STDFOCU	Sa		(Mod. from Tether and Tajar, 2008)
y 4	.66	.28	Our innovation activity focuses on the development of new products and services
у5	.87	.49	During the last three years, our company has focused on building success based on the development capabilities for new products and/or services
y 6	.87	.45	During the last three years, our company has focused on developing products and services new to the industry
Firm perfo	rmance		
MPERF ^b			(Deshpandé <i>et al.</i> , 1993; Jaworski and Kohli, 1993; Kandemir <i>et al.</i> , 2006)
y 7	.90	.46	increased market share (during the last three years)
y 8	.77	.36	induced changes in the market (during the last three years)
y 9	.86	.36	faster growth relative to competitors (during the last three years)
FPERF ^b			(Deshpandé <i>et al.</i> , 1993)
y 10	с	.59	improved profitability (during the last three years)
y 11	с	.60	increased product/service sales (during the last three years)

(Scale items continued)

Notes: ^a The response options ranged from 1 = "totally disagree" to 5 = "totally agree."

^b Performance indicators measured perceptions of firm performance during the last three years.

The performance rating options ranged from 1 to 5.

^c Formative scale.

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