SAEED KHANAGHA

Dynamic Capabilities for Managing Emerging Technologies

Organizational and Managerial Antecedents of Effective Adoption of Cloud Computing

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Dynamische vaardigheden voor het benutten van opkomende technologieën
Organisatorische en management antecedenten voor de effectieve adoptie van cloud computing

Thesis

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Saeed Khanagha

Born in

Tehran, Iran

ERASMUS UNIVERSITY ROTTERDAM

Doctoral Committee

Promoter	Prof.dr. H.W. Volberda
Other members:	Prof.dr. K. Pandza
	Prof.dr. F.A. Van Den Bosch
	Prof.dr. P.H.M. Vervest
Copromoter	Prof.dr. I. Oshri

Preface

Kurt Lewin surmises that "there is nothing so practical as a good theory" (Lewin, 1951: 169), and developing useful theories was my main motivation throughout this PhD project. I focused on an area which excited me and in which I had experience information and communication technologies (ICT), and in particular cloud computing technology that is known to be a driver of major transformations in organizations and society. This context served as a fertile ground in which to study the evolution and challenges in the industry and to attempt to contribute to the theoretical debates through a case that illustrates dramatic technological change. All four studies in this dissertation are rooted in a process of iteration between theoretical and practical domains.

My experience at Rotterdam School of Management was very rich. First of all, I would like to express my gratitude to my supervisory team. I believe that in any career an ideal supervisor is one who generates opportunities for growth and learning. Working with Henk was full of such opportunities. I was privileged to work with such a prominent management scholar who was a great source of inspiration and insight throughout my PhD project. I am also grateful to Ilan who helped to sharpen my research ideas and point them in better directions. Second, I would like to thank the department staff, our great administrative team, the extremely supportive ERIM management and doctoral office, and all my fellow PhD students for their support and kindness during the past four years. In particular, I would like to thank Jochem who helped me when I needed it most. Also I would like to thank Andreas, a good friend with whom I share a lot of good memories and looking forward to having more in future. Kevin helped me during the empirical data collection and most recently in writing the Dutch abstract for this thesis.

This project was undertaken in collaboration with a number of industry partners such as Ericsson, Intel, and several Dutch companies. Ericsson, in particular, was always like a second home to me. I was honored to work with a wonderful team in the *Ericsson Research* organization who not only helped me access the empirical data, but also contributed by sharing their ideas and perspectives with me. I am especially grateful to Manfred Dasselaar who was always a source of novel and interesting ideas, which were sometimes ahead of the academic debates. I would also like to thank Daniel Catrein, who first introduced me to the world of cloud computing and was a constant source of support at different stages of the project.

This PhD project was part of a European Commission Marie Curie project called Managing Emerging Technologies for Economic Impact (MANETEI). I would like to acknowledge the efforts of prof.dr. Krsto Pandza, the project leader, who facilitated numerous interactions with academic and industry players and provided various learning and networking opportunities for the team. And many thanks also to my fellow MANETEI researchers and academic staff: I will always remember our rich and enjoyable research gatherings. My special appreciation goes to Davy van Doren with whom I am working on several exciting research projects and also helped me in parts of the dissertation.

Finally, I need to thank my family. My father was a researcher and my mother was a teacher. I believe that their careers were very important in triggering my own enthusiasm for an academic career. But the person for whom I reserve my deepest and most heartfelt thanks is my wife Saeedeh. She was there when I wrote my applications for PhD position, and she is here now, as I write these last words, her support never once faltering along the way. Her incomparable judgment and her unbounded confidence in me mean the world to me. My life would be much poorer for the absence of Saeedeh and her love - and for this dissertation, it wouldn't exist.

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Organizations are not equally successful in dealing with the discontinuity and change triggered by exogenous factors such as the emergence of a new technology. Accounts of firms that fail to survive technological change, despite their superior technical capabilities and knowledge, highlight the importance of a range of non-technical inter-organizational, intra-organizational, and managerial factors that influence adaptability (see Lewin, Massni, & Peeters, 2011; Teece, 2007; Volberda, Foss, & Lyles, 2010). In studying non-technical factors, organizational theory has focused mainly on contingent fit which considers the match between discrete organizational settings and environmental conditions (Nickerson & Zenger, 2002) in a very static way (Raisch, Birkinshaw, Probst, & Tushman, 2009; Volberda, Foss, & Lyles, 2010). However, in order to cope with contradictory and rapidly changing environmental conditions, there is a need for creative and dynamic problem-solving approaches that go beyond selecting off-the-shelf "fit" solutions (Ansari, Reinecke, & Spaan, 2014). Nevertheless, there have been relatively few studies that investigate how organizations can make creative adaptations of this kind. (Crossan & Apaydin, 2010; Volberda, Van Den Bosch, Mihalache, 2014). Moreover, introducing creative and novelty-oriented adaptations in the organization is dependent on the cognition and initiatives of individual managers (Pentland, Feldman, Becker & Liu, 2012; Helfat & Peteraf, 2014). However, prior studies have often not included individual-level capabilities alongside organizational antecedents of adaptability and renewal (Gavetti, 2005: Eggers & Kaplan, 2009). This project seeks address this gap by focusing on the context of emerging technologies.

Achieving that objective means that we need to depart from existing static views on the enablers of strategic renewal and adopt a more dynamic perspective that considers creative and active problem-solving initiatives undertaken by managers in response to technological discontinuity. Such problem-solving activities can be studied through theoretical constructs such as *management innovation* – the

introduction of novel processes, practices, and structures (Birkinshaw, Hamel, & Mol, 2008) – or *business model innovation* (Zott & Amit, 2008), defined as the wholesale renewal of an organization's means of creating and capturing key value. Both of these concepts will be central to this research project. This study looks at the nature as well as antecedents, processes, and outcomes of such novel adaptations in the organization. By focusing on the central role of managerial cognition, interpretation and attention in enabling or conditioning organizational response to change (Helfat & Peteraf, 2014), we seek to advance the understanding on the enablers of effective adaptation.

In the sections that follow, we provide an introduction to the context of emerging technologies and discuss the characteristics of such technologies. Throughout the dissertation, these properties will be examined in relation to the competitiveness and survival of established organizations that are attempting to adopt these technologies. The dynamic capabilities perspective, which is the central theoretical lens used in this dissertation, will be briefly discussed. We will conclude the chapter by presenting our research aim, methodology, and an outline of the four studies in this project.

1.1 Emerging technologies: definition, characteristics, and implications for organizations

Emerging technologies are leading-edge technologies that are recent or new to an entire industry (Ahuja & Lampert, 2001) and that have the potential to alter usage patterns in the market, create a new industry or transform existing ones (Day & Schoemaker, 2000), In extreme cases, emerging technologies can redefine business and social environments (Porter et al., 2002). Emerging technologies have some distinctive characteristics; rather being developed by individual players, they are typically developed through a network of interacting companies and individuals (Hamilton, 1985; van der Valk et al., 2010). Another important feature of emerging technologies is the existence of competing technological trajectories. Furthermore, such technologies require remarkable and sustained investment before they payoff (Soares 1997). When a new technology emerges, industry

will enter a phase ferment, which is characterized, by new entrants and new business models, and it may take years before the industry landscape becomes stable. Therefore, at the initial stages of development new technologies are typically risky investments (Day & Schoemaker, 2000).

All of these factors and characteristics coalesce to make a highly complex and uncertain environment for organizations searching for ways to respond to new technologies. Milliken (1987) defines uncertainty as the "perceived inability to predict something accurately" and discusses "environmental uncertainty" as the situations where the source of uncertainty is the firm's external environment. He defines three categories for environmental uncertainty: environmental state uncertainty, organizational effect uncertainty, and decision response uncertainty. In the earlier phases of technology change, the nature and the timing of changes, the implications of such changes for organizations, and the optimal ways of responding are highly uncertain. Such uncertainties have implications for the organizational capabilities required to survive and to maintain competitiveness. Dealing with uncertainties requires more responsiveness, risk-taking, innovative strategies, and more sophisticated organizational resources and capabilities (Aragón-Correa & Sharma, 2003). Emerging technologies also have important implications for individual managers by involving them in dealing with the complexity caused by proliferation and diversity of factors and challenges in the environment (Miller & Friesen, 1983; Tan & Litschert, 1994). This in turn escalates the perceived difficulty of making detailed changes (Smart & Vertinsky, 1984) and intensifies the challenge of identifying key strategic success factors (Amit & Schoemaker, 1993). In this research, the dynamic capability perspective will be discussed and utilized as the key theoretical angle for studying the implications of emerging technologies at managerial and organizational levels.

1.2 Dynamic capabilities for managing emerging technologies

The concept of dynamic capabilities deals with 'the capacity of an organization to purposefully create, extend or modify its resource base' (Helfat et al., 2007, p. 1). It concerns the organizational factors

that underlie an organization's ability to sense emerging technologies, to seize the related opportunities, and to align itself in the face of changes in the business environment (Teece, 2007), including those relating to the emergence of a new technology. Management scholars have discussed dynamic capabilities in detail and explored the processes through which organizations develop specific ways of 'selecting and linking' resources in response to environmental changes (e.g., Camuffo & Volpato 1996; Eisenhardt & Martin, 2000; Rindhova & Kotha, 2001; Zolo & Winter, 2002; Kale & Singh, 2007; Lichtenthaler; 2009). Despite the value of this body of research, dynamic capabilities are still puzzling to researchers and there is no clear consensus on their nature, antecedents, and consequences (Eisenhardt & Martin, 2000; Teece, 2010; Schreyogg and Sydow, 2011). This dissertation attempts to take forward this discussion by focusing on the particular context of emerging technologies and exploring the nature of dynamic capabilities, their mechanisms of influence, and outcomes in relation to the context of emerging technologies.

1.3   Research Aim

The overall aim of this research is to increase our understanding of dynamic capabilities and their antecedents and consequences. The dissertation seeks to provide a dynamic perspective that considers significance of time and feedback loops in the processes of technology adoption. To do this, investigating the interrelationships between managerial and intra-organizational antecedents will be central to this thesis. A spectrum of managerial initiatives ranging from introduction of novel organizational systems, structures, processes, and practices to more overarching alteration of key value creation systems of the organizations is being investigated in relationship with successful response to technological change. In this way, the project makes a clear attempt to identify the source of such capabilities in terms of the individual and combined effects of three groups of organizational capabilities, namely structures, routines, and managerial cognition. As noted by Gavetti (2005), joint consideration of the triplet of structure, routine, and cognition is a crucial but overlooked requirement

when studying the micro-foundations of capabilities. Although the idea that routines, cognition, and hierarchy should be given joint consideration lies at the roots of the Carnegie school (Simon, 1976; March and Simon, 1958; March and Olsen, 1976), with a few exceptions (for example, Eggers and Kaplan, 2009) existing research provides very little discussion of the joint effects of these three factors. Therefore, our research aim can be formulated as:

Research Aim:

- To increase understanding of the effects of management innovation and business model innovation as enablers of successful adoption of emerging technologies.
- To investigate the combined influence of organizational structures, processes, and managerial cognition on the successful adoption of emerging technologies.

As such, this dissertation seeks to make a number of contributions. First, we contribute to the literature on dynamic capabilities by examining management innovation and business model innovation as two capabilities that underlie effective responses to the emergence of a new technology. This research thus provides empirical evidence that clarifies and increases our understanding of the nature, processes, and sources of dynamic capabilities (See Schreyogg and Sydow, 2009). Second, by giving concurrent consideration to cognition, routines, and structures the project seeks to contribute to discussions on the micro-foundations of capabilities. The aim is to provide a better understanding of the interrelationships between individual-level and organizational-level antecedents of capabilities. Finally, by combining qualitative and quantitative studies, we make a contribution to the emerging literature on management innovation as well as business model innovation. This mixed method approach helps us to shed more light on the processes, sources, and outcomes of the key variables of interest. More details on the contributions will be provided in the discussion of the individual papers within the dissertation.

1.4 Methodologies

This dissertation seeks to explore non-technical capabilities that enable the successful adoption of emerging technologies, and to investigate the sources of such capabilities in terms of structures, routines, and managerial cognition. The first objective requires us to look closely at how organizations respond to the emergence of a new technology, and for this we use a longitudinal qualitative case study. We combine the insights from the case with theoretical discussions to develop a number of hypotheses, which we then test using quantitative techniques. In order to deepen the findings and to ensure richness of detail and hypotheses testing, both qualitative and quantitative methods will be used. The qualitative data serve as the basis for theory development and also helps to increase the clarity of the quantitative analysis by clarifying some of the complicated relationships.

1.5 Outline of the Dissertation

The research aims of this dissertation will be addressed through four interrelated studies. The first two studies use qualitative data from an extensive four-year field study. In the first study, we consider the adoption of technology as an organizational learning process (Attewel, 1992; Woiceshyn, 2000) and discuss how adaptations and changes in organizational systems, structures, processes, and practices (management innovation) enhance organizational learning and thereby improve the firm's capacity to deal with exogenous technological innovations. The second study considers the longer-term and more extensive influence of a new core technology (Taylor & Helfat, 2009) on an organization's business model. In this study, we discuss the contradictory and conflicting needs that have to be reconciled when organization are continuing existing businesses and also making a transition to a radically new business model and we investigate the relationships between strategy, structure, and business model. In the final two studies we combine data from a multiple case setting with survey data on a carefully selected population. Our third study seeks to explore the micro-foundations of dynamic capabilities by focusing on the role of senior managers. We identify a link between customer orientation and

breakthrough innovations through investigating the effect of involving the key customers in the innovation processes on managerial attention and initiatives that nurture exploration in an emerging technology field. Our fourth and final study considers the combined effects of structures, routines, and managerial capabilities in in enabling the firm to sense and seize new technological opportunities at the right point in time. Table 1-1 provides a summary of the studies which we will elaborate on further in the upcoming chapters. Figure 1-1 shows the research framework and how the four studies are interrelated.

Table 1-1- Overview of Study I-IV

	Study I	Study II	Study III	Study IV
Data source	3 Years of field study, Interviews, Company data	4 Years of field study, Interviews, Company data	Survey among 131 Dutch companies and 40 interviews	Survey among 131 Dutch companies and 40 interviews
Year	2010-2012	2010-2013	2011-2012	2011-2012
Unit of analysis	Single case study	Single case study	Questionnaire based survey Interviews	Questionnaire based survey Interviews
Dependent variable(s)	Adoption of emerging technologies	Business model renewal	Exploratory innovation	Sensing and seizing of emerging technologies
Independent variables	Management innovation	Structural alteration	Customer co-creation	Managerial attention
Moderating variables	-	-	-	Centralization Formalization
Mediators	Experimental processes and routines Incentives for exploration Structural fit	Strategic intent	Managerial attention Management Innovation	-
Method	Semi-grounded theory	Semi-grounded theory	Hierarchical Regression Structural equation modeling Multiple case study	Logistic regression Multiple case study

Studies III and IV

Managerial attention

Organizational antecedents
- Routines
- Structure

Organizational adaptation
-Management Innovation
-Business model innovation

Performance outcomes
- Sensing and seizing
- Balance between exploration and exploitation

New routines and capabilities
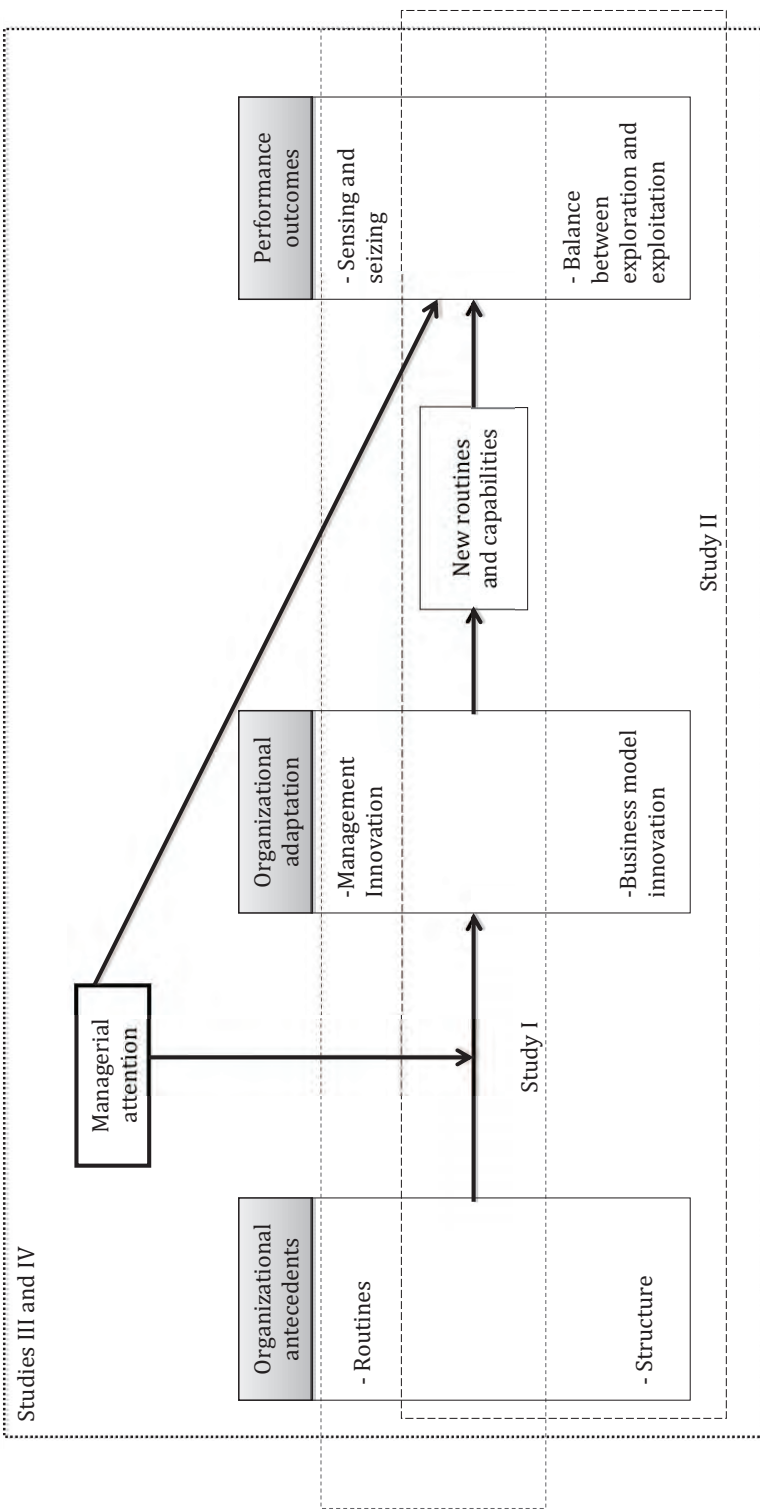
Study I

Study II

Figure 1-1- Research Framework: Positioning Studies I-IV

2 Study I: Management innovation and adoption of emerging technologies -The case of Cloud computing[1]

Abstract

This article examines the effect of management innovation on a firm's ability to effectively adopt an emerging core technology. Organizing for technological change is often associated with structural dilemmas for incumbents: while structural contingent solutions such as spatially separated units and parallel organizations have been frequently discussed as enablers of handling contradictory requirements of existing and emerging technologies, there is empirical evidence that such solutions are likely to be either unfeasible or unsustainable in the cases of core technologies. Our analysis on the adoption process of a new core technology by a large telecommunication firm reveals the role of management innovation in fulfilling seemingly paradoxical structural requirements of knowledge accumulation in a dynamic knowledge environment. We discuss how a novel structural approach enabled the organization to overcome rigidities in the existing routines and foster a favorable environment for adoption of cloud technology and to overcome organizational challenges, with which the firm's conventional practices failed to commensurate.

2.1 Introduction

As unrelenting technological change and globalization spawn new threats and opportunities, there is growing scholarly and managerial interest in the notion of management innovation, that is, the conception and implementation of novel management ideas which could potentially contribute to the strengthening of a firm's competitive position (Birkinshaw et al., 2008; Vaccaro et al., 2012). Birkinshaw and colleagues (2008) define management innovation in their seminal paper as a concept that relates to the introduction of new management practices, processes, or structures intended to further organizational goals. This paper contributes to this emerging scholarly discourse by exploring the role of management innovation in aligning a firm with the contradictory requirements of a changing technological environment in which predictable and routinized managerial responses become less effective. In particular, we look into the effect of management innovation on the relatively under-researched adoption process of emerging core technologies where, despite their severe consequences on the incumbents' survival, associated organizational challenges (see Taylor & Helfat, 2009) are not fully explored and understood.

When an alternative core technology emerges, it may take several years until the time that it completely replaces the old one and becomes the industry standard (Anderson & Tushman, 1990). The concurrency of the two technologies has important organizational implications in established firms. In particular, in the absence of profitability expectations in the short term, experimentation and knowledge accumulation becomes central to the exploratory activities on the emerging technology (Christensen et al., 1998). The co-existence of emerging and existing core technologies obliges alignment with both stable (existing) and turbulent (emerging) knowledge environments. Considering the contradictory structural implications of stability and turbulence (Van Den Bosch et al., 1999), structural differentiation of the two technologies seems to be effective in coping with this requirement (Gilbert, 2005; Tushman & O'Reilly, 1996). However, resource constraints and the need for the preservation of existing complementary assets often mandate close structural integration or close links

between existing and emerging core technologies (O'Reilly & Tushman, 2008; Taylor & Helfat, 2009) and makes for a paradoxical situation for the selection of the appropriate structural form. This study examines the role of management innovation in handling such tensions between emerging and established technologies and in ensuring sufficient amount of learning in the emerging field while maintaining the ongoing businesses of the organization intact.

Although a lot of studies, anchored in evolutionary (Nelson & Winter, 1982), behavioral (Levinthal & March, 1993), and technology-based (Tushman & Anderson, 1986) arguments, have inquired into factors that affect incumbents' abilities to respond effectively to new technologies, the link between management innovation and the incumbents' success in the adoption of an emerging technology has been the subject of less frequent inquiry. Even so, past studies do suggest that organizational and administrative routines and, hence an innovative change in them, might have a bearing for the adoption of emerging technologies and vice versa. For example, Benner and Tushman's (2003) analysis of routinization associated with total quality management practices indicates that these might hamper a firm's engagement with novel technologies (see also Benner & Tushman, 2002). Schroeder and his colleagues (2000) have discussed the positive impact of organizational adaptations, such as the introduction of new organizational responsibilities, teams, and control systems, on the firms' ability to adopt a new technology. Fleming (2002) relates HP's success with inkjet technology to a number of novel managerial initiatives that helped the organization to deal with the increased risk of failure during the exploration of the new technology. Overall, prior work hence points to a possible relationship between changes in the organization and the potential to successfully embrace new technologies. Importantly though, because factors such as managerial attention and identification, internal competition and group dynamics might impede alteration in routines (cf. Taylor, 2010; Tripsas, 2009), the re-orientation of a firm towards a new technology through the introduction of management innovations is unlikely to be straightforward process.

This paper examines the link between management innovation and technology adoption within the specific context of an emerging core technology, cloud computing. With reference to the information technology (IT) sector, cloud computing circumscribes a variety of evolving interconnected technologies that center on delivering computing services (i.e., data storage, computation and networking) to users in the quantities needed at a particular time and location (Kushida, Murray, & Zysman, 2011). The potential implications of cloud computing for both customers and providers of information technology hardware and software are enormous (Martson et al., 2011). Virtually all sets of actors in the IT sector including providers of access devices, providers of infrastructure, application and content services and providers of network connectivity are affected by the unfolding cloud computing paradigm. As different IT-sector incumbents re-orient themselves to take advantage of opportunities afforded by cloud computing, telecom infrastructure vendors must also re-orient themselves to align with the changing ecosystem and be prepared to adopt the cloud-based delivery model and its underlying technologies. Against this general backdrop, the present paper reports an inductive case study of a leading European telecom firm, Telco (pseudonym), to develop a richer understanding of the micro-dynamics of learning and absorptive capacity that link management innovations to the technology adoption and integration with the firm's existing knowledge base and technology repertoire.

The paper is structured as follows. In the next section we present a review of the literature to which the existing study relates. After discussions on the research context and methodology, we present the findings obtained from the empirical analysis of Telco's adoption process during the period of 2008–2012. We conclude the paper by presenting discussion, conclusion, and possibilities for further research.

2.2 Management innovation and technology adoption

Management innovation (MI) is a relatively new term in the management literature, but the concept has been discussed for decades through somewhat interchangeable terms such as "organizational", "managerial" or "administrative" innovation (see Damanpour & Aravind (2012) for a discussion on the distinctions and the ideas behind each of these terms). Following the definition provided by Birkinshaw et al. (2008) and in line with Vaccaro and his colleagues' (2012) clarification, we broadly define management innovation as the introduction of "new to the firm" structures, processes, and practices. The factor of novelty sets a distinction between change and management innovation. For example, as Vaccaro et al. (2012) have exemplified, downsizing is a type of organizational change that cannot be considered management innovation, because it is a predictable managerial response in certain circumstances. In other words, a change is a management innovation only if it modifies the "regular and predictable behavior patterns" of the firm or "organizational routines" (Nelson & Winter, 1982: 14) that give gestalt to the prevalent organizational structures, processes, and practices (see Edquist et al., 2001).

In their seminal work, Damanpour and Evan (1984) have discussed the relationship between administrative innovations and technological innovations and have elaborated the ways through which technological change mandates organizations to adapt their structures and practices in order to maintain the balance between social and technical systems. Arguing that technical systems are "generated and controlled by social system[s]" (Damanpour & Evan, 1984: 397), the authors provided empirical evidence for the effects of administrative innovations on triggering the adoption of technological innovations. In the same line of thought, Birkinshaw and his colleagues (2008) have exemplified introduction of novel structures as a specific type of management innovation that large companies utilize in order to deal with complex situations (Chandler, 1962; Damanpour & Aravind, 2012), and in particular, to increase their ability for technological innovation (Fleming, 2002; Hargadon, 2003; Sanidas, 2004). Despite the unique insights that these studies offer on the

relationship between management innovation and technology adoption, the scholarly research is yet to inquire why management innovations enable technology adoption and how (Lam, 2005). Given the prevalence of incumbents' failure in the transition to new core technologies (Gilbert, 2005; Taylor & Helfat, 2009), it is valuable to further explore the role of management innovation as a potential enabler for overcoming associated managerial challenges in established organizations.

Management innovations, according to the definition, are sought to provide novel solutions for unprecedented managerial problems (Birkinshaw et al., 2008). The adoption process of an emerging core technology is replete with such problems, in part due to the tensions between 'stable and familiar' and 'dynamic and uncertain' knowledge environments. A tendency to support ongoing businesses may result in persisting alignment only with the existing technologies and consequently deprive the organization of a favorable environment for experimentation and knowledge accumulation in the new field. The consequences can be serious because, as prior research indicates, experimentation is the primary way through which organizations engage with an emerging technology in the earlier phases of the technology lifecycle in the absence of short-term financial incentives (Thomke, 1998; Day & Schoemaker, 2000; Thomke, 2003; Edmondson et al., 2001; Fleming, 2002; Lavie, 2006; Taylor, 2010; Crossan & Apaydin, 2010). Before discussing the incumbents' possible responses to this challenge, it is worthwhile taking a closer look at why and how focus on the existing technologies negatively influences experimentation and knowledge accumulation in the emerging context.

Table 2-1 presents some organizational antecedents that cast difficulties on the embrace of technological change. These factors are linked to prior research on technology adoption as an organizational learning process which emphasizes the need for having sufficient amounts of resources, motivation, and capability for any successful technology adoption to happen (See Woiceshyn, 2000 for a detailed discussion). Some of the other research works that have looked into the effects of these

factors on the adopting organization are listed in Table 1 and will be reviewed in the following paragraphs.

First, existing learning routines tend to be efficiency oriented and focused on the key strengths of the organization which are not necessarily valid in the emerging context. The issue of inertia in the existing organizational routines is a common theme in many studies around technological change (Hannan & McDowen, 1984; Henderson & Clark, 1990; Tushman & O'Reilly, 1996; Tripsas & Gavetti, 2000; Gilbert, 2005). Excessive attachment to the existing core competencies makes the learning and development of fundamentally new capabilities extremely difficult for established organizations. Because of the codification of technological knowledge into the organizational routines, a firm's behavior becomes constrained and guided by the learning around the local processes of search. Despite their helpfulness for evolutionary change and incremental innovations, such learning processes are, however, not effective for the development of radically new technological capabilities that a new core technology mandates (Tripsas & Gavetti, 2000; Taylor, 2010). In particular, existing efficiency-oriented routines and capabilities often do not accommodate experimentation (Eisenhardt & Tabrizi, 1995; Day & Schoemaker, 2000; Eisenhardt & Martin, 2000). While existing routines need to be preserved and strengthened until the time that the new technology rises, the very different logic of experimental routines cannot be achieved when efficiency is the main concern of the organization.

A second source of managerial challenges is related to a general unwillingness to allocate the required level of financial and attention-based resources of the firm to an alternative core technology. Gilbert (2005) puts forward two reasons for the rigidity in the financial resources of established firms in the face of technological change. First, financial dependence on the existing technologies, which are vital arteries of the organization, engenders a general hesitation in extensive resource allocation to the activities that do not contribute to the revenues. Second, a strong market position in the existing technological context makes firms cautious in investing in and, therefore, promoting an alternative

technology in which they will not necessarily be able to preserve the same position. Taylor and Helfat (2009) discuss yet another source of difficulties that is rooted in the organizational dispersion of essential resources and complementary assets for experimentation in the new technological field. This dispersion results in a considerable amount of challenges in the communication and coordination of activities in the new technological context. Hence, resource allocation mechanisms (Christensen & Bower, 1996) become a major issue in the way of allocating the required resources for learning and experimentation and result in a situation in which the incumbents' attempts to explore the emerging technology may remain to a large extent under resourced.

Table 2-1 Incumbent's organizational challenges in the face of emerging core technologies

Organizational challenge	Characteristic	Impact	Representing Sources
Learning routines	- Local processes of learning	- Inability to develop new capabilities and routines	Tripsas & Gavetti (2000); Taylor(2010)
Resource allocation mechanisms	- Resource dependence on existing technologies - Threat of cannibalization of existing technology - Organizational dispersion and intensity of resource requirements	- Unwillingness to assign resources - Difficulties in coordination and communication	Gilbert (2005) ; Taylor & Helfat(2009); Christensen & Bower(1996)
Incentive systems	- Reward financial pay-back and shareholder value creation	- Limited motivation for experimentation and learning	Woiceshyn(2000); Kaplan & Henderson(2005); Day & Schoemaker(2000)

A third managerial issue that confines the ability of established firms in learning in an emerging technological field concerns incentive systems that, even in the presence of the required learning capabilities and resources, may seriously reduce the motivation of the organizations' members to engage with the learning activities (Woiceshyn, 2000). The nature of technological

change mandates a different type of incentive structure which, instead of contributing to the revenues, enables experimentation and learning. However, it is very difficult for established firms to depart from revenue-oriented incentive structures (Kaplan & Henderson, 2005). The problem stems from the fact that activities on emerging technology are unlikely to fulfill the criteria for payback or shareholder value creation (Day & Schoemaker, 2000). In the absence of accountability and reward systems that measure the experimentations that are not necessarily paying off in the short term, employees tend to prefer remaining within the traditional technological fields of the organization. However, dominance of the efficiency driven performance measures in established organizations casts a lot of challenges on the efforts to design and implement experimentation oriented incentives (Kaplan & Henderson, 2005).

2.3 Technological change, knowledge accumulation, and management innovation

Beyond simply arguing that management innovations can generate solutions that enable organizations to overcome the discussed organizational challenges, it is important to understand why, despite availability of contingent managerial solutions, there might be a need for innovative management initiatives. Existing scholarly research (e.g. Cooper & Clayton, 1992; Tushman & O'Reilly, 1996; Gibson & Birkinshaw, 2004; Gilbert, 2005; Raisch & Birkinshaw, 2008) recommends structural differentiation of new technologies (for example through cross-functional teams or parallel organizations) as the effective response to the prevailing organizational challenges that are caused by divergent requirements of the two technologies. Such provisions are known to be accommodating for development of a new knowledge base that, according to the research findings (See Christensen et al., 1998), is essential for the firms' competitiveness in the forthcoming stages of the technological lifecycle. Nevertheless, development of such knowledge base without close links to the existing knowledge repositories of the firm tends to cause important issues, especially in relation with the firm's future ability to absorb and utilize knowledge, or its absorptive capacity (Cohen & Levinthal, 1990). This is because of the fact that competitiveness of an established organization entails maximal

preservation of expertise and know-how that may remain valuable in the face of technological change (Taylor & Helfat, 2009) and therefore, precise evaluation of the impacts of emerging technology on existing complementary assets becomes essential. An upshot is the requirement for pervasive involvement in the process of experimentation and learning by organization members who influence the complimentary assets. This requirement is arguably better fulfilled through structural integration of the technology adoption initiative. However, as we discussed in the previous section, structural colocation of emerging and existing technologies engenders a large amount of organizational challenges.

From the above discussion, one may infer that neither structural integration nor separation of the emerging core technology is necessarily the ultimate solution for overcoming the organizational challenges of adopting a new core technology. Nonetheless, despite the mentioned deficiencies, each of the generic structural solutions (and their variations) offers distinct advantages for the process of knowledge accumulation and adoption of the new technology. Hence, in order to maximize the benefits from structural choices, organizations may opt to alternate between the two modes and their combination in a cyclical manner (See Siggelkow & Levinthal, 2003; Gulati & Puranam, 2009; Boumgarden et al., 2012). The selection logic for the structure would then follow the specific goal that the organization is pursuing at each time period. Since the degree of uncertainty has an influence on the appropriateness of alternative organizational forms for learning and generation of new absorptive capacity (Van Den Bosch et al., 1999; Lane et al., 2006; Lewin et al., 2011), a possible scenario is to start by reducing the uncertainty through a structurally differentiated approach that is, according to research findings (e.g., Gibson & Birkinshaw, 2004; Gupta, Smith, & Shalley, 2006), more appropriate for scanning the uncertain environment. Subsequently, in order to relate the acquired knowledge to the firm's context, an integrative structure may prove to be more helpful. The outcome of each cycle contributes to the generation of the required knowledge base in the emerging field and guides the nature of exploratory activities and the structural mode in the next period of time.

Obviously, the above-mentioned scenario is only a possible way through which firms may respond to the related organizational difficulties. Overcoming the paradoxical demands of the two technologies, as well as managing competing goals of revitalization and preservation of existing capabilities, necessitates avoiding constraints that are posed by contingent managerial contingencies. Hence, analyzing the obstructs and requirements at each point of time and designing an effective and efficient structure for technology adoption becomes a managerial problem-solving task that is succinctly captured by the notion of management innovation. Our empirical analysis on the adoption process of cloud computing technology in Telco's organization is intended to shed more light on the relationships between management innovation and the incumbent's response to an emerging core technology.

2.4   Research context

We discuss the transition of a telecommunication infrastructure manufacturer towards currently emerging cloud-computing technologies to explore the incumbent's response to managerial paradoxes caused by disruption in core technologies. Cloud computing and related concepts are based on "*service logic*" that is clearly distant from the comfort zone of Telco and other telecom players who are basically *manufacturers* of complex telecommunication equipment. In comparison with the existing telecommunication technologies, cloud-based technologies are known to be superior in terms of efficiency, flexibility, and sustainability and therefore the transition seems to be inevitable. For the purpose of this research, such a drastic shift in the architecture and underlying logic of the core technologies provides an optimum opportunity to explore the associated challenges and responses of the established organization in more detail. In order to increase the richness of data, we particularly focus on the initial phases of technology emergence, the period between 2008 and 2012, when high levels of uncertainties associated with the nature, timing, and scope of impacts echoed the organizational challenges of Telco and its competitors.

Cloud computing represents a fundamentally different way in invention, development, deployment, scaling, updating, paying for information and communication services (Marston et al., 2011). The United States' national institute of standards and technology (NIST) defined cloud computing as *"a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."* (Mell & Grance, 2011) While cloud computing has different implications in different parts of the ICT value network, it disrupts the technological subsystems and complementary assets in the telecommunication infrastructure in several ways. In Table 2-1, we provide a summary of these disruptions according to the definition of cloud computing, in contrast with the common wisdom on the characteristics of the existing technologies and complementary assets in the telecommunication infrastructure sector. Despite the fact that the threat of the deterioration of core competencies of Telco and its competitors sounded alarming, the technology was not sufficiently matured to justify extensive commercial use in this sector of the industry and, as of 2012, still both the architecture of the technology as well as the timing and scope of the impacts on the markets were to a high extent uncertain. We cover the early lifecycle of the technology between 2008 and 2012 (Figure 2-1) and investigate the organizational challenges of the adoption and managerial responses in the context of Telco.
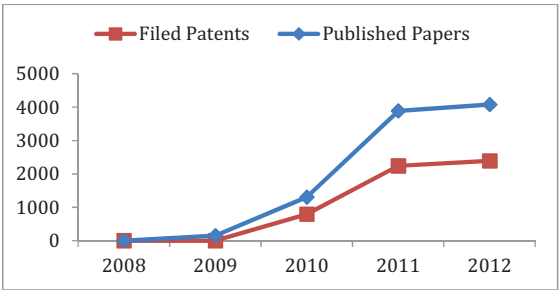
Figure 2-1- Rise of Cloud computing according to the number of published papers and filed patents on this technology - retrieved from Inspec engineering data base (published papers) and Google patent search (filed patents)

2.5 Data and methods

With the aim of providing a better understanding on the relationship between management innovation and technology adoption, we used an inductive, longitudinal, field base case study that is appropriate for grounded theory building (Eisenhardt 1989, Glaser & Strauss, 1967). This methodology was particularly suitable for the purpose of our study, because it enabled us to closely investigate different stages of the less explored processes of management innovation in connection with technology adoption. In line with the insights provided by Suddaby (2006) and further elaborations by Volkoff, Strong and Elmes (2007), we started our case study without defining any theoretical concepts or assumptions, but after each round of data collection and analysis we repeatedly returned to the literature in order to relate the findings to existing theories. Focus on a single case study limits the generalizability of the findings, but at the same time it provides an opportunity for deepening our understanding on the enablers, process, and consequences of management innovation in Telco's organization. The firm was chosen with consideration of the substantial organizational challenges that the managers were experiencing in the adoption process of cloud computing technology. Case selection was, therefore, in line with the expectation for increased transparency in observation of theoretical issues through "extreme cases" (Eisenhardt 1989).

In order to improve the validity and avoid common disadvantages of retrospective data, we utilized a few strategies. First, we triangulated the data by the inclusion of three sources: interviews, document research, and observations during different stages of the technology adoption process (Eisenhardt, 1989; Yin, 1984). Second, we verified each individual story through asking similar questions to the other respondents (Cardinal, Sitkin, & Long, 2004). Third, we collected data before and after each major milestone in the adoption process and this enabled us to avoid much of the respondents' bias by comparing the answers at each stage.

Table 2-2 Disruptive effects of cloud computing on existing telecommunication technologies according to NIST (Mell & Grance, 2011) definitions

	Essential characteristics of cloud computing (Mell & Grance, 2011)	Existing telecommunication technologies and complementary assets
1	*"On-demand self-service - [Customer] can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider."*	Customers usually buy off-the-shelf products and services that are developed, marketed, sold, and implemented by the vendor
2	*"Broad network access - Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms"*	Functionalities are embedded in the products that are purchased by the customers
3	*"Resource pooling - The provider's computing resources are pooled to serve multiple [customers] using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand"*	Resources are distributed and sold to each individual customer
4	*"Rapid elasticity - Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand"*	Capabilities are often being sold to the customers for the whole lifecycle of the product and even if the customers do not intend to use them, they need to pay for them
5	Selling offering as service – Service provider sells access to the pool of resources without selling any physical products	Physical products are the main unit of sales and revenue streams for the vendor

The inevitable issue with the generalizability of single case studies persists but is less influential in this study. Firstly, focus on a single case was necessary and more helpful compared to the other options in the exploration of the complex adoption process over a long period of time. Secondly, a main contribution of this study that is providing more details on the co-existence and co-evolution of management and technological innovations in established firms is viable through a case study.

Four sources of data were used in this research: (1) semi-structured interviews, during the period between 2010–2012, (2) focus group sessions with key stakeholders, (3) field study and

observation by one of the researchers in the period of September 2010 to September 2012, (4) searching internal and external archival data for the period of 2007–2011, including intelligence reports, knowledge-sharing tools, minutes of meetings, and scientific databases. Therefore, a combination of external and internal perspectives toward Telco's experience with cloud computing was utilized in order to ensure the validity and reliability of the research.

Interviews, focus groups, and observation - Data collection started in September 2010 with a focus on the adoption process of cloud computing technology in Telco. The research team had access to the company premises and secured the opportunity to participate in related meetings and be involved in correspondences in this period. The majority of the interviews took place in Telco's headquarter premises. A total number of 33 interviews and five focus group sessions took place in this phase, mostly in person, except for eight interviews which took place over the phone. We selected interviewees to cover different levels of managers as well as different units that were participating in the cloud computing initiative. The duration of the interviews ranged from 45 to 90 minutes. Transcripts of the interviews were communicated with the interviewees via email and any following comments and modifications were applied (see 2-3 for a list of interviewees). The format for the focus groups was designed in a way to gather together people with knowledge about the same topic and present the intermediary data analysis to them in order to receive feedback and comments. This approach was helpful in validating and complementing our understanding on the inputs from individual interviews. In addition to these sources, observation of the discussions in the internal meetings and numerous informal talks with the people who were dealing with the issue of technology adoption provided important inputs for the purpose of this case study research.

Archival records - During the whole period of data collection, researchers systematically reviewed relevant internal intelligence records and internal reports and documentations. Furthermore, a large collection of external intelligence and analysis reports through which it was possible to analyze internal and external events from the onset of the emergence of cloud computing to its adoption at

Telco was included in the analysis. These sources of data were complemented by engineering and academic databases which were more likely to be unbiased in providing insights for the involvement of different players that were involved in the development of cloud computing. External intelligence reports included Yankee report series, ABI research, Informa, Ovium, Inscope, and more, all searchable through Telco's business intelligence intranet. Engineering and academic databases included Inspec, Compendex, and Scopus.

Table 2-3 Overview of interview participants in Telco

Role	No. of interviews
Senior VP strategy	1
VP strategy and business development	1
Director of Telco's cloud program (from 2009 to mid-2011)	1
Director of Telco's cloud program since mid-2011	1
Product managers	6
Product management staff	18
R&D staff	11
Technology intelligence experts	7

2.6   Data analysis

As we discussed earlier, grounded theory approach necessitates iteration between data gathering and analysis. We transcribed all the interviews and subsequent focus groups and assigned one (or several) code(s) that we perceived to be relevant to each paragraph. The codes were selected in a way that reflects and summarizes the passage in the best possible way. Then we grouped the codes that were similar to one another and attempted to relate them to one another. Intermediate findings were used in the focus groups and also informal discussions to see the possibilities for improvement. At each intermediary stage, we also referred to the literature in order to find the substantive theories that better pertain to the concepts that our data reveals.

With the aim of studying the adoption process of cloud computing in Telco, we started the analysis of initial interviews with an illustration of key internal and external events in the time period between 2008 and 2012 and identified major milestones. Figure 2-2 provides a timeline of the key

events in the external environment and in Telco's organization that will be explained further in the forthcoming sections. Very early in the data collection process, it became apparent that the organization experienced a lot of difficulty in progressing with making sense of the technological change and sending clear messages to the market that was expected and demanded by the major customers in the later stages of the time span. The sense of frustration that was repeatedly expressed by the key stakeholders of the cloud computing initiative guided the data collection towards the investigation of the sources of difficulties in the technology adoption at each period of time. As one of the opening questions in the interviews, the interviewees were asked to talk about the story of cloud computing in Telco from their own point of view. In response, the respondents almost unanimously started to spontaneously list the administrative issues that they believed were the sources of perceived slowness in progressing with experimentation of the technology and using the results to set the strategies and send clear messages to the market. In order to get a more in-depth view on the nature of the stated administrative issues, the interviewees were confronted with repetitive follow-up questions on "why" such problems existed. The stated challenges and the underlying reasons were coded and grouped. A summary of the key codes and their respective frequencies is presented in Table 2-4. We present a synthesis of this data in the following section.

Figure 2-2- Timeline of cloud adoption in Telco and the field study

Initial screening
of the
technology by
Telco

1ˢᵗ structural change, new
resource allocation
approach

3ʳᵈ structural change,
continuation with
experimentation through
newly developed routines

Structur
al form:

2009

Targete
d

2011

2012

2013

Phase 5:
Dissolution of
independent
organizationEmer
gence of cloud
computing - An
industry-wide
initiative by
Google, IBM, &
universities

Technology rise -
significant increase
in the number of
scientific
publications and
patents

2ⁿᵈ structural change, new
incentive structures,
development of
experimental routines

4ᵗʰ structural change,
returning to initial
structure after having
experimental routines
established

Data collection

Table 2-4 - Key codes and their frequency

Code group	Code	Frequency of passages	Frequency of sources
Learning routines	Incompatibility/ Ineffectiveness	19	12
	Inefficiency	14	7
Resource allocation	Intensity of resource requirements	23	17
	Diversity and dispersion of resources	8	5
	Unwillingness to allocate by managers	7	5
	Resistance/threat perception	8	3
Incentive structures	KPIs, targets, performance measures	14	9
	Recognition	5	3

2.7   Technology adoption process at Telco

In the presentation of the results, we start by a brief introduction to Telco's structure in connection with the roles of each sub-unit in the adoption process of cloud computing. Telco is a large organization with more than 100,000 employees in more than 100 countries. Figure 2-3 provides a simplified overview of Telco's organization.
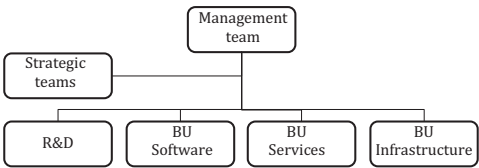
Figure 2-3- Simplified representation of Telco's organizational structure

At the top of the organizational hierarchy are the CEO team and a number of relatively small strategic teams which take care of corporate-wide activities such as strategic planning, financial control and accounting, technology monitoring, and so forth. Three business units are the main profit centers of the company and are responsible for securing the profitability of their respective organization. The majority of the organizational power and resources are assigned to these business units. The business units are respectively responsible for "infrastructure equipment", "independent software", and "services". The majority of the revenues come from "infrastructure equipment" and complementary services for the deployment and maintenance of such equipment. The R&D organization is the driver of Telco's ambition in technology leadership through continuous technological innovation. In the following sections, we look into the sequence of events in the period of 2008–2012 and illustrate the organization's challenges and responses in connection with the adoption process of cloud computing technology.

2008 – Q4 2010: Dispersed activities and organizational challenges

With the rise of cloud computing in 2008, the technology intelligence units of the company spotted the emerging trend very early and communicated their findings through technology forecast reports throughout the organization. The subsequent awareness, in turn, resulted in the formation of cross-functional teams to discuss and plan for potential impacts of cloud computing on Telco's portfolio of offerings. In less than a year, the outcomes of these endeavors found their way into the corporate technology strategy document, which is endorsed by the senior management team. While no remarkable market demand was foreseeable for the cloud-based offerings in the short term, it was left to the individual business units' discretion to investigate the implications of the new technology on their respective products and services. A number of the organization's members in the R&D unit, strategic teams, and business units got engaged in these efforts because of their responsibility for technology strategy or merely due to personal interest in cloud computing as a research topic. During the period 2009–2010, however, these activities failed to result in any tangible outcomes, in terms of experimentation and technological innovation in accordance with Telco's portfolio of offerings. In the following section we will present the organizational difficulties that hindered experimentation in the new technological context during the period of 2009–2011 according to the interviews and other sources of data. Subsequently, we explain the organizational measures that enabled Telco to overcome those difficulties from early 2011 and onwards.

Organizational routines and capabilities - According to the interviews and our observations, one of the very evident characteristics of Telco is known to be its long-lasting and influential routines and processes. There is virtually a process description for all of the activities of the organization. A few of the processes were referred to as corporate-wide directives among which are the processes for the lifecycle management of the product, including innovation and product development processes. Perceived to be the source of Telco's competitive advantages, these processes are preserved and

controlled by the highest levels of organizational hierarchy. Such processes and similar, generally accepted routines and ways of working, both written and unwritten, however, were stated to be a source of ineffectiveness for experimentation in the cloud computing context.

One of the examples, according to the interviews, was related to the tradition of the internal development of prototypes and then testing them in the customer sites. As one of the senior engineers who pioneered the cloud initiative in Telco stated:

" … Our innovation activities are extremely […] based on prototypes, because that is our comfort zone. It's always like when I have an idea, then I make a prototype but in the context of cloud when the prototype is there, you don't know what to do with it."

This issue with the prototype is a reflection of a general difference in the new technological context, where customers play a key role in innovation and development. When it is about selling on-demand services, the technology-push tradition of the industry by Telco and its peer companies becomes less relevant. The new concepts such as value co-creation and customer and frontline involvement in the development were being speculated in different parts of the organization, but the existing businesses and technologies were still following the conventional ways of working. Among the references to the problems with the existing routines, need for "faster development processes", "adaptations in financial and support systems", and "new sales mentality and approach" were prevalent and each of these references were related to a problem with experimentation and innovation in the cloud context that stem from the very different logic of the underlying technologies. For example, the need for faster development is, in part, related to the fact that cloud-based offerings are in essence services that require iterative feedback from the customers which mandates shorter development cycles. In short, interviewees consistently stated there was a need for new capabilities and routines for handling cloud opportunities, and at the same time they believed it was very difficult to develop such new routines, because of the strong influence of long-lasting traditions and existing best practices.

Resources and complementary assets - Working with emerging technologies is not unusual for Telco. The research organization is designed to embrace such technologies by the formation of innovation teams and laboratory work that receives support from business units in the later stages of product development. Very early in the process, researchers and technology strategy teams realized that cloud computing required the engagement of the three business units, because it implied selling infrastructure equipment, software, and services as an integrated package of services through a different sales, delivery, pricing, deployment, and maintenance model. First and foremost was the fact that the development of new cloud-based offerings required engagement from the different product areas within each business unit. In addition, close cooperation from the three business units was essential. The need for modifications in core and peripheral sub-systems was much more extensive than what small teams that are routinely being formed to deal with new technologies are able to handle. Moreover, it was not only the technical aspects that were important in the context of cloud computing. For example, some of the research teams realized that, due to the different nature of cloud-based offerings, many of the experimentations should be initiated with open discussions with the customers before conceptualization, whereas Telco's research and development teams did not have (access to) the competences and communication channels for that sort of interaction with the customers. So, why was it so difficult to secure the required resources for experimentation with cloud computing while it was already part of Telco's technology strategy?

One of the main reasons for such difficulties in the allocation of resources was stated to be related to the fact that the resource planning outside the research unit of Telco is optimized to support the existing businesses of the firm. In other words, the exploration of future opportunities is delegated to the research unit and the rest of the organization is focused on applying the outcomes in the portfolio of the offerings whenever some benefits are associated with such incorporations. Considering the global financial turmoil during the period of 2008–2012, business units were tightly

resourced in order to maximize the efficiency of the very large organization and they could not afford the allocation of resources to long-term projects with no clear link to their existing portfolio of offerings. Another observation was related to the fact that resources in Telco are already tied to the existing product development plans well in advance and those plans are not being regularly reconsidered and revised. This situation generates a lot of difficulties in convincing managers to invest in a technology when its outcomes are not clear. As a senior researcher who pioneered the cloud discussions in Telco stated:

"We also don't have the data for the future and this is the biggest problem, because for [the existing] businesses that you have, you can easily get the data, but if we say [to the senior managers] that we think that the cloud will take over everything and this much [revenues] will be built on this, how can we confidently go and say we really believe in this?"

In addition to the resource limitations, we understood that there was quite an amount of resistance in accepting that Telco needed to invest in cloud computing from some parts of the organization and mainly the business units. The cloud model was perceived to be disruptive and a potential alternative to the way that Telco makes revenues from selling very expensive and high-margin infrastructure products and turns it into selling services. Investing in cloud computing and collaborating with customers on that would endanger the sales of existing infrastructure offerings from Telco by making customers wonder whether they should invest further on existing technologies or whether they should wait until cloud-based offerings touch the market. One of the key stakeholders of Telco's cloud initiative formulated this problem as follows:

"... [We experienced] internal friction also, because the future technology will be replacing existing businesses. Then there is [a tendency for] internal competition [on the resources]"

In other words, the threat of the cannibalization of the existing offerings was a major argument that was repeatedly expressed as a source of resistance against accepting extensive resource allocation to the new technology.

Incentive structures - Telco is a decentralized organization which is a reflection of the size and geographical dispersion of the company. Decision-making power and authority is, therefore, distributed across the organization in exchange for accountability for targets and performance measures that are assigned to each unit of the organization. Such targets and goals, especially in business units, are related to measures such as profitability, growth, and customer satisfaction requirements. According to a key stakeholder of the cloud initiative:

"… All the [existing] KPI [key performance indicators] are geared up for the short-term view. But with the disruptive things [like cloud computing] we need to have a long-term view based on what's going to be in one or two years, or five years [that is not supported by existing KPIs]."

With the exception of the research organization and a few small strategic teams, the body of the organization mainly focuses on short-term and mid-term profitability targets of the organization. This leaves very limited interest for the business units to heavily invest on the areas that are unlikely to contribute to their own targets. In fact, cloud was not perceived to be a source of fundamental change in the structure of the revenues in the short run. Considering the intensified competition and the effects of the global downturn on Telco, this approach seemed to be somewhat justifiable for the organization's members in the earlier phases of technology emergence. In other words, efficiency was a main priority of the organization during 2009 and 2010 and this makes the consideration of different performance measures for experimentation on a potentially large area such as cloud computing even more difficult. Recognizing this issue during earlier phases of cloud adoption, a number of interviewees discussed the need for the involvement of senior management in the experimentation

process. Such provisions were considered a solution to the perceived unwillingness to release the resources that were tied to existing projects and in line with short-term and mid-term measurement targets.

The combination of the above-mentioned difficulties resulted in a situation where Telco had not achieved going beyond studying and planning for cloud computing as a potentially important technology. We did not find any evidence for the incorporation of cloud in the product plans of Telco, except for a couple of small-scale projects by individual researchers. The initial activities, however, increased awareness of the cloud as a disruptive technology and this, together with the ever-increasing attention to the topic from customers and rumors about the activities of the major competitors, convinced Telco's senior management to look into solutions for the slow progress of the cloud initiative. According to the insights from interviews and our observations, a chronological representation of these activities is presented in the following section.

Q4 2010 – Q1 2011: Initiation of cloud program

The above discussion highlighted the failure of Telco's technology adoption routines in the face of an emerging core technology. As we describe in the following pages, Managers' realization of these issues motivated introduction of new to the firm structural approaches and development of novel practices for handling cloud adoption. As the first step, in order to secure allocation of necessary resources and ensure development of new incentive systems and learning routines that support experimentation, management decided to form a cross functional team in the form of a program structure. Since the majority of revenues, and therefore the concentration of financial resources, was related to the business unit for infrastructure equipment, this unit was chosen as the host of the new program. This setting reduced the difficulties with resource allocation to some extent and increased the incentives for investment because of the direct involvement of senior management.

Having the resources in place and starting with attempts to develop demo products based on the cloud technology, the teams were becoming more and more aware of the technical and organizational challenges of experimentation with cloud. From organizational perspective, two major issues were evident in this period: first, embedding the new technology within the most traditional business unit (infrastructure manufacturing) of Telco inevitably constrained the goals of the program in the departure towards cloud technology and related business models. Second, despite senior management involvement, the securing and coordination of resources and complementary assets from different business units proved to be very challenging. Nevertheless, the program setting helped in speeding up the progress and enabled initial phases of experimentation with cloud computing to some extent and was referred to, by a number of interviewees, as the turning point of Telco's efforts to embrace the new technology. Increased understanding about the fundamentally different requirements of cloud, especially in terms of the profound organizational implications of the technology, guided the next round of managerial initiatives.

Q1 2011 – Q4 2011: Program separation and expansion

With the aim of allowing experimentation without confinement to the context of a business unit, management decided to take the program out of the business unit and start a corporate-wide program under the direct supervision of the senior management team. The number of engaged personnel to the program increased considerably (from around 30 to around 100) and a lot of attention was directed towards the program. This setting created a great momentum towards relaxing the ineffective organizational routines and developing new ones. In this situation, the speed of development increased and Telco managed to successfully develop the planned demo product for the industry event that they had planned for. A challenge was reaching a common language among the multidisciplinary participants of the cloud program, mainly because of the technological uncertainties that created different perceptions among people with different backgrounds. The common goal, however, assisted

the participants to synchronize and form a coherent understanding about their activities and this proved to be a valuable outcome in the later stages of the initiative. Having a common understanding and an improved alignment enabled Telco to realize a few developments in the organizational challenges that we listed before as hindrances of cloud adoption. The most important was the development of a set of new and unprecedented practices for working with the technology. Examples of such new practices that company explored to different extents in this period are direct involvement of customers in the earlier phases of product development process, new pricing and contracting approaches, supplier and competitor involvement in development processes In the new setting, the teams had the opportunity to develop such new practices through trial and error and experimentation, whereas former structural settings proved to be incapable of accommodating such developments.

Despite all the advances, the program was not free from organizational difficulties. The growing size of the program proved to be a challenge in itself. Having around 100 employees coming from different disciplines, without a well-defined structure and relationships with the other departments, was indeed troublesome in terms of coordination and management and could not be continued further. Therefore, the technical and organizational advancement with adoption of cloud were at the cost of reduced organizational efficiency to an alarming extent.

Q4 2011 – Q2 2012: Program shrinkage and delegation of tasks to the business units

During late 2011, organizational challenges with the growing size of the program left two options for Telco's senior management team: either to create a new permanent organizational unit with all the required resources and administrative requirements or to shrink it to a manageable size. The latter approach was chosen by Telco's senior managers, because of two reasons: first, cloud computing proved to be still a bit far away from the market rise and having a line organization without any business was perceived to be too costly and inefficient. Second, the fact that the new technology

would ultimately affect the existing businesses of Telco justified a close link between the cloud initiative and ongoing activities of the organization. Eventually, the program was shrunk to a small project, with the involvement of s senior steering members representing different organizational units. The activities were also divided to a number of tasks, each of which was delegated to one of the organizational units.

Although similar to the structural setting before 2010, the new structure interestingly proved to be far less problematic in terms of resource allocation, incentive systems, and rigidities in the routines. First of all, the required resources were already identified and allocated in the previous phases, so it was much easier to ensure continuation of their involvement throughout the upcoming phases of the technology adoption. Therefore, resource allocation mechanisms of the existing business were less influential on the activities on cloud technology. Second, the ways for motivating and measuring experimental activities in an extensive scale were explored and identified to a good extent and it was still possible to follow the newly developed incentive structure after delegating the tasks to existing businesses. Lastly, the need for development of new practices that were required for cloud context had been investigated to an extent that organization's member was aware about the mismatch between many of the existing practices, processes, and capabilities with the requirements of the cloud. Therefore, unlike the first two first stages of cloud adoption, not only attempts to develop new practices were considered deviance from organizational directives, but also an organizational group was designated to actively search for and assist development of such new practices.

All in all, this new setting was perceived by the respondents positively, mainly because they believed it provided the best possibilities to progress with the identified areas in the previous forms while minimizing the organizational frictions and challenges in the way of experimentation with the new technology. The steering group served as a facilitator for the allocation of resources and the operational groups within the business units had the possibility to experiment with the new technology and develop the required supporting processes and practices.

Q2 2012: Program dissolution and integration within the existing organization

In the second quarter of 2012, the management decided to dissolve the program and formally announce "execution phase" of the cloud by integrating the activities within the agenda of different organizational units. Telco returned to the before-2010-structural form for driving experimentation with the new technology, as many of the organizational problems were no longer as intense. Cloud was already a strategic priority for the three business units and allocating resources and incentives to experimental activities was not so challenging anymore. The new practices were becoming more mature and relevant teams in the organization already started standardization of such practices for replication. While many technical and market related challenges were yet to be overcome, organizational hindrances were to a good extent controlled by the second quarter of 2012.

Figure 2-4 depicts the different structural modes that assisted overcoming the challenges with resources allocation and incentive systems and enabled developing new organizational practices for cloud computing during the period 2008–2012.

2.8   Discussion

This paper sought to explore the relationship between management innovation and the adoption of an emerging core technology. While prior work has shown the effect of organization, and in particular structure, on a firm's ability to cope with competing goals of the exploitation of old certainties and the exploration of new possibilities, little emphasis has been devoted to understanding the role of adaptations in the structure as an enabler (and not just a consequence) of technological change. Through the Telco story, we demonstrated that, when contingent structural forms, including hybrid ones, become ineffective of unsustainable, it becomes a managerial problem-solving task to ensure a structural fit with the organization's goal at each point in time.
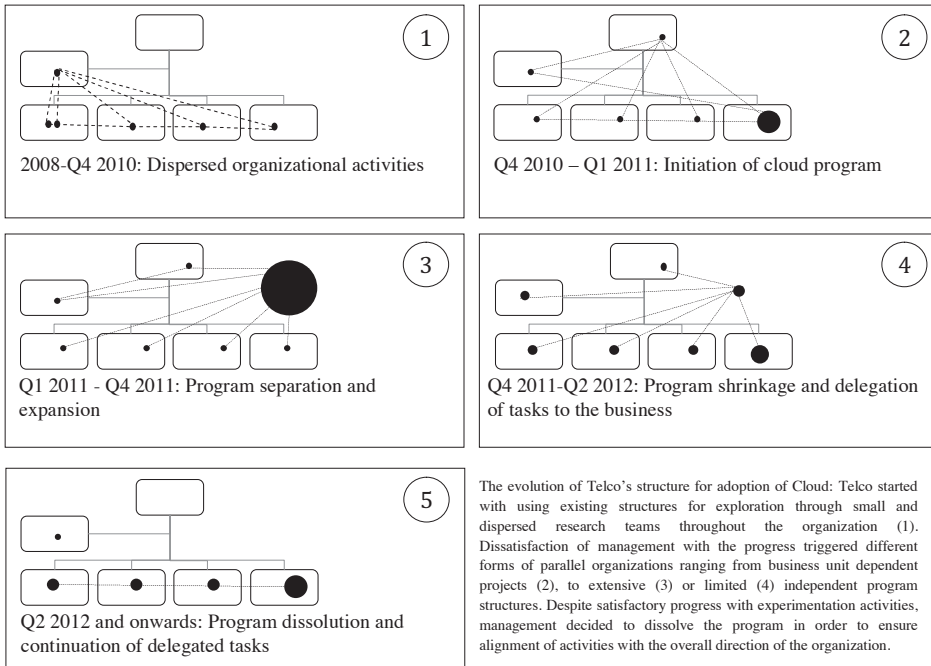
Figure 2-4- Evolution Telco's structure

From the perspective of organizational routines, one would expect a technology-driven company to be quite adept in handling emerging technologies. Instead, we find that the firm had remarkable amounts of problems in the initial period because of a reliance on existing routines that were not developed for changing the core business of the firm. In fact, subsequent structural adaptations were in essence aimed at overturning the organizational routines that hindered experimentation and knowledge in earlier stages. Lack of appropriate learning routines, absence of sufficient resources and competences, and not having relevant performance measures in place were examples of the organizational challenges that our theoretical and empirical analysis highlighted as hindrances of knowledge accumulation in the emerging field. Looking at the sources of such

problems, we find reliance on routine organizational responses, as opposed to searching for novel solutions, as the root cause of initial difficulties in the earlier phases of technology adoption. During 2011 and onwards, recursive structural adjustments were utilized in order to ensure allocation of sufficient resources and motivation, as well as capabilities and routines that are required for learning in the specific context of cloud.

The case of Telco is an example of managing contradictions that are caused by unprecedented changes in the business environment. Such situations entail going beyond selecting the most appropriate available situations and require a combination of different alternatives (See Smith & Tushman, 2005; Smith, Bins, & Tushman, 2010). This is mainly because the contingent solutions in response to environmental dynamism usually assume a certain degree of certainty about what is going to happen, what would be the consequences for a given firm, and what are the best solutions to face such consequences (See Milliken, 1987). However, such levels of certainty do not always exist in the earlier phases of paradigm shifts. For Telco, the consequence was the ineffectiveness of some best practices in their managerial toolbox and they found themselves in need for inventing novel administrative structures, processes, and practices. The notion of management innovation and the process framework that is provided by Birikinshaw et al. (2008) concerns such a process.

From a knowledge absorption perspective, we observed that the firm was dealing with two different knowledge areas, one of which was known and certain, whereas the other was embryonic and unfamiliar. Without experimentation, Telco was not able to relate the emerging body of knowledge to their context, and, therefore, was at risk of losing its capability to innovate when the technology became mature. Inasmuch as a firm's ability to absorb and utilize knowledge is influenced by the organizational structure and its alignment with the knowledge environment that the company is dealing with (Van Den Bosch et al., 1999; Lewin et al., 2011), a logical response seemed to be the creation of a new structure for the emerging knowledge area. Yet, for Telco, it proved to be a challenging managerial task to decide upon the characteristics and establish such a structure. Devising

hybrid structures, for example by means of a spatially separated unit, was not viable for two main reasons: first, the extensive resource requirements made it impossible for Telco to consider duplicating the organization. Second, the requirement of relating the new core technology to the existing one was the source of a great deal of interdependence that required close integration with the existing structures. A parallel organization and cross-unit collaboration also proved to be unsustainable, because of coordination and other organizational challenges stemming from the size of the initiative. The path that Telco took, in terms of moving to different possible structural modes for the new initiative, was aimed at addressing such contradictory requirements for integration and separation. Introduced structural innovations assisted the firm in reducing the negative influence of organizational factors on experimentation and accumulating new absorptive capacity in preparation for the forthcoming stages of the technological lifecycle.

In short, the case of Telco illustrated the need for and the process of management innovations that enabled adoption of an emerging core technology. Through recursive structural adaptations and subsequent development of practices and processes which were appropriate for cloud, Telco accomplished a collective experimentation process that eventually led to adoption and integration of the technology. This relationship is illustrated in Figure 2-5.
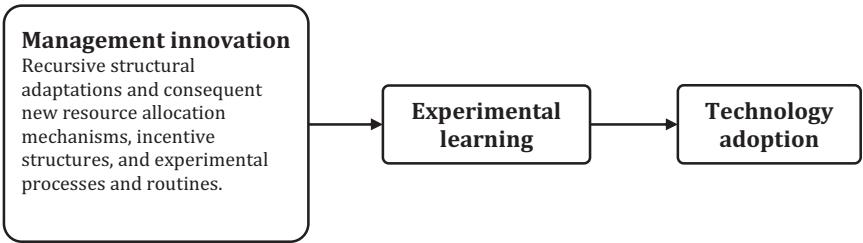
Figure 2-5- The effect of management innovations on experimental learning and technology adoption

2.9   Conclusion

Our analysis of Telco's responses to these challenges provides an empirical account of the role that management innovation plays in the process of technology adoption. Damanpour and Evan (1984) questioned a widespread belief that technological innovations are drivers of and hence superior to organizational innovations. The authors hypothesized and empirically demonstrated that innovation in administrative aspects of the organization can play an important role in fostering a favorable ecosystem for technological innovation. In the quest for increasing our understanding of the underlying mechanisms of this relationship in the specific context of adopting emerging core technologies, we showed that the need for a continuation of existing businesses and at the same time the preservation of existing complementary assets creates an unfavorable environment for experimentation and knowledge accumulation in the emerging field. This, in turn, casts difficulties on knowledge accumulation and generation of absorptive capacity that is crucial for competitiveness in the maturity phases of the new core technology. The failure of managerial contingencies, such as structural separation or integration, in overcoming these challenges necessitated unprecedented and new-to-the-firm structural adaptations to which we referred to as management innovation. The case study revealed that such managerial problem-solving initiatives can be an integral part (and not merely a consequence) of the technological change process and, therefore, should be considered by managers along with the technological aspects of the transition process.

This paper contributes to the growing body of literature on management innovation by providing insights into its relationship with organizational routines. In the context of this case study, we discussed how unconventional structural adaptations replaced the routinized behavior of the organization in response to technological innovations. In other words, management innovations in this study were in essence managerial interventions in the organizational routines in order to overcome ineffectiveness of familiar practices of the organization for dealing with a new technology. An upshot is a distinction between management innovation and routinized organizational adaptations in response

to environmental triggers which are discussed, for example, by the literature on dynamic capabilities (cf. Zolo & Winter, 2002; Teece, 2007; Lewin et al., 2011). Awareness and intensive involvement of senior management in the cycles of structural adaptations highlight another distinct feature of management innovation in this empirical analysis.

The findings have implications for the literature on technology adoption. While prior studies have discussed the antecedents, processes, and consequences of the technology adoption process on peripheral (Rogers, 2001) or process (Woiceshyn, 2000; Edmondson et al., 2001) technologies, the adoption process of core technologies that we discussed in this paper is a relatively overlooked area. Although organizational structure was previously considered a contextual factor influencing technology adoption (Woiceshyn, 2000), our findings indicate *adaptations* in the structure as an important precursor of technology adoption in emerging fields. The findings also revealed the adoption process of an emerging core technology as a gradual, step-wise process that is aimed at maximal preservation of existing complementary assets.

The study raised some interesting questions for further scholarly inquiry. While we explored the role of management innovation in the technology adoption process, we did not discuss the individual and organizational enablers of management innovation. First, it is important to understand what factors influence the time between the generation of a managerial dilemma and the actual recognition of such an issue by the relevant managers. From the presented case study it would seem that organizational contextual factors (size, centralization, etc.), different organizational players (gatekeepers, middle managers, senior managers), and individual characteristics of senior management may potentially influence the firm's ability for timely identification and response to the ineffectiveness of organizational-administrative routines. Further qualitative and quantitative research may provide a better view on the dynamics of the interplays between these factors and management innovation.

This study reported adoption of a new structural approach as enabler of engagement with technological innovations in an emerging field and provided detailed information about why such initiatives may prove to be crucial for adoption of a new core technology. Although the results represent advancements to our understanding on management innovation in connection with technological change, the findings may not be exhaustive. This is, in part, related to the limitation of the data, which comes from a single case study. Further research could investigate the incumbents' responses from multiple sources of data, including firms with dissimilar size or with different initial structure for handling emerging technologies. Such observations may increase our understanding on the conditions in which management innovation becomes effective and on the nature of interaction mechanisms that influences the technology adoption process.

3 Study II: Business model renewal and Ambidexterity-Structural alteration and business model renewal during transition to a Cloud business model[2]

Abstract

This paper presents the findings of a longitudinal study of Telco's transition to a new business model in the face of a major transformation in the ICT industry brought about by Cloud computing. We build theory on the process of business model innovation through a qualitative study which investigates how an established firm organizes for an emerging business model. Contrary to previous findings that presented spatial separation as the optimal structural approach for dealing with two competing business models, our findings indicate a need for recursive iterations between different modes of separated and integrated structures in line with the emergent nature of strategic intent towards the new business models. Our analyses reveal strategy formation to be a collective experimental learning process revolving around a number of alternative strategic intentions ranging from incremental evolution and transformation to complete replacement of the existing business model. Given the fundamental differences in the nature and requirements of those alternative intents, iterations between different structural modes and differing combinations proved to be crucial in enabling Telco to make transition to the new business model.

...Somewhere in 2008, we started to get into Cloud computing activities within Telco. I think the starting point for our team has been [....] how you could utilize Cloud to improve the performance of the network (senior researcher, Telco; interviewed in December 2011).

...[in 2011] We realized that Cloud cuts quite badly through the organization in many of the areas, of course some products fit[...], but very few I would say. (Senior manager, Telco; interviewed in December 2011)

.... [as of 2013] I think the practical impact of Cloud on Telco will be smaller than what it looked before and we were assuming that everything will be changed. (The same senior manager, Telco; interviewed in January 2013).

In 2008, when a small group of Telco's researchers and technology analysts started to wonder how they could utilize Cloud computing to enhance the performance of their existing technologies, it was difficult to predict the various waves of changes that would affect the organization in the years that followed. As early as 2009, Cloud computing was indicated to be a potential source of disruption in the telecommunication sector, with an influence ranging from incremental enhancement of existing networks and possibility of new offerings to complete obsolescence of existing business models for a wide range of industry players. Analysts and managers in Telco realized quite early on the various possibilities that Cloud computing offered, but deciding which path to take and how to set the organization in line with that path was not as easy. In fact, figuring out whether it was wise to plan for harvesting the new Cloud opportunities or to consider burying the business model that the organization had used for more than 150 years took about five years of experimentation in different directions. During this period, devising an optimum structure for experimentation was a key question for managers.

The growing body of research on business model innovation addresses the issue of dealing with two fundamentally different business models. Discussing the need to facilitate resource allocation and foster a favorable environment for experimentation as crucial means of enabling organizations to deal with discontinuous change (Gilbert, 2005), research has emphasized the need for structural separation of the two business models (Izosimov, 2008; Smith, Binn and Tushman, 2010; Zott and Amit, 2010; Bock, Opsahl, George and Gann, 2012; Markides 2008, 2013; Gilbert, 2005; Zook, 2011; Bower and Christensen, 2011). Despite the benefits of spatially separated structures, it is not always feasible to use this approach, especially where another business model has the potential to

replace the existing one (Markides, 2008; 2013). Business model disruptions have impacts on the whole organization and, therefore, providing human resources and other assets to a separated structure that deals with such an extensive scope seems to be quite challenging (Taylor and Helfat, 2009). Committing to such risky investments becomes even more challenging when one considers the great uncertainty surrounding the nature, timing, and scale of the effects of fundamental changes in the business environment (Milliken, 1987). Therefore, as contended by Markides (2013) it is still a matter of debate as to when and how separating, integrating, or adopting a combination of these two structures might represent the optimal solution for business model innovation.

To address this gap, we look into the dynamic process through which an established firm adapts the organization in order to respond to an emerging business model with a disruptive potential. Our longitudinal case study on Telco's transition towards a Cloud business model indicates that the firm introduced structural changes as enabler of a kind of learning process that then fed into strategy formation to move towards the new business model. As such, our empirical analysis suggests that, rather than adopting any particular structural form, iterating between different modes of separated and integrated structural forms offers the potential to experiment with the new business model and revise the strategy through a collective learning process. By studying the evolution of the firm's strategic intent (Hammer and Prahalad, 1989; Branze, Ursacki-Bryant, Vertinsky, and Zhang, 2004) towards Cloud, we postulate that structural changes are reflections of temporal intention in each stage of the process and at the same time enablers of learning that will feed the subsequent formulation of the strategy and design of the new business model. We provide further details on nature and implications of interrelationships between strategic intent, structure, and business model renewal.

This study contributes to the literature on business model innovation by exploring the interdependence between strategy formulation, structuring, and business model innovation processes. The relationship between business model and strategy has been a matter of debate among strategy and organization scholars (Achtenhagen, Melin, and Nadi, 2013). Our study improves general

understanding of why and how strategy and business models are interrelated. Drawing on the existing theories on discontinuity and discussions of alternative transition strategies that range from incremental evolution to radical substitution (Lavie, 2006), we discuss why it was challenging for Telco to decide upon which transition path to take and how experimentation enabled them to overcome the challenges. The result is greater clarity over the issue of what the best structure for business model transformation might be as we link different strategic intents to particular structural forms.

With a few exceptions (e.g., Kotha, 1998; Garnsey, Lorenzoni, and Ferriani, 2008; Sosna, Trevinyo-Rodríguez and Velamuri, 2010), process studies on business models and corresponding innovation are scarce. In particular, although strategy scholars contend that static approaches to strategic issues are less effective in turbulent times (Mintzberg and Waters, 1985; Noda and Bower, 1996; Fajouran, 2002), no-one has taken a dynamic view on the process of business model transformation when environmental turbulence is at its most extreme. To contribute towards such a perspective, we conducted an in-depth single case study that is well suited to the purpose of building grounded theory. A longitudinal case study approach not only provides us with the opportunity to look at different stages of business model innovation but also allows us to explore the sequence of events and at what role members of the organization play in each decision (Hutzschenreuter and Kleindienst, 2006).

In the following sections, first we review the existing literature on business models and in particular on the extant research that discusses the role of structure in the business model innovation process. We then discuss the methodology and empirical data. This is followed by an analysis of the data and discussion. The paper concludes with a discussion of the results and recommendations for future studies.

3.1 Theoretical Background

Technological disruption versus business model disruptions

In studying the failure of established companies in the face of discontinuous change, technological disruptions (Christensen, 1997) have received considerable attention during past decades. Disruptive technologies have the potential to overturn technical subsystems and necessitate major redefinitions of capabilities for industry players that are seeking to remain competitive in this new business environment. Research on technological disruption provides insights and recommendations on how to overcome the challenges involved. However, in certain circumstances, technological change or other exogenous forces trigger the discovery or emergence of new business models that can potentially alter the ways in which incumbent firms within particular industries create value. Disruptions to the business model (Markides, 2006) are similar to technological disruptions in that both types of change involve potential devaluation of the organization's key capabilities and other resources. Nevertheless, business model disruptions are distinctive because they have a broader impact and can potentially overturn the core value creation and value-capturing mechanisms of established organizations (Teece, 2010). This implies a need for different theories to help us understand an organization's response to business model disruption to those indicated in the technological disruption literature (c.f. Christensen, 1997). Although the growing body of literature on business model innovation provides insights into this area, the question of how incumbent organizations respond to a disruptive business model has remained unanswered, and this is what we aim to resolve in this paper.

A business model consists of a customer value proposition, key resources and processes, and a profit formula (Johnson, 2010). Companies increasingly realize that they need to renew or reconsider their business models in line with the requirements of new century (Boulton et al. 2000). Business model innovation concerns the redefinition of existing products or service and how they are provided to customers (Chesbrough, 2007; Baden-Fuller and Haefliger, 2013). As such, business model

innovation activities can range from incremental changes in individual components of business models, extension of the existing business model, introduction of parallel business models, right through to disruption of the business model which may potentially entail replacing the existing model with a fundamentally different one. Therefore, when studying the implications and requirements of business model innovations, including the structural approaches likely to be most effective, it is crucial to take into account the nature of the associated change and the characteristics unique to each type of business model innovation activity. In particular, business model disruptions have some idiosyncratic characteristics that pose extraordinary challenges for established firms. We discuss below some of these differences.

Complexity and uncertainty: Business model changes never occur in isolation and require interactions and initiatives from a large range of players, including customers, suppliers, competitors, and regulatory bodies. Moreover, they have the potential to overturn every detail of an organization's processes and activities. Although any type of innovation entails a degree of uncertainty and risk, business model disruptions carry the highest degree of risk. Unlike other types of business model innovations where companies can decide relatively quickly upon their intent and goals, with disruption it is very challenging to make sense of what is going to happen in the sector, determine what the implications for the firm will be, and decide on the best ways of responding.

Threat of cannibalization: Disruptive forces that require organizations to develop a new business model are usually driven by external shifts in markets and technologies that cannot be matched by the organization's existing value-creation activities. In other words, any investment in developing an alternative business model implies speeding up the obsolescence of the current business model on which firm is financially dependent (Gilbert, 2005). The competition between the existing and the new business models severely limits the incentive to invest in the new one.

Extensive resource requirements: Business model disruption affects a wide range of resources and assets within an organization. Unlike minor improvements in business models or extensions to the

existing model, replacing the existing model with a new one is extremely resource-intensive, and implies the involvement of virtually all areas of the organization. The associated costs are therefore much higher than for any other type of business model innovation.

3.2 Strategic goals, strategic intent, and structural approach to business model innovation

The characteristics of disruptive business models poses important challenges in evaluating what would be the effective response and how to set the structure in order to survive and to remain competitive. Prior research contends that in the presence of environmental attributes such as uncertainty, complexity, munificence, and dynamism, the strategy-making process is known to be an unfolding process (Dess & Beard, 1984; Sharfman & Dean, 1991) that influences the future moves of the organization (Hutzschenreuter and Kleindienst, 2006). In the extreme levels of environmental uncertainty, the concept of emergent strategy offers a viable alternative for delving deeper into business model innovation process (see Farjoun, 2002). In fact, understanding the nature of the strategy formation process can provide insights into how established firm need to adapt the structure for business model disruption. In the face of a potential disruption to the business model, an organization should prioritize at least three strategic goals which influence strategy formation throughout the process.

Aligning the internal activities with external rate and direction of change: When responding to discontinuous change, it is equally dangerous to be too early or too late in forming an action (Dowell and Swaminathan, 2006). Adopting a very different business model before the market and value network are not sufficiently developed is clearly not advisable. At the same time, being late deprives the firm of early-mover advantages such as being able to influence the value network, establish channels and partnerships, and acquire an internal stock of knowledge before competitors. Hence, an organization needs to ensure that it times its entry well not only by monitoring the external

environment but also by increasing the organization's preparedness for a swift transition when appropriate (Baum and Wally, 2003).

Retaining resources and capabilities: Competitive advantages of organizations are to a large extent dependent on their capabilities and complementary assets that are shaped around existing core technologies and associated business models (Teece 1986; Tripsas 1997). Even though an emerging business model may potentially erode the value of an organization's resource base, managers try to minimize this effect and attempt to align to new business model in a way that helps to preserve the source of competitive advantage as much as possible. Hence, in formulating the strategic intent, a key consideration is to avoid replacing the existing resource base wherever possible and instead to reuse existing complementary assets.

Minimizing costs of change: With fierce competition and an economic downturn, organizations seldom have sufficient slack in their resources to allow them to invest heavily in emerging phenomena that are a long way from the market (Jansen et al., 2009; Raisch and Birkinshaw, 2008). Shareholder demands for profitability and efficiency in running the existing business are at odds with substantial investment in developing a totally new business with no clear market prospect. Given the small likelihood of success and the hype that so often surrounds any new technology or business model or a new business model, it becomes crucial to invest only the right amount of resource in the right time.

Hence, in dealing with the uncertainties of emerging business models, firms need to consider how various alternative strategies may help them to better address and manage these considerations. Andries, Debackere, and van Looy (2013) consider focused commitment and simultaneous experimentation as two alternative strategies for dealing with business models, with the former facilitating initial growth and the latter fostering long-term survival. In order to include a wider range of possibilities in terms of analyzing business model innovation, we consider incremental evolution, directed transformation, and radical substitution of capabilities as alternative choices in the face of discontinuous change (Lavie, 2006). Each of the choices has different implications for achieving the

three strategic goals outlined above, and, at the same time, is associated with different structural requirements.

When choosing an *incremental evolution* path, organizations have a chance to minimize the costs of transition and to retain the resources and capabilities within their existing business model. Due to factors such as path dependency and inertia (Schreyogg and Sydow, 2009), it is quite often the natural choice for an industry incumbent to try and utilize the new possibilities without damaging the ongoing businesses. The optimal approach for evolution seems to be allocation of the tasks to members of the existing organization. Indeed, using existing structures accommodates identifying the possibilities to utilize the emerging business model in line with the organization's existing mechanisms of value creation.

In rare circumstances when an invention or other shifts in technology and markets suddenly has a devastating impact on the value of an organization's capabilities and ways of doing business, *replacing the* existing business model may become inevitable. In such conditions, an established firm will need to abandon or renew its capability and resource base and acquire new sets of capabilities in a short period of time. Hence, an adequately resourced, spatially separated, organization is crucial for inventing a new business that is in many ways very different from the old one (Zook, 2011; Bower and Christensen, 2011). This recommendation is in line with theories of structural ambidexterity that lay stress on the fact that exploration and exploitation require different structural characteristics (Cooper and Clayton, 1992; Tushman and O'Reilly, 1996; Gibson and Birkinshaw, 2004; Gilbert, 2005; Raisch and Birkinshaw, 2008). Ensuring the existence of appropriate processes for experimentation as a requirement for overcoming the barriers associated with business model innovation (Chesbrough, 2010) and this is more likely to be achieved by using structurally separated approaches.

Somewhere in between incremental evolution and radical substitution are a range of transformation paths by which firms try to utilize existing means of value creation and acquire or

develop new ones. If the strategic intent towards the new business model entails a transformation path, there will be a need to deal with the differing requirements of two business models. Working with new business model requires experimentation and divergent thinking that can be better achieved by flexible and decentralized structures (Tushman and O'Reilly, 1996; Benner and Tushman, 2003; Raisch and Birkinshaw, 2008; Benner and Tushman, 2003). In contrast, continuing with the existing business model requires focus (Jansen, Tempelaar, van den Bosch, and Volberda, 2009) and is better done via efficient and centralized structures. Therefore, separated structures with some strong linkages to the existing business may prove to be essential (Taylor & Helfat, 2009).

Table 3-1- Alternative strategic intents when transiting to a new business model and their consequences

	Alternative strategic intent towards the emerging business model		
	Incremental evolution	**Directed transformation**	**Radical substitution**
Key benefits	Low costs Minimum effects on existing businesses	Possibility to transfer key capabilities and complementary assets	Full alignment with the requirements of the new business model
Potential shortcomings	Undetected disruption and late response	Relatively costly Organizational challenges	Excessive costs Cannibalization of existing business
Optimal structure	Integrated structure	Integrated or separated structures with strong linkages	Separated structure

The discussion above (summarized in Table 3-1 and Figure 3-1) indicates a spectrum of possible strategic intents towards the emerging business model, each implying different structural requirements. It indicates that prescribing a particular structural approach for business model innovation is only valid when we assume that the firm has a very resolute strategic intent. However, the environmental conditions associated with disruptive business models that we discussed earlier impose serious limitation on the ability of established organizations to set a rigid plan in the earlier stages, and mean that experimentation and learning is needed (Mintzberg and Waters, 1985). In other

words, existing research says too little about how organizations resolve the tensions between existing and emerging business models in times of turbulence and when a new business model emerges. This leads to the research question that we seek to answer in this research: *When a potentially disruptive business model emerges, how does an organization set its strategy for business model innovation, and what role does structure play during the transition to the new business model?*
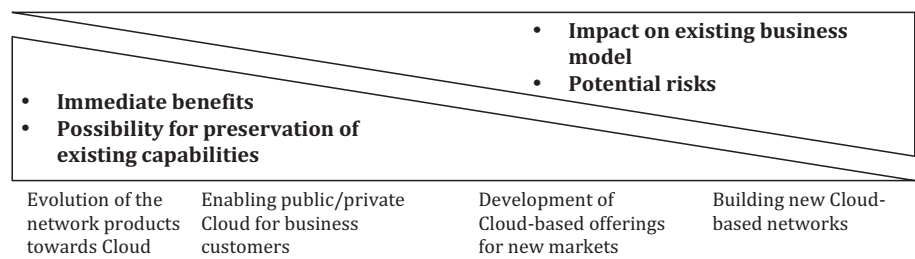
Figure 3-1- Range of alternative options in Telco's transition towards a Cloud-based business model

3.3   Method

To address this research question, we undertook a longitudinal case study of Telco's transition to a Cloud business model. The telecommunication industry has been frequently used as a context for study due to characteristics such as high levels of volatility, interdependence among value network players, and issues with the adoption of technology (Majumdar and Venkataraman, 1992; Majumdar and Venkataraman, 1998; Cai and Tylecotem 2008; Suarez 2005). The case of Cloud computing and transition of telecommunication network players to the new business model has a high revelatory power (Yin, 1994: 40) in that the rather slow pace but subtle effects of change on individual players can be studied in detail. The Cloud is expected to redefine the telecommunication value network in an unprecedented manner and this context provides more transparency in observation of theoretical issues (Eisenhardt, 1989). To investigate Telco's transition to Cloud, we adopted a qualitative approach, which is suitable for process study (Lee, 1999) and would enable us to gain a better

understanding of dynamics of the relationships between strategic intent and structure and the underlying mechanisms that drive this relationship.

Business model disruptions are interesting due to their devastating impact on a range of industry players. At the same time, such disruptions are very individual in nature and occur infrequently. Hence, getting in-depth insights into the sporadic waves of disruptions requires a great deal of scrutiny of the available cases, and grounded theory building is best suited to such requirements. In order to answer the question of what structural approach is most effective when dealing with business model disruption, we focused on a particularly rich example of the phenomenon and carried out four years of detailed field study into the Cloud adoption process and the associated structural dynamics.

3.4   Data collection

The study was carried out in Telco's headquarters in Stockholm from the fall of 2010 through the winter of 2013. For the data collection, however, we covered a wider time period starting from mid-2009, when the Cloud business model emerged. In conducting the study, we utilized a combination of retrospective and real-time data collection approaches (Pettigrew, 1990). Discussions with Telco started in 2010, when the first author approached Telco's headquarters with regard to studying the effects of transition toward service business models at the company. In order to get a thorough understanding of Telco's Cloud initiative, we defined an internal investigation project within the company, and one of the researchers was placed in the company premises in order to grasp a better understanding on the details of the transition process. Informants were middle- and senior-level managers who were involved in the Cloud business model innovation process and were influencing or influenced by related organizational adaptations. Formal and informal leaders who were orchestrating the implementation process received extra attention in our data collection process. Interviews were sought with the members of a research unit within Telco that was responsible for studying the

business model innovation process. Interviews were conducted with 49 informants from different organizational units. Seven of the informants were senior managers and the rest were middle managers or senior technical staff. The duration of the interviews ranged from 45 to 90 minutes. Focus groups were held in order to gather together people with knowledge of the same topic and to present the intermediary data analysis to them for feedback and comment. This approach was helpful in validating and complementing our understanding on the inputs from individual interviews. In addition to these sources, observation of the discussions in the internal meetings and numerous informal talks with the people who were dealing with the issue of technology adoption provided important inputs for the purpose of this case study research. Table 3-1 presents an overview of informants in the formal interview process and their positions. A summary of data sources and their use in the analysis is presented in Table 3-2.

Table 3-1- Overview of interviewees and their positions

Position	No. of interviews
Senior vice president and board member	1
Vice president	3
Senior program manager	3
Product manager	6
Product management staff	18
Senior researcher	11
Technology analyst	7

3.5 Data analysis

In line with the recommendations for longitudinal case studies (Langley, 1999; Stake, 1995; Yin, 1994), we started the analysis by reconstructing the timeline of events in the adoption and implementation of the Cloud business model. In analyzing the key events, we identified four rounds of structural change (Figure 3-2) and collected data in order to understand the nature and motivation behind each round of restructuring in the Cloud initiative. The interviewees were asked to reflect upon the evolution of the Cloud initiative and that associated organizational challenges at each phase.

Systematic coding of interview transcripts was then carried out to identify the transition process according to interpretation of our informants. We searched for the data related to challenges, implications, enablers, and other potential factors that influence the transition to Cloud within Telco. As we collected and coded the data, we realized that there had been a shift in the interpretation of organizations' members in different level on what the company intends to do with the Cloud. Moreover, when the organization started to move towards a different direction, we realized that the perceived challenges and requirements of transition to Cloud were being ascribed differently.

Table 3-2- Source of data

Source	Type of Data	Use in Analysis
Semi-structured interviews	49 interviews at headquarters of Telco between 2010-2013	Tracking the process of transition towards Cloud business model in Telco. Interviews with senior managers were aimed at understanding the strategic aspects of the transition. Middle managers, analysts, and senior researcher were providing more in-depth insights into the possibilities to utilize Cloud and potential implications on existing offerings and organization. Structural implications were being discussed by all of the informants.
Focus group sessions	2 focus group sessions in 2011 1 focus group session in 2012	For the sake of triangulation and deepening the understanding on validity of the interpretation, results were being presented to groups of middle managers and senior managers. Subsequent conversations were recorded and utilized for the same purpose.
Observation in the headquarters	About 500 hours of presence at headquarters	Becoming familiar with the context in order better assess inputs from the informants and establishing trust with informants
Intranet	Internal documentations about Cloud computing and service business model (confidential)	Investigating the ongoing projects and debates on Cloud in the organization and getting acquainted with the terminology being used by the informants.
Company publications and reports	Online versions of annual reports and other publications 2008-2013	Tracking of changes in the strategies, actions, and performance.
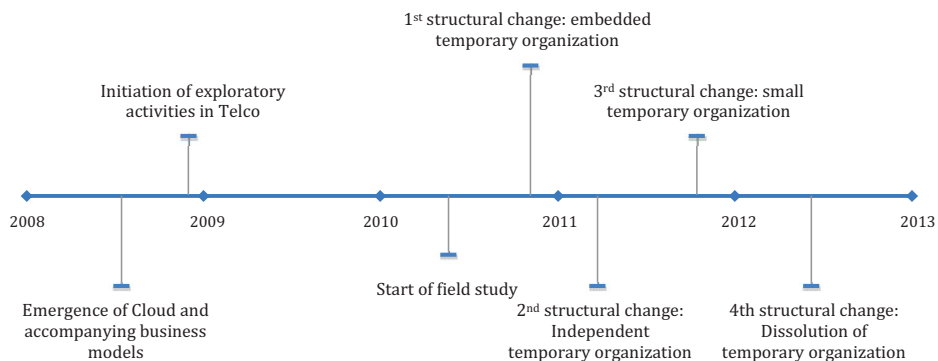
Figure 3-2- Timeline of study and key structural changes during adoption of Cloud business model by Telco

The outcomes were presented to the key contacts in Telco and in the focus groups in order to ensure reliability of interpretations. In line with the requirements of grounded theory-building (Eisenhardt 1989; Glaser and Strauss, 1967), these observations were explored in the light of literature review. Archival data and other sources (Table 3-2) enabled triangulation of the interview results. Observations, participation in key events and seminars, and informal conversations complemented formal interviews by providing further insights into interpretations of the employees about transition to Cloud and its implications. Some external reports such as industry and market analysis were used to contrast the external timeline of the Cloud's evolution and the interpretation of other industry players with those of Telco staff.

3.6 Findings

The analysis on the interview data indicated five major phases in the Telco's transition process between 2008 and 2013. Figure 3-3 provides an outline of these phases, each identifiable by a different structural form and strategic intent. Our analysis of the key activities and challenges encountered in each phase provides further details on each phase. In the following sections, we

provide a description of each phase, and whenever possible we use representative quotes to illustrate our interpretations.

Phase 1 – screening and speculation. For about two years, Cloud was understood as a regular technology, along with many other technologies that a research-focused organization deals with. Having an ambition to be the market leader, the company naturally monitors the technological and market trends in order to ensure its competitiveness in the long run. There are formal organizational units responsible for analyzing the market trends and setting strategies for responding to the associated threats and opportunities. Concurrently, exploring the long-term aspects of the business and technology is the remit of senior and middle managers across the organization. Both streams of explorative activities in relation to Cloud computing were initiated very early and as soon as the Cloud and its enabling technologies emerged as a potential source of disruption. Without any formal or official change in the company's structure, a number of organization members (15–20) representing different units formed a group to assess the impact of Cloud on Telco's business. The main focus at this phase was the technological implications of Cloud and, although the impact on the business model was to some extent understood by the participants, the general belief was that it would be possible to utilize Cloud in order to enhance existing offerings but remain with the existing business model.

Consequently, no structural adaptations were implemented during this time, and activities were carried out collaboratively by the unit officially responsible for monitoring market and technology trends and representatives from other units. Involvement from senior management in this period was limited, and on an ad-hoc basis, because the new business model was not perceived to be crucial to Telco's business in the near future. Initial analysis by the researcher involved and analysts, together with a few small-scale projects, highlighted a number of shortcomings and issues. First, there was a need for allocation of resources beyond what was available for regular research activities. Second, a potential deviation from existing roadmaps and trajectories highlighted a need for high level of

managerial involvement so that the required resources could be secured. A summary of the characteristics of this phase and the challenges encountered is presented in Table 3-4.

Table 3-2- Key characteristics of the first phase of transition to Cloud business model

Phase 1: Screening and speculation	
Pursued strategic intent(s)	Incremental evolution
Targeted outcomes	Evolution of the network products towards Cloud
Key roles	Technology analysts
	Researchers
Key activities	Investigation and discussions on the potential impacts of the new technology
	Writing research papers and reports
	Small-scale projects driven by individuals
Organizational structure	Fully integrated
Key challenges encountered	**Illustrative quotation**
Lack of support from business units	*"It is not easy to get something done in the research organization where no-one in the business organization really understands what this is. You have to have a few people who can really take the technology information and transform it into some way that is understandable by the business people if you say so, act as a translator in this."*
Lack of financial resources	*"When something comes along that is disruptive to that, it is difficult for the company to act on that without also impacting the overall result. And that makes it difficult. So the root cause might be the fact that there is no continuous money to invest in the new areas and do the necessary pre-development for new types of business."*

Phase 2 – initiating experimentation through an embedded temporary organization: Internal research and technology analysis activity on Cloud, together with developments in external environment, highlighted a need for greater focus on issues from the senior management. The initial step was to form a temporary organization in one of the business units. The selection of a host business unit was based on two criteria: first, the unit that was responsible for the development and manufacturing of hardware products was exposed to more disruptive effects than other organizational units; second, most of the resources required for experimentation with the new business model were in

this unit. There was still a need for involvement from other business units and, in order to facilitate such involvement a senior-level manager was closely involved with the Cloud initiative. The temporary structure in this period, therefore, consisted of a group of managers and technical staff from the host business unit who were not dedicated to the Cloud program, technical and business complementary resources from other business units (again not dedicated), and an executive-level manager.

This semi-integrated structure reflected the managers' perception of the Cloud and the corresponding strategic aim at that period of time: the Cloud was understood as potentially important but not necessarily disruptive to the existing business model of the organization. The strategic aim at this period was to investigate Cloud and to identify opportunities for using the technology, at the same time adjusting the product roadmaps when needed to make the portfolio "Cloud-ready". The activities during this period created a clearer picture of important differences between the ways in which the existing business model, based on a primarily hardware-manufacturing logic, was being managed and the requirements of the Cloud as a service-based business model. Additionally, the driving role of the business unit that was more affected by the Cloud than the others was helpful in getting the Cloud accepted within the company and acquiring the resources required for the project. Nevertheless, after three months, the management realized they would need to restructure the Cloud initiative. One of the reasons was the development of a view that the Cloud was fundamentally different from the existing business model of the organization, and in particular the business unit in which the initiative was embedded. Confining the Cloud initiative to the most traditional business unit of Telco, one with well-established routines and mentalities, inevitably restricted the possibilities for exploration of possibilities in the new business context. Additionally, the coordination of an extensive cross-unit initiative proved to be problematic, mainly because, in spite of senior management support, bringing in the resources from other business units was associated with coordination challenges. The Cloud initiative was growing exponentially and the challenges, as noted previously, were rising

correspondingly. A summary of the characteristics of this phase and the challenges encountered is presented in Table 3-5.

Table 3-3- Key characteristics of the second phase of transition to Cloud business model

Phase 2: Embedded experimentation	
Pursued strategic intent(s)	Incremental evolution Directed transformation
Targeted outcomes	Evolution of the network products towards Cloud Enabling public/private Cloud for business customers
Key roles	Senior managers Business unit managers
Key activities	Investigation of the effects of Cloud on the existing roadmap of Telco's products
Organizational structure	Semi-integrated
Key encountered challenges	**Illustrative quotation**
Lack of cross unit collaboration	*"We realized that Cloud cuts quite badly through the organization in many of the areas, of course some products fit with [our existing] product areas, but very few I would say. And the whole way of going to market with "as a service" and so on. It is kind of between [business units for] multimedia, networks, and service in a way that I think at some point in time it will affect the organization."*

Phase 3 – Continuation of experimentation through an independent structure: In order to overcome the various challenges, the management decided to detach the Cloud organization from the business unit structure and to form a large program with 70–80 dedicated technical staff and representation from business unit management as well as a senior management team. The emerging understanding that the Cloud would have a serious impact on Telco's future business and therefore required the participation of the entire organization was the main motivation for devising such a

structure. The independence from the business units allowed for the development of routines and processes from scratch whenever needed and eliminated, at least to some extent, the bias toward the existing business model. The exploration of different ways of engaging with the Cloud resulted in a few small-scale commercial offerings. Internal and customer feedback from the initial offerings served as a crucial input for the organization's strategy-making process. With the knowledge accumulated from exploratory activities, the managers became more convinced that, instead of replacing the existing business model with the Cloud and an "offerings as a service" business model, Telco should go down a less radical path, preparing itself better for the time when the new business model would become the market standard.

In addition to making an input to the strategy-making process of the company, the separated structural form helped to form a common language and understanding of the cloud and its accompanying business model among members of different organizational units. In the two previous phases, employees and teams had formed their own views about the emerging business model and its implications for Telco. However, these views were not necessarily aligned, and it was crucial to synchronize the efforts and create a common language and understanding of the cloud across the whole organization. Even with remarkable inefficiencies owing to the collision of differing views, the separated structure form facilitated formation of such a common language among members of different organizational units.

In spite of these positive outcomes, the need for another restructuring gradually emerged. The structure was becoming larger, and managing a large temporary organization over a long period proved to be problematic. There were neither clearly defined relationship with the organization, nor financial and budget plans, and the company needed to do one of two things: either to stabilize the temporary organization in the form of a new business unit, for example, or to make it more manageable within the existing structure. The strategic aim of going down the transformation path made the latter choice more appealing for the organization, and this served as the basis for the next

round of structural change. A summary of the characteristics of this phase and the challenges encountered is presented in 3-6.

Table 3-4- Key characteristics of the third phase of transition to Cloud business model

Phase 3: Independent separated structure	
Pursued strategic intent(s)	Radical substitution
Targeted outcomes	Building new Cloud-based networks
	Development of Cloud-based offerings for new markets
	Enabling public/private Cloud for business customers
	Evolution of the network products towards Cloud
Key roles	Senior managers
	Heads of business units
Key activities	Establishment of organization-wide projects
	Acquisition of new competences and partnerships
Organizational structure	A large separated structure
Key challenges encountered	**Illustrative quotation**
Resource allocation	*"… we should have projects instead of [existing setting for] Cloud programs; there is a difference in that. Programs become some sort of additional line organization without budget, without resources, without clear goal that tends to go on and on without making anything happens.*
Difficulties in coordination	*"… the process of running in the same direction and growing the program too fast, makes everyone running into different direction, so we start moving into one direction, then it stops and turns back and everyone runs in different directions. And that destroys the ongoing initiative and then we will be less productive and efficient and in the end it might risk everything."*

Phase 4 – Shrinkage of the separated structure and delegation of tasks: The strategic intent of transformation implied a need for increased integration of activities into the existing structures. The common language and goals that had been established in the preceding phases had also created a much better environment for synchronizing dispersed activities. Therefore, the management decided to shrink the extensive independent structure into a small steering group and to delegate the activities to the existing structures. In the new structures, the activities were planned and monitored

by the steering group, and the business units were responsible for accomplishing them. This setting was associated with far fewer organizational difficulties and, because of the common understanding and goals formed in the previous separated structure, the synchronization of activities was also less challenging. The small steering group was in place in order to ensure that the pace and direction of exploratory activities were in line with the strategic goals of the organization.

Table 3-5- Key characteristics of the fourth phase of transition to Cloud business model

Phase 4: Small separated project	
Pursued strategic intent(s)	Directed transformation
	Incremental evolution
Targeted outcomes	Development of Cloud-based offerings for new markets
	Enabling public/private cloud for business customers
	Evolution of the network products towards Cloud
Key roles	Senior managers
	Business unit managers
	Managers of product units
Key activities	Dividing the tasks between different organizational units and set up small projects to pursue the targeted outcomes
Organizational structure	Partially separated

In addition to directing and monitoring ongoing exploratory activities within the existing organization, the steering team focused on creating a solid strategy on the Cloud and its accompanying business model, using the knowledge acquired during this period. The transformation path of the organization needed to be carefully devised and evaluated. The strategy formulation activities were affected by intensive involvement in exploratory activities at an operational level, and such involvement was perceived to be decelerating for both strategic and operational activities. This highlighted a need to separate out these two tracks, implying yet another round of restructuring. A summary of the characteristics of this is presented in Table 3-7.

Phase 5 – Dissolution of the temporary organization and full integration of exploratory activities: During this period, for at least two reasons Telco's managers became convinced that the radical replacement of the existing business model was not as imminent as they had speculated in the past. First, internal activities on the Cloud had resulted in a high level of know-how on how the company could utilize the new opportunities to focus on an evolutionary path towards the Cloud and at the same time could start transforming part of the business model and offering limited Cloud-based products. Second, monitoring developments in the market and industry and the number of ongoing concerns in terms of security, legal issues, and many other factors convinced Telco managers that the value network was not moving in that direction as fast as they had expected. Progress in setting the strategy and ensuring that efforts were all going in one direction was sufficient for the managers to drop the temporary structure and use the official organization and line of command to manage two parallel processes of business model evolution and transformation. The fully integrated approach to a business model transformation process was followed thereafter, and while business units handled all the exploratory activities on the new business model, senior managers and business analysts took care of strategy formulation and communication. Returning to its 2009 structural form for the management of the Cloud after three years, Telco's Cloud initiative went through four rounds of restructuring allowing exploration to take place in line with the organization's strategic aims at each point in time. A summary of the characteristics of this phase and the encountered challenges is presented in Table 3-8.

3.7 Recursive cycles of strategy formation, restructuring, and organizational learning

This case study of Telco's engagement with the Cloud business model has highlighted a dynamic approach in structuring for business model transformation. When levels of uncertainty about the implications of the new business model were high, the company had to use incremental experimentation in order to try out various new ways of doing business. An important goal in such

circumstances is to preserve existing sources of competitive advantage, including routines and capabilities. Therefore, starting with a fully integrated structure for adopting a new business model seems a logical solution. For Telco, the fundamental differences between the existing and emerging business models and the dispersal of required resources served as sufficient reasons for structural separation. In the initial integrative structural form, not only was it very difficult to persuade the existing businesses to move to a different and sometimes opposite direction, but also the ambiguities of the new business model were a source of challenge for managerial decision-making on the direction of exploration. Starting with a rather conservative approach, the company defined a dependent structure within one of the business units and started experimenting with and developing new offerings based on the Cloud business model. Through learning by doing, the company formed a better picture of the requirements and prospects of the new business model and the knowledge accumulated during this learning process served as an input for revising the strategic intent of the organization.

Table 3-6 - Key characteristics of the fifth phase of transition to Cloud business model

Phase 5: Dissolution of separated structure and initiation of small embedded projects	
Pursued strategic intent(s)	Directed transformation
	Incremental evolution
Targeted outcome	Development of Cloud based offerings for new markets
	Enabling public/private Cloud for business customers
	Evolution of the network products towards Cloud
Key roles	Business unit managers
	Product unit managers
	Cloud project managers
Key activities	Following three different trajectories
Organizational structure	Integrated with small embedded projects

Phase 1: Screening and speculation	**Phase 2:** Embedded experimentation	**Phase 3:** Independent organization	**Phase 4:** Small independent organization	**Phase 5:** Dissolution of independent organization
Strategic intent: -Incremental evolution	**Strategic intent**: -Incremental evolution -Directed transformation	**Strategic intent**: -Radical substitution	**Strategic intent**: -Incremental evolution -Directed transformation	**Strategic intent**: -Incremental evolution -Directed transformation
Structural form: Fully integrated	**Structural form:** Semi-Integrated	**Structural form:** Fully separated	**Structural form:** Partly separated	**Structural form:** Fully integrated
Key roles: - Technology analysts - Researchers	**Key roles:** - Senior managers - A Business unit manager	**Key roles:** - Senior managers - Business unit managers - Cloud program manager	**Key roles:** - Senior managers - Business unit managers - Managers of product units	**Key roles:** - Business unit managers - Product managers - Cloud project managers
Targeted outcomes: -Evolution of the network products towards Cloud	**Targeted outcomes:** - Evolution of the network products towards Cloud - Enabling public/private cloud for business customers	**Targeted outcomes:** - Building new Cloud-based networks - Development of Cloud-based offerings for new markets - Enabling public/private cloud for business customers - Evolution of the network products towards Cloud.	**Targeted outcomes:** - Development of Cloud-based offerings for new markets - Enabling public/private cloud for business customers - Evolution of the network products.	**Targeted outcomes:** - Development of Cloud-based offerings for new markets - Enabling public/private cloud for business customers - Evolution of the network products.

Figure 3-3- Five phases of transition to Cloud business model in Telco (2008-2013)

Figure 3-3 presents a summary of discussions on the five phases of restructuring for the adoption of the Cloud business model at Telco.

The process of business model innovation revealed through this case study is based on the iterative cycles composed of three main components: strategizing, (re) structuring, and learning. In line with the uncertainties associated with the new business model, it was not viable for Telco to be definite about their strategic intent towards the cloud business model. Instead, they started with a tentative strategy, which was pursuing the Cloud as a complement to the existing business model, and

set the structure accordingly. After a period of experimentation, the learning outcomes provided feedback for the firm's strategy formation process, and this in turn directed the next round of restructuring and learning. This iterative process eventually led to a level of knowledge regarding the potential, impacts, and requirements of the new business model so that the managers could make a long-term decision about the strategic aim and match the structural form in order to facilitate the realization of the strategy. Figure 3-4 depicts this process.
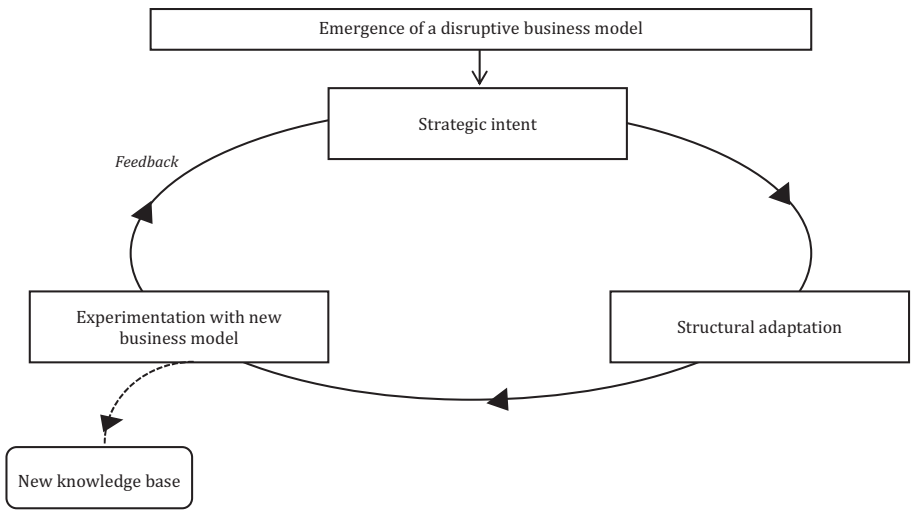
Figure 3-4- The relationships between strategy-making process and business model renewal

3.8   Discussion and Conclusion

When an established organization decides to move towards a potentially disruptive business model, how should it formulate its strategy effectively and how is the organizational structure affected during the transition process? Contrary to underlying assumptions within the existing literature on business model innovation, our observations show strategy formulation process to be as an emergent process based on experimentation and learning: organizations have a number of choices as to how they engage

with a new business model, and it is not possible to assess those choices in relation to strategic considerations and goals without experimentation. The business experimentation process has the potential to entail drastic changes in the strategic intent of the organization, and therefore demands recursive structural adaptations.

Drawing on the prior research that contends that in turbulent environments, it is not enough to plan and enforce deliberate strategies (Farjoun, 2002; Hutzschenreuter and Kleindienst; 2006; Mintzberg and Water, 198), this study illustrates how a strategy formulation process interacts with business model design and innovation. Telco's motivation for restructuring was primarily a consequence of the emergent nature of the firm's strategic intent towards Cloud. The knowledge accumulated through experimentation during the period of each structural form was the main input for updating the company's strategic intent and its subsequent restructuring in the Cloud initiative. Considering strategy-making as an iterative process that is influenced by and influences the structure (see Noda and Bower, 1996), we can see that Telco's intent towards Cloud and its accompanying business model underwent recursive evaluations and revisions. Perceiving the business model to be a complement and add-on to its existing businesses, Telco started with a fully integrated approach. After realizing the fundamental mismatches between the Cloud and existing routines and capabilities, Telco then considered developing the new business model independently and in parallel to the ongoing businesses of the organization. Eventually, the transformation path and structurally integrated approach to the Cloud business model were selected.

Drawing on the notion of ambidexterity as a firm's ability to pursue divergent activities concurrently (Gibson and Birkinshaw, 2004), we developed a process model for exploring a disruptive business model that is fundamentally different to the existing business model. Our findings suggest that while it is generally recommended that structural separation should be used with a new business model, this is in fact only valid in certain situations. The uncertainties associated with an emerging business model hindered deterministic decision-making on the nature of engagement with the new business model,

and experimental activities thus became the key means through which the organization accumulated knowledge and engaged with the Cloud business model. The structure of experimental activities followed the dynamic nature of strategic intent during this period and alternated in cycles between separation and integration. The findings extend other research findings that consider a role for dynamic structural alteration (Nickerson and Zenger, 2002; Siggelkow and Levinthal, 2003; Gulati and Puranam, 2009; Boumgarden et al., 2012) by linking the need for structural dynamism to the emergent nature of the strategy. Our findings reveal that Telco's organization had only some high-level strategic goals as guiding principles, and selection of alternative strategic intentions for dealing with the business model was realized through business experimentation process.

We discussed the role of structural adaptation as a primary means through which the incumbent drives experimentation, essential for dealing with an uncertain and emerging phenomenon (Thomke, 1998; Day and Schoemaker, 2000; Thomke, 2003; Edmondson et al., 2001; Fleming 2002; Lavie, 2006; Taylor, 2010; Crossan and Apaydin, 2010). The findings suggest that the ability to mobilize and to reorganize dispersed organizational resources plays a key role in successfully renewing the business model. This factor, in turn, is dependent on senior management's understanding of the need to revise the business model, despite the uncertainties that are associated with the benefits, and on the logic and the mechanisms of value creation that underlie a new business model.

The link between strategy and business models is another area to which our process study brings some additional clarity. Organizations have to decide whether they want to engage with a new business model, and when and how they want to do so. Making such decisions entails setting strategies – in our case study, a long and complicated process. When the uncertainties inherent in a new business model make it impossible for managers to set firm plans, incumbent firms can make use of experimentation that enables learning and helps to eliminate uncertainties. In cases of transition to non-disruptive and less radical business models, it may prove to be easier to form a strategic intent towards the new business model and to implement it. But it can be inferred that, irrespective of the

degree of uncertainty, the design and implementation of a new business model is a function of an organization's strategy at a given period in time.

3.9 Future work

This research shows why it is necessary to consider disruptive business models and their innovation processes differently. Much of the existing literature on business model innovation discusses the introduction of a new business model as an add-on to existing business models. This case study suggests that the way that an established firm manages a disruption to its business model, for example in terms of structuring, is quite different to what other research findings suggest when considering peripheral or complementary adaptations to the model. To reach a more comprehensive understanding of such differences, classifying business models in terms of, for example, their pace and degree of impact on the organization, seems to be an important direction for future research.

Our in-depth study elaborated the process of strategy making, structuring, and experimentation in a single established organization. Despite shedding light on overlooked aspects of business model innovation processes, the study is naturally limited in terms of its generalizability. In particular, factors such as organizational culture, market position, centralization and formalization, and leadership style seem to be influential for the process of business model transformation, and should be studied through multiple cases or industry surveys in order to compare effects and reach a more generalizable result. Additionally, such a survey could provide a better insight into the question of why some established firms are more successful than others in moving to a new business model. Furthermore, focusing on clear performance outcomes that can be used to evaluate the success or failure of an incumbent firm's approach to business model transformation will provide a better basis for judging the effectiveness of managerial decisions.

4   Study III: Value co-creation and exploratory innovation: The mediating roles of managerial attention and initiatives[3]

Abstract

The involvement of customers, also known as co-creation, is believed to affect the innovation performance of a firm. Indeed, past studies have provided ample support for the positive effects of customer involvement on product quality, innovation speed, and productivity; but the discussions on the effectiveness of co-creation for achieving radical innovations and the drivers of this relationship are less clear. By examining the effects of collaboration with customers on senior managers' attentiveness and behavior in favor of exploration, we advance the understanding of the link between customer co-creation and radical innovations. Analysis on six case studies and a survey of 131 companies adopting a similar emerging technology indicate a higher probability for exploratory innovation among the companies that co-create with their customers. Our findings further suggest that managerial attention and management innovation are two factors that mediate this relationship.

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[3] This Chapter is based on: Khanagha, S., Volverda, H., Oshri, I., Value co-creation and exploratory innovation: The mediating roles of managerial attention and initiatives (Under second round of review at *Long Range Planning*)

4.1　Introduction

Value co-creation with customers has been repeatedly discussed as a source of innovativeness and competitive advantage for organizations (e.g., Cook, 2008; Evans and Wolf, 2005; Prahalad and Ramaswamy, 2004a; Chesbrough, 2003; Fey and Birkinshaw, 2005; Laursen and Salter, 2006; and von Hippel, 2005). Prior research findings suggest that co-creation positively influences efficiency and speed of the innovation process, quality of the offerings, and a company's reputation and product image (Gupta and Wilemon, 1990; Lengnick-Hall, 1996; Carbonell et al., 2009). Moreover, co-creation is suggested to be a precursor of firms' knowledge exchange and combinatory capacity (Kogut and Zander, 1992; Nahapiet and Ghoshal, 1998; Nambisan, 2002) and, therefore, responsiveness to environmental dynamicity (Belderbos et al., 2004; Baker and Sinkula, 2007; Nambisan and Barron, 2011; Foss, Laursen and Pedersen, 2011). However, as the degree of dynamicity and uncertainty in an environment rises, benefiting from customer co-creation becomes more challenging. Prior findings suggest that in uncertain conditions, additional costs and challenges are associated with involving customers in the innovation process (Bowen and Jones, 1986; Laursen and Straler, 2006; Almirall and Casadesus-Masanell, 2010). From a different perspective, when a discontinuous technological change occurs, excessive focus on the customers' input may keep organizations blindsided in recognizing the sources of change that are not related to the existing customer base and, as Clayton Christensen (1997) argues, there would be a risk that companies become held "captive by their customers" and fail to cope with technological change (Christensen, 1997: p.18). To illuminate what would be the effective organizational choice for involving customers in the face of these two streams of favorable and unfavorable forces, a number of scholars investigated enablers and environmental conditions of benefiting from co-creation in the face of dynamism and turbulence (Bowen and Jones, 1986; Laursen and Straler, 2006; Carbonell et al., 2009). Still, despite the presence of strong theoretical support for the importance of senior managers in enabling an effective response to the environmental forces, the discussions that relate co-creation to the top management team's role are scarce. This paper develops a conceptual framework wherein senior

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managers' cognition and initiatives are essential in order to link customer involvement to competitiveness in a turbulent environment. We argue that, by triggering sufficient levels of managerial attention to the sources of dynamism and the introduction of novel managerial practices, value co-creation with customers supports the organizations' effective response to dynamism.

In this study, we focus on the industry dynamism infused by the emergence of Cloud computing in the IT industry and, through that, scrutinize how the involvement of customers may influence an effective response to this wave of change. We investigate the customer-supplier relationship in the IT sector that is traditionally characterized by customer lock-in to IT solutions because of the factors such as investments on the infrastructure and high costs of substituting the suppliers. Cloud, by minimizing the capital expenditures on IT infrastructure and by providing the possibility for extensive customization to the customers, has the potential to empower the customers of IT solutions in a way that they will no longer be locked in to any particular IT investment or solution and can conveniently pay only for what they need and as they use it. This trend, however, has severe implications for the value creation means and strategies of providers of IT solutions, and their response to the related opportunities and threats is not always homogeneous. We discuss two common strategies for embracing Cloud, either through utilizing it as an enabler of minor improvements in the existing offerings (exploitative innovation) or by a radical redefinition of products and services (exploratory innovation), where the latter approach enables organizations to redefine the architecture of their solutions and to better realize the full potential of Cloud. Throughout the paper, we seek to illuminate the antecedents of exploration focus in dealing with an emerging phenomenon. Drawing on the prior research that indicates a prominent role for senior managers in enabling adaptation in their organizations (Adner and Helfat, 2003; Thomas, 1988; Tushman and Rosenkopf 1996; Virany et al., 1992), we pay particular attention to the roles of managers in enabling exploration focus and investigate customer involvement as a potential trigger to managers' ability to perform such roles.

With this goal in mind, we explore the influences of customer involvement on two top management level measures: cognition and actions. Following prior research (Ocasio, 1997; Eggers and Kaplan, 2009; Maula et al., 2012), we measure cognition in terms of the amount of attention that senior managers devote to the environmental changes, i.e., Cloud, in this study. We operationalize managerial actions through the management innovation construct (Vaccaro et al., 2012) which measures the prevalence of the introduction of new managerial initiatives to the organization. First, this paper investigates the degree to which the direction of senior managers' attention and their tendency towards the introduction of new initiatives influence exploratory innovation in uncertain environmental conditions. Second, we examine the influence of value co-creation on the increased attentiveness of managers towards environmental dynamism and their focus on the introduction of managerial initiatives that enable exploratory innovation. We utilize the findings of prior research and our analysis on a multiple case study setting to explore the proposed relationships and to develop hypotheses that will be tested in the quantitative analysis.

In doing so, we make three contributions to the literature on strategy and organization. First, we highlight the positive effect of close interactions with customers on the ability of managers to recognize the value and importance of emerging technologies in general and, in particular, on their support for exploratory activities. Second, we find that, over time, companies that co-create with their customers have a tendency to introduce new initiatives to their organizations that are more accommodating to exploratory innovations. As such, value co-creation with the customers will be discussed as an antecedent for two organizational dynamic capabilities, i.e., managerial attention and management innovation. Finally, this study addresses a gap in the literature on the relationship between co-creation and exploratory innovation by investigating how working with customers in the innovation indirectly and through enhancing managerial capabilities results in exploratory innovation.

4.2   Theoretical background
Value co-creation and exploratory innovation

According to the extant literature, value co-creation can influence the innovative activities of organizations in a number of ways. First of all, co-creation makes it possible for firms to observe how their current products are actually being used, how they are failing to satisfy customer requirements and how small design changes might close this gap (Utterback, 1994). In addition, it enables customers to share their know-how about product improvement possibilities and new product functions when using/designing the product (von Hippel, 1988). Therefore, it is almost a truism that increased interactions with customers and a better understanding of their product usage gives rise to opportunities for continuous improvements in existing products (Grewal, Lilien, and Mallapragada, 2006; Xie, Bagozzi and Troye, 2008). Additionally, co-creation may lead to the improvement of internal processes, owing to the fact that co-creation leads to a faster speed-to-market of products (Joshi and Sharma, 2004; Sawhney, Verona, and Prandelli, 2005).

The above stream of research primarily discusses the relationship between co-creation and improvements in existing products or processes with the aim of meeting the needs of existing customers or markets, or exploitative innovations (Benner and Tushman, 2003: p.243; Danneels, 2002). However, it is widely acknowledged that, in order to survive, firms need to achieve exploratory innovations, which are breakthrough innovations aiming to meet the needs of emerging customers or markets (Benner and Tushman, 2003; Danneels, 2002). The need for exploration becomes even more important in dynamic environments (Jansen et al., 2006) where redefining product offerings and even business models is essential to firms' survival. However, the discussions on the effectiveness of co-creation for exploration provide mixed views that are not conclusive.

On the one hand, there are evidence for positive effect of customer orientation on exploration and variance seeking behavior. There are influential research works that highlight the effect of customer co-creation in search and knowledge absorption abilities, which are essential elements of

exploring emerging opportunities (Kogut and Zander, 1992; Nahapiet and Ghoshal, 1998; Nambisan, 2002). It is suggested that interaction with customers influences the knowledge search area and boundary spanning activities to move towards unexplored external sources and thereby improve a firm's outward-looking absorptive capacity (Foss et al., 2011). Carbonell and his colleagues (2009) found out that both technological novelty and turbulence are positively related to the degree of customer involvement.   Therefore, it seems that co-creation has the potential to increase organizations' abilities for exploratory innovation by better sensing and seizing opportunities in the dynamic environment.

On the other hand, another stream of research contends that too much listening to the customers is detrimental to exploration and dealing with changing environment. There are discussions on the costs and challenges that are associated with customer involvement in uncertain and complex situations. Exploratory innovations are by nature uncertain and target long-term profits of the innovator firm that are not necessarily beneficial for the collaborating customers. Bowen and Jones (1986) discuss the consequences of performance ambiguity and goal incongruence on co-creation costs which may decrease incentives for collaboration between innovators and business customers. This argument is supported by a more general finding that, when the complexity of the innovative activities is high, the return on the involvement of external parties diminishes as the coordination costs increase (Almirall and Casadesus-Masanell, 2010). In the same line, Laursen and Staller (2006) use empirical data to discuss an inverted U-shape relationship between external search activities and the innovative performance of an organization. From a different angle, Christensen (1997) analyses cases of customer-oriented companies who failed to understand the disruptive forces because of being excessively aligned with their customers' needs and plans. In short, the debate on when and how customer co-creation is helpful in dealing with environmental turbulence is still ongoing.

In response to the mentioned divergence in findings, academic scholars have tried to illuminate organizational enablers and other factors that may influence exploration that result from

customer co-creation. This stream of research provides evidence for the influence of co-creation on knowledge search and responsiveness of organizations in turbulent times (e.g., Laursen Staller, 2006; Foss et al., 2011; Carbonell et al., 2009). In this research, first we draw on the existing literature on the important role of managers in enabling exploratory activities and, on that basis, postulate co-creation with customers as an influential factor that enables exploration through pervading managerial attention and initiatives. Through a case study, we seek to explore and provide a better understanding of the interplay between these factors. Following, we use the qualitative analysis in combination with prior research findings to develop hypotheses that will be tested in the quantitative analysis.
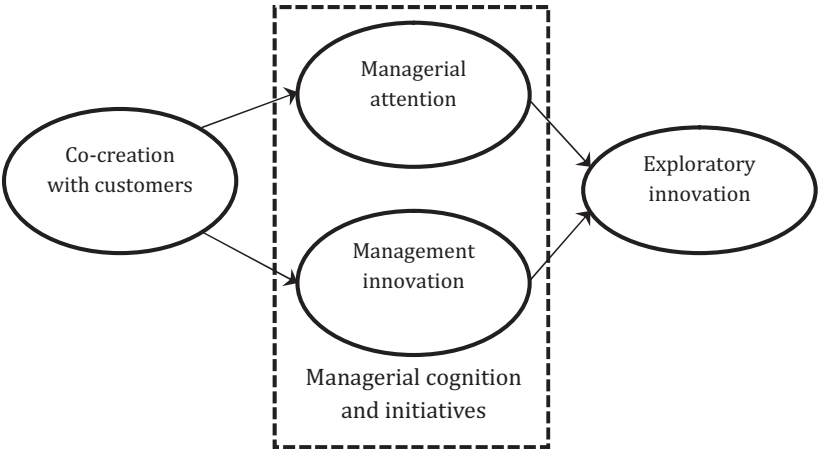
Figure 4-1- Theoretical Framework

4.3   Data and method

We applied a multi-method approach to examine in which organizational conditions managerial attention has more influence on the adoption of a radical new technology. Using a multi-method approach is useful for gaining an in-depth understanding of a phenomenon (Hodson, 2004). An important advantage of this approach is that it provides a means to confirm or disconfirm, cross-

validate or reject, and corroborate or contradict evidence from multiple angles, so enhancing theoretical validity (Creswell, 2008). Combining strengths from both quantitative and qualitative techniques of data collection and analysis is particularly advantageous for fine triangulating results and enhancing the rigor and robustness of the research deliverables (Creswell, 2008). This study started with a qualitative study based on a multiple case study setting among six firms in order to contrast the potential reasons for differences in their responses to the emergence of the new technology and subsequent shifts in markets. We utilized the results of the qualitative study in conjunction with the findings from the relevant prior research to develop hypotheses.

In order to get a more thorough understanding of the practice of management innovation, to identify best practices of the operationalization of each management innovation type and to assess which management innovation types (Vaccaro et al., 2012) were influential in accommodating co-creation to result in exploratory innovation, the quantitative analysis was followed up by a qualitative analysis. The qualitative research was carried out in the form of multiple case studies, focusing on several companies that are similar in many of the variables but different in terms of the variables that we measured in the quantitative study. The qualitative research allowed the collection of detailed and in-depth data that contributed to gaining insights as to what types of management innovations played a role in linking co-creation and exploratory innovation, while it was also used as a way to validate outcomes of the quantitative analysis.

The qualitative analysis started with interviews with several Cloud computing experts to gain further understanding of what role co-creation and management innovation played in the Cloud computing context. We selected cases in companies that are similarly affected by Cloud as an emerging phenomenon, but have different approaches in the exploration of related opportunities. We selected three companies with a more exploratory focus and three companies which had lower degrees of exploratory activities on the Cloud. In total 22 individuals participated in the research, representing six companies; a summary of cases that participated can be found in Table 1. The case studies were

conducted using semi-structured interviews, which allowed a flexible interview process, enabling the researcher to pick up and ask follow up questions based on the statements made by interviewees that were of particular interest to the study. All the interviews were fully transcribed and coded by two researchers. The analysis on the qualitative data was used in combination with the literature review to develop hypotheses.

Next, we performed an online-survey among the population of Dutch adopters of Cloud computing to test the proposed theoretical framework. Through collaboration and interaction with a large professional Cloud computing community in the Netherlands, a sample of 962 companies active in Cloud computing was identified. 299 of members of the population were accessible through email and a total of 131 completed the survey. The respondents had an average tenure of 6.76 years (S.D. = 5.99). 25.1% of the companies represented had 48 or fewer employees, while 50.3% of the companies had 160 employees or fewer, and 79.0% had 3000 employees or fewer.

To control for varying responses between early and late respondents, model variables were compared for early and late respondents. T-tests did not reveal any significant differences ($p < 0.01$). Additionally controlling for single-source bias, second respondents were included, first and second respondents were compared but no significant differences ($p < 0.05$) were found. To control for non-response bias, company size for respondents and non-respondents was compared; also here no significant differences were found ($p < 0.05$). Additionally, secondary data from company reports, press and news, and official websites were used to triangulate some self-reported scales.

4.4   Research context

Cloud computing is "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Zhang, Cheng and Boutaba, 2010). Companies no longer need to be concerned either

about over-provisioning for a service where popularity might not meet their predictions, and so wasting costly resources, or for under-provisioning for one that becomes wildly popular, thus missing potential customers and revenue. This elasticity of resources, without paying a premium for large scale, is "unprecedented in the history of IT" (Armbrust, Fox and Griffith, 2009).

Cloud computing represents a convergence of two major trends in information technology – (1) IT efficiency through highly scalable hardware and software resources and (2) business agility, through rapid deployment, the usage of computer-intensive business analytics and mobile interactive applications that respond in real time to user requirements (Marston, Li, Bandyopadhyay, Zhang, and Ghalsasi, 2011; Smith, 2009). In addition to these direct effects, Cloud is believed to have more fundamental effects on a range of industries and markets. Cloud-based platforms can bring together disparate groups of people and enable them to collaborate and share resources, information and processes. Owing to the increased possibility of storing tremendous amounts of data on customers, companies have a valuable asset in hand that could also possibly boost innovation. Moreover, companies can make the data they store on customers even more valuable when they find a way to enable two-way communication with their customers, or when the entire supply chain is involved in this information exchange (Berman, Kesterson-Townes, Marshall, and Srivathsa, 2012).

The above discussion highlights multiple ways through which Cloud can benefit adopting organizations. In broad terms, it has the potential to make the legacy IT infrastructure more efficient and scalable, enabling more profitability, speed, and quality in a firm's portfolio of offerings. At the same time, Cloud has the power to enable the radical redefinition of businesses, for example by turning vendors of infrastructure equipment to service providers (e.g., Amazon.com). While there are many factors that influence the decisions to opt for one of these two (radical or incremental) approaches in adopting Cloud, the full realization of Cloud potential mandates a fundamental reorientation of businesses and, hence, sustaining competitive advantage requires going beyond efficiency-oriented and incremental utilization of Cloud in the legacy systems.

4.5 Management level enablers of exploratory innovation

A recurrent observation during the qualitative phase was the role of managers in motivating and enabling exploratory activities within the organizations. The companies with a prominent focus on exploratory activities provided clear indication of the managers' role in their respective organizations' focus on utilizing Cloud beyond their existing goals and plans. In contrast, three organizations with less focus on exploration were the ones in which Cloud initiative was considered a peripheral activity, usually driven by a number of interested individuals without an active role by senior managers of the organizations. The role of managers in enabling effective responses to environmental forces has been pointed to by a number of scholars. The summary of findings is presented in Table 2 and will be discussed in more detail in the following sections.

Inasmuch as the decisions concerning such movements are associated with subtle risks and uncertainties, there would be a prominent role for managers in the effective reorientation and renewal of organizations (Tushman and Rosenkopf, 1996; Adner and Helfat, 2003; Eggers and Kaplan, 2009). Senior managers shape the otherwise challenging connection between changes in the environment and internal organization by defining and legitimizing particular decisions and actions (Eggers and Kaplan, 2009). The ability to align the internal organization in accordance with external sources of change, or firms' dynamic managerial capabilities, enables the reconfiguration of competencies and other resources in the organization to sustain competitiveness (Adner and Helfat, 2003). The findings of the qualitative study highlighted two distinct yet related set of management capabilities that influence the exploratory orientation of the organizations in response to dynamism. In the following section, we discuss these two capabilities, namely managerial attention to dynamism and management innovations, in connection with motivations and abilities for exploratory innovation.

4.6 Managerial attention and exploratory orientation

One of the interesting findings in our qualitative analysis concerns the fact that among our focal companies, the exploratory-focused organizations unanimously had CEO or board members as prime advocates of Cloud initiatives. According to the interviewees, this involvement of senior managers proved to have a number of contributions to exploratory oriented firms. Firstly, given the intensity of resource requirements when exploring an emerging field, they had far less difficulties in securing the requirements of experimentation and learning. Secondly, the drivers of Cloud initiatives did not experience much resistance from other members of the organization when exploring the Cloud, although their ambitions were not aligned with their key value creation activities. In contrast, difficulties in securing resources and in overcoming resistance in the organization were clearly more prominent in the three case studies with less exploratory focus. In these organizations, because managers did not support Cloud as a strategic priority or at least did not communicate such a priority using formal and informal means, only a few employees based on their job description or personal interest seriously allocated time for exploration.

Extant research also provides support for the importance of managerial cognition in enabling effective reorientation and responding to forces in the environment. Managers' perception of the nature of change has a key role in aligning internal and external environments (Ocasio, 1997; Barr, 1998; Cho and Hambrick, 2006; Kaplan et al., 2003; Eggers and Kaplan, 2009). When environmental turbulence increases, the cognition of managers becomes even more influential on the direction and intensity of exploratory activities, primarily because of rigidities in firms' resources that result in a lack of incentives to invest in long-term oriented investments (Gilbert 2005). When senior managers more effectively search and acquire new knowledge they can better guide the search process in the organization and, through that, enable a more effective response to the uncertain waves of change (Li et al., 2012). Through the search process and depending on how much of the resources and

capabilities of the organization retain their value in a new regime, managers may find it attractive to explore the possibilities for innovation in an emerging field (Eggers and Kaplan, 2009).

During the interviews the role of managers' cognition and their perception of the nature of Cloud's implications were also brought up by the interviewees. Senior managers were usually mentioned as the ones who create an exploratory focus in the organization. As one of the key drivers of Cloud initiatives mentioned:

"[Our new senior manager] was very disappointed with [our progress with] Cloud […] she was seeing the industry progressing very quickly at and we were kind of lagging behind. So, basically, she gave the mandate to create what is now our Cloud program."

We observed that, in the exploratory focused organizations, the attention of senior managers is not merely in the form of providing general directions but they also become intensively involved in the details of the activities of those people dealing with the emerging technology. One of the key informants described this involvement as follows:

"The CEO is sometimes personally involved in what we are doing [on Cloud]. That's pretty much remarkable for a relatively small department."

Therefore, according to prior research as well as our interview findings, managerial cognition is a key determinant of the strategic decisions that concern the nature and intensity of exploration in emerging technologies and therefore, we argue:

Hypothesis 1: Managerial attention to the dynamism is positively related to exploratory innovation in emerging technology fields.

4.7 Management innovation and exploratory orientation

It is not only managers' attention to emerging opportunities and their predictable responses, such as aligning strategies and directing resources, that influence firms' willingness and ability to

explore. According to the case studies, the three exploratory oriented organizations had devised a number of systems, structures, processes, and put practices in place that were carefully designed or evolved to cope with the requirements of exploratory activities. These initiatives included temporary organizations and linkages to accelerate and facilitate exploration, novel mechanisms to make use of internal and external information and ideas, new incentive schemas, and so forth. In comparison, in the second group of companies that indicated low levels of exploratory activities, it was difficult to identify such managerial initiatives that are essential for experimentation and learning in the Cloud context with a focus on the long-term benefits for the organizations.

Management innovation, defined as the introduction of novel systems, structures, processes, and practices (Birkinshaw et al., 2008), is one of such dynamic managerial capabilities (Gebauer, 2011) that is found to be influential on productivity growth (Mol and Birkinshaw, 2009) and on firm performance (Gruber and Niles, 1972; Walker, Damanpour and Devece, 2011) in the face of change. Prior research contends that exploration in an emerging field has certain requirements that call for novel managerial initiatives (Fleming, 2002; Khanagha et al., 2013). Management innovations that enable explorations tend to favor decentralized structures, flexible work processes, informal roles, functional differentiation, decreased administrative intensity, and changes in external and internal communication (Damanpour, 1991; Jansen, Van Den Bosch and Volberda, 2006; McGrath and Macmillan, 2000; Veryzer Jr, 1998; Birkinshaw et al., 2008).

From a knowledge perspective, it has been argued that exploratory innovations are concerned with working with knowledge areas that are distant from the existing knowledge base of the organization. While existing organizational routines tend to become strong in recognition, assimilation, and utilization of knowledge in familiar areas, they act as a filter for unfamiliar and emerging areas (Henderson and Clark, 1990; Dougherty, 1991). Organizational routines are rooted in existing systems, structures, processes, and practices and, therefore, the introduction of managerial

initiatives becomes crucial for overcoming the inability to learn which has been caused by established routines.

In the interviews, several informants discussed how new managerial initiatives supported their exploration in the emerging technology field. This influence occurred in a number of ways. For example, new initiatives supported and facilitated collaboration across functions and technical disciplines of an organization that is developed around existing technologies. In the case of Cloud, close collaboration between sales and front-line employees, technical staff, and business and strategy people was crucial for enabling exploratory activities. This requirement was fulfilled by the presence of structures and processes that enabled and facilitated cross-function collaboration. As one of the interviewees mentioned:

"One of the things we have arranged for this (inter-departmental communication) is that we use intranet to provide employees opportunities to share their ideas with the right person. So if an employee sits with a customer and they collectively develop an idea for an innovation, that employee will look up on the intranet the person he should connect with in order to make sure that this idea leads to an innovation."

More examples of such initiatives are presented in Figure 4-2. Based on the above discussion, we argue:

Hypothesis 2: Management innovations will be positively related to exploratory innovation in emerging technology fields.

4.8 Managerial influences as the links between co-creation and exploratory innovation

The next step for the development of our theoretical framework concerns the origin of the discussed dynamic capabilities, managerial attention and initiatives that enable exploration in an emerging technology context. Therefore, we investigated the cases and analyzed them in the light of

prior research findings to discover potential enabler(s) of managers' attentiveness to external sources of dynamism and their development and implementation of exploratory oriented initiatives. A common feature of exploratory oriented organizations is their relationships with external parties, particularly with their customers. These companies have a higher tendency to work with their key customers in partnership terms, and their innovation processes are to a high extent driven by customer and market generated data. In contrast, the other group of companies indicated a higher focus on internally driven R&D and their relationships with customers are relatively less of a partnership in nature. Our further investigation suggested that such a focus on customers is a prominent enabler of managers' attentiveness to Cloud and the existence of exploratory oriented initiatives in our focal companies.

Mediating role of managerial attention

Emerging technologies are often inconsistent with the key means of value generation in the incumbent organizations, as they make obsolete core competencies that firms develop through long periods of time and necessitate the development of a totally new set of capabilities (Gilbert, 2005; Taylor and Helfat, 2009). For the same reason, Cloud is associated with threats for many of the established providers of IT infrastructure and services and this naturally affects the perception of senior managers and decision makers in such organizations. Our qualitative analysis indicated that organizations that are less focused on customer interactions and relied more on internal sources in their innovation process tend to have a less radical perception of the influences of Cloud and, consequently, are more inclined to utilize Cloud merely as a means to improve their existing offerings. In contrast, the decision makers of companies with closer relationships with buyers of IT services have a different perception in accordance with their higher level of understanding of the customers' values. This perception guides them towards the radical reconsideration of the logic and the architecture of their product and service offerings. Although supplier companies are similarly influenced by the potential devaluation of their existing offerings and competencies, the ones with a

focus on value co-creation sooner realize emerging trends and have the opportunity to align to the market trends quicker than their rivals. During the interviews, it was repeatedly mentioned that senior managers or other key employees have realized the importance of Cloud during interactions with their counterparts in customer companies and this realization has greatly influenced the ambitions of their Cloud initiative. For this group of companies, strategic relationships with customers served as an important source of information that are typically prioritized over internal conversations and, hence, are more powerful in attracting managers' attention.

The impact of customer-related knowledge on managers' attention to change has been discussed in prior research work. Senior management's attention to specific areas is quite likely to be triggered by interactions with the customers and such inspirations have the potential to influence the innovation and product development activities (Li, Maggitti and Smith, 2012). Such influences that are originated from external triggers are expected to be valuable for the long-term focused activities of the organization and exploratory activities. Exploratory innovations in the face environmental change rely on the acquisition and realization of new knowledge and a departure from existing knowledge (Benner and Tushman, 2002; Levinthal and March, 1993; McGrath, 2001; Jansen et al., 2006) and the origin of such movements is often related to changes in the preference of customers and structure of the market (Jansen et al., 2006) which is difficult to monitor without interaction with customers. Customer involvement amplifies the recognition and utilization of customer knowledge and is likely to increase the ability for sensing weak signals of the market or technology changes that are likely to be neglected otherwise (Thomke and von Hippel, 2002). Additionally, in the presence of competing trends and factors that utilize attention-based resources of the firm, customer inputs may serve as an important leverage to create a sense of urgency for responding to the emerging changes in the market. Therefore, co-creation with customers is likely to increase the alignment between senior management's perception and shifts in markets and this perception in turn balances the organization's activities in favor of exploration.

In our interviews we also realized how close collaboration with the customers is a key trigger for managers' attentiveness to Cloud. In one of the cases, the company started the Cloud initiative with an exploitative focus, but through interaction with the customers their senior managers recognized the need for reorientation of the initiative towards exploration. This was also a common feature among attentive senior managers that they had close interactions with a number of strategic customers who were seeing Cloud as a big phenomenon and were expecting a response from the supplier companies in line with their visions. Based on the above discussion, we argue:

Hypothesis 3: Managerial attention mediates the relationship between value co-creation and exploratory innovation in emerging technology fields.

Mediating role of management innovation

Besides increasing attention and involvement of senior managers, involvement with customers was indicated as an important reason for having initiatives in place that our focal exploratory focused organizations were using as a basis for experimentation in Cloud. We asked about the systems, structures, processes, and practices that they utilized for experimentation with Cloud and enquired about the origin of such initiatives. The responses quite frequently referred to the way they worked with their customers in the partnership relationship and how they put initiatives in place to ensure customer input in the innovation process. The empowerment of decentralized teams that work with customers is an essential pillar of their relationship. Such practices rely on the delegation of responsibility that ensures customer input will be utilized effectively and will not get lost in the hierarchy and in competition with competing internal matters. Moreover, the interviewees mentioned how they were used to experimental practices for product development and innovation processes when working on joint projects with the customers. In contrast, organizations that primarily relied on internal sources of knowledge that can be utilized inside their own premises did not possess the required experimental tools and processes to work with their customers.

There are indications in the literature that strengthens our findings about the influence of customer relationship on the introduction of experimental initiatives in the organizations. Indeed, customer value co-creation is quite often associated with triggering novel initiatives in the organizations that are by nature nurturing to exploratory activities. "If companies want to use co-creation successfully it will require a major overhaul of the traditional governance systems and organizational structures of the company" (Prahalad and Ramaswamy, 2004a). The introduction of new practices for communication with customers and the integration of knowledge gained from the customer into the firm (Bowen, 1986; Prahalad and Ramaswamy, 2004b; Payne et al., 2009; von Hippel, 2005), and devising structures and rules that facilitate interactions with customers (Campbell, 2003; Koka and Prescott, 2002; O'Hern and Rindfleisch, 2010) are features of the value co-creation business model. Such new initiatives are influential on the knowledge search and utilization abilities of the organization. By enhancing gatekeeping (Allen, 1977; Allen and Cohen, 1969; Tushman and Katz, 1980) abilities of the organization, customer-oriented managerial practices enable outward orientation in the search for knowledge (Foss et al., 2011) and increase the likelihood of radical innovation. Moreover, iterative approaches in innovation and use of experimentation are common features of customer co-creation practices that are also helpful for exploration purposes.

Several of the interviewees referred to customer involvement as the direct or indirect origin of the initiatives that were supporting exploration in the Cloud context. For example, turning customers' input to innovation requires structures, processes, and communication channels that cut through the functions of the organization. When dealing with Cloud as an emerging technology, such provisions were key enablers of exploratory activities as well. For example, experimental processes that are crucial for exploratory activities are also essential tools for innovating with the customers. One of the informants explained it as follows:

"… The customer needs are unknown; we need to face unknown challenges and we must learn and experiment so we can develop a standard process again."

Therefore, we argue that:

Hypothesis 4: Management innovation mediates the relationship between value co-creation and exploratory innovation in emerging technology fields.

Figure 4-1 depicts the conceptual model of the hypothesized relationships. An extended version of the theoretical framework in connection with representative quotations from the case studies is represented in Figure 4-2.

Table 4-1- Description of Cases and Informants

Firm	Number of employees	Number of informants	Position of informants	Exploratory activities based on Cloud
A1	350	4	-CEO -Manager, Infrastructure -Manager, End-user Automation -Manager, Strategy & Innovation	No
A2	35	4	-Product Manager -Account Manager -Project Manager -Lead Developer	No
A3	290	3	-CIO-Manager ICT -Manager Customer Service	No
B1	2200	4	-Product Marketing Director -Managing Director -Customer Care Manager -Technology Director	Yes
B2	610	3	- President -Chief Strategy Officer -Director Sales & Marketing	Yes
B3	26000	4	-Manager Cloud Services -Innovation Manager Cloud Businesses -Director SaaS -Senior Manager	Yes

4.9 Measures

Co-creation. Prahalad and Ramaswamy (2004b) provided the four building blocks of co-creation: dialogue, access, transparency and risk. Based on this work O'Hern and Rindfleisch (2010)

defined four distinct types of customer co-creation: (1) collaborating, (2) tinkering, (3) co-designing, and (4) submitting. Collaborating was defined as a process in which customers have the power to collectively develop and improve a new product's core components and underlying structure; tinkering was defined as a process in which customers make modifications to a commercially available product and some of these modifications are incorporated into subsequent product releases. Co-designing was defined as a process in which a relatively small group of customers provides a firm with most of its new product content or designs, and a larger group of customers helps select which content or designs the firm should adopt. Submitting is defined as a process in which customers directly communicate ideas for new product offerings to a firm. We combined these four measures of co-creation with the relationship learning scale developed by Selnes and Sallis (2003). A seven-item scale was developed ($\alpha = 0.89$), asking to what extent the respondents agreed with the following statements: (1) they collaborate with customers to collectively improve or develop new products/services, (2) their customers directly communicate ideas for new product/service offerings to their firm, (3) they share information with customers in a two-way communication to make their product offerings more valuable, (4) customers' inputs are used to determine which products/services should be offered/pursued further by the firm, (5) they collaborate with customers to come up with solutions for problems related to their product offerings, (6) they collaborate with customers to track changes in consumer needs, preferences and behavior, (7) their relationship with external parties/customers has resulted in actual new/improved products or services.

   Management innovation. The scale developed by Vaccaro, Jansen, Van Den Bosch and Volberda (2012) was utilized for measuring the tendency of the organizations for introducing new systems, processes, and practices. Following the definition and insights provided by Birkinshaw and his colleagues (2008), this scale measures changes in six organizational areas: rules and procedures, employees' tasks and functions, management systems, compensation policy, the intra- and inter-

departmental communication structure and organizational structure. The resulting six-item scale for management innovation ($\alpha = 0.91$) was used.

Managerial attention. Following several prior studies that have used frequency of references to major discontinuities in formal communications as measures of management cognition (Barr, 1998; Eggers and Kaplan, 2009; Gerdes, 2003; Kaplan, 2008; Kaplan et al., 2003; Osborne et al., 2001; Schnatterly, 2003; Maula et al., 2012), we requested the respondents to report the degree to which Cloud computing is being referred to in internal and external communication means (such as annual reports, exhibitions, internal speeches, etc) by senior managers on a Likert scale. We further enquired if the respondents believed their senior managers considered Cloud as a strategic phenomenon to their organization. The resulting three-item measure for managerial attention ($\alpha = 0.85$) reflects the degree to which senior managers perceived and communicated Cloud computing as one of the strategic priorities for their respective organizations. We used the company publications and reports, press news, and senior management related contents in the websites to verify the validity of self-reporting items on managerial attention. We scored indications of senior management involvement in Cloud in each of the three sources into three categories, Low, Medium, and High, and calculated an average score for managerial attention according to this measure. Contrasting the calculated scores with the self-reported scale indicated a high degree of correlation between the two measures ($r = 0.53$, $\rho < 0.001$).

Exploratory innovation. To measure exploratory innovation in the Cloud context we used the scale developed by Jansen, Van Den Bosch and Volberda (2006). It captures whether organizations deviate from existing knowledge and pursue radical innovations for emerging customers or markets. The respondents were asked about the extent to which: (1) the organization accepts demands that go beyond existing products and services; (2) they invent new products and services; (3) they experiment with new products and services in their local market; (4) they commercialize products and services that are completely new to the firm; (5) they utilize new opportunities in new markets; (6) they use

new distribution channels; and (7) they search and approach new clients in new markets. We averaged the items to create a composite index for exploratory innovation ($\alpha = 0.93$).

Control variables. In order to account for potential alternative explanations, several control variables were included. As several studies have claimed that the size of a company may influence its innovation outcomes, since they have more resources but may also lack the flexibility to explore (e.g., Pierce and Delbecq, 1977), we included the natural logarithm of the number of full-time employees within the organization to account for firm size. Additionally, the nature of the company in relation to Cloud computing is likely to have implications on their orientation towards exploratory innovation. Four main types of companies are identifiable, namely Cloud providers, Cloud brokers, Cloud buyers, and Cloud enablers/consultants. While each of these companies may utilize Cloud computing in both exploratory and exploitative ways, we controlled for their roles in the statistical model. Moreover, given the existing empirical support for the effect of match between product-market strategy and business models on a firm's performance (Zott and Amit, 2008), we controlled for the effects of the firm's strategy towards Cloud computing. In doing so, we distinguish between the companies who consider Cloud as a means to increase their operational efficiency or serve existing markets in a better way (defensive market strategy) and the ones who use it to expand in existing markets or totally new markets (aggressive strategy).

4.10 Data analysis

Table 3 presents the descriptive statistics and correlations between the variables studied. Table 4 shows the results of the regression analyses with exploratory innovation as the dependent variable. Eight models were specified in this analysis (see Table 4). The first, third, and fifth models include only the control variables with three different dependent variables. In models 2, 4, and 6 co-creation is included to test its direct effect on managerial attention, management innovation, and exploratory innovation respectively. In model 6 and model 7, managerial attention and management innovation

are added to test their mediation effect on the relationship between co-creation and exploratory innovation. To check the potential multicollinearity in the statistical models, we computed variance inflation factors (VIF) and tolerance values to further assess whether multicollinearity was a concern in our sample. All values were below the cut-off VIF value of 3 and well above the tolerance values of 0.2 (Neter, Wasserman and Kutner, 1990).

Models 2 and 4 confirm the necessary conditions for mediation effects that we tested by models 7 and 8. In model 2, co-creation shows a significant effect on managerial attention ($\beta = 0.20$; $p < 0.05$) and model 4 indicates a similar but even stronger relationship between co-creation and management innovation ($\beta = 0.44$; $p < 0.001$). In model 6, we test the direct relationship between co-creation and exploratory innovation and the results do not reject the positive significant relationship between two variables ($\beta = 0.35$; $p < 0.001$).

In model 7, we add managerial attention and the results support our first hypothesis on the positive influence of managerial attention on exploratory innovation ($\beta = 0.30$; $p < 0.05$). In model 8, we include management innovation instead and again the results indicate a strong relationship ($\beta = 0.69$; $p < 0.001$). Therefore, our second hypothesis on the relationship between management innovation and exploratory innovation is also supported by our model.

Table 4-2- Summary of Qualitative Analysis

Variables of interest	Case study companies						Observed indications
	A1	A2	A3	B1	B2	B3	
Exploratory innovation	☒	☒	☒	☑	☑	☑	- Focus on developing radically new offerings and services - Redefining the architecture of their products and services - Searching for and utilizing new markets, channels, and business models - Experimentation with new offerings in pilot markets
Managerial attention	O	◗	O	●	●	●	- Having CEO or a board member as the driver or sponsor of Cloud initiative - References to Cloud in formal and informal conversation
Management innovation	◗	O	O	●	◗	●	- Delegation of responsibilities to innovation teams - New structures for linking cross function innovation activities - Incentive systems that support incorporation of customer input - Procedures to ensure customer involvement in the innovation process
Customer co-creation	◗	O	O	●	◗	●	- Having customers as partners - Formal involvement of customers in early stages of innovation process

☒ : Presence of variable
☒ : Absence of variable

O : Low level
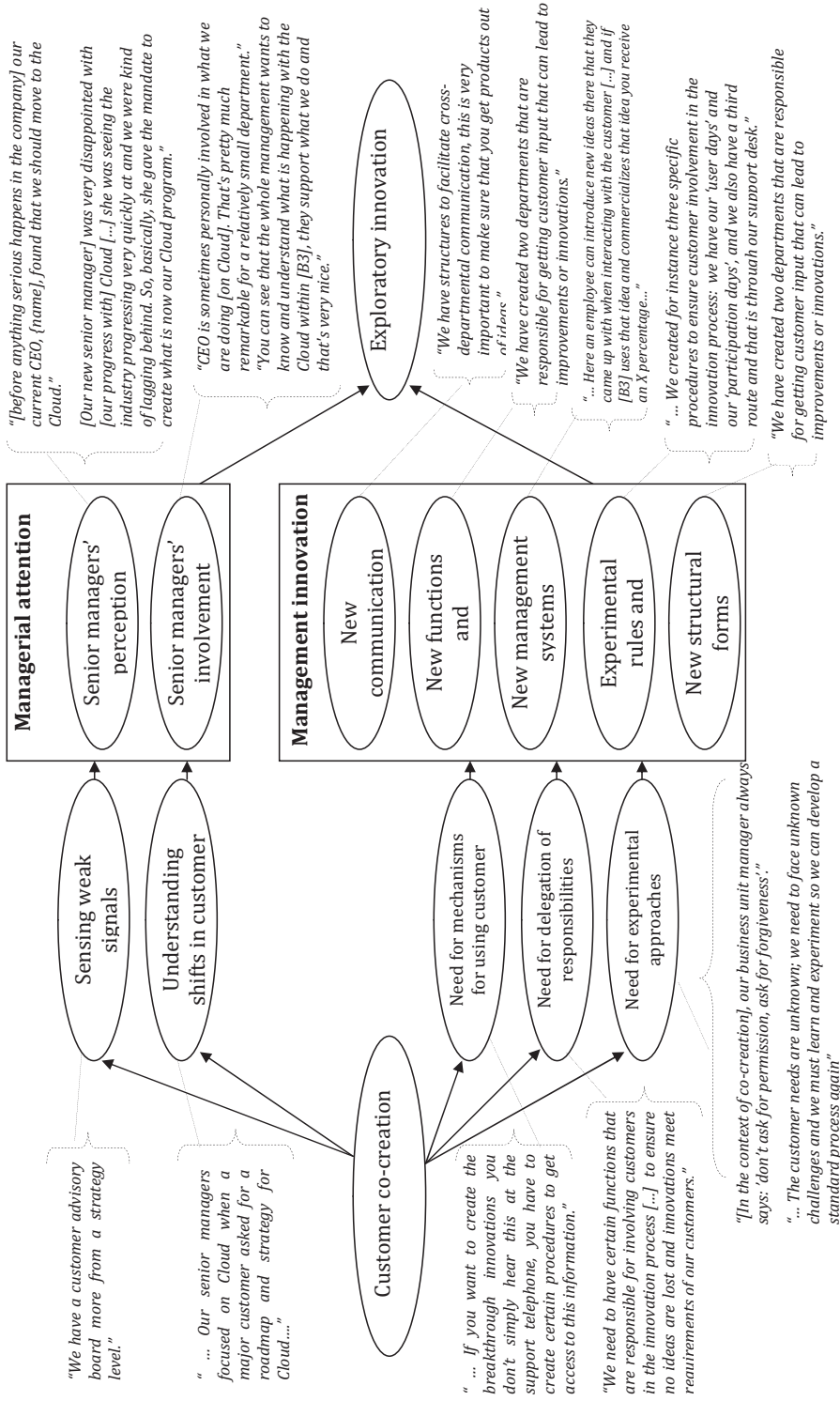◗ : Medium level
● : High level

Managerial attention

- Senior managers' perception
- Senior managers' involvement

Management innovation

- New communication
- New functions and
- New management systems
- Experimental rules and
- New structural forms

Sensing weak signals

Understanding shifts in customer

Need for mechanisms for using customer

Need for delegation of responsibilities

Need for experimental approaches

Customer co-creation

Exploratory innovation

"[before anything serious happens in the company] our current CEO, [name], found that we should move to the Cloud."

[Our new senior manager] was very disappointed with [our progress with] Cloud [...] she was seeing the industry progressing very quickly at and we were kind of lagging behind. So, basically, she gave the mandate to create what is now our Cloud program."

"CEO is sometimes personally involved in what we are doing [on Cloud]. That's pretty much remarkable for a relatively small department."

"You can see that the whole management wants to know and understand what is happening with the Cloud within [B3], they support what we do and that's very very nice."

"We have structures to facilitate cross-departmental communication, this is very important to make sure that you get products out of ideas."

"We have created two departments that are responsible for getting customer input that can lead to improvements or innovations"

"... Here an employee can introduce new ideas there that they came up with when interacting with the customer [...] and if [B3] uses that idea and commercializes that idea you receive an X percentage..."

"... We created for instance three specific procedures to ensure customer involvement in the innovation process: we have our 'user days' and our 'participation days', and we also have a third route and that is through our support desk."

"We have created two departments that are responsible for getting customer input that can lead to improvements or innovations."

"We have a customer advisory board more from a strategy level."

" ... Our senior managers focused on Cloud when a major customer asked for a roadmap and strategy for Cloud...."

" ... If you want to create the breakthrough innovations you don't simply hear this at the support telephone, you have to create certain procedures to get access to this information."

"We need to have certain functions that are responsible for involving customers in the innovation process [...] to ensure no ideas are lost and innovations meet requirements of our customers."

"[In the context of co-creation], our business unit manager always says: 'don't ask for permission, ask for forgiveness'."

" ... The customer needs are unknown; we need to face unknown challenges and we must learn and experiment so we can develop a standard process again"

Figure 4-2- Mechanisms for Mediation Role of Managerial Attention with Representative Quotations

Table 4-3- Mean, Standard Deviations, and Correlations

	Mean	s. d.	1	2	3	4	5	6	7	8	9	10	11
1. Size [b]	2.18	1.27	-										
2. Cloud provider	0.65	0.48	0.11	-									
3. Cloud buyer	0.25	0.43	0.04	-0.21**	-								
4. Cloud broker	0.14	0.35	0.02	-0.49**	-0.16*	-							
5. Cloud enabler/consultant	0.20	0.40	0.06	0.10	0.38**	-0.13	-						
6. Strategy: expansion	0.63	0.48	0.13	0.35**	-0.22*	-0.05	0.15	-					
7. Strategy: defensive	0.37	0.48	-0.02	-0.25**	0.29**	0.00	0.03	-0.79**	-				
8. Customer co-creation	4.06	0.59	0.02	-0.08	0.08	0.00	-0.12	-0.09	0.10	(0.89)			
9. Managerial attention	4.13	0.90	0.04	0.26**	-0.44**	0.08	-0.01	0.39**	-0.32**	0.18*	(0.85)		
10. Management innovation	3.42	0.97	0.05	-0.10	0.03	0.11	0.09	0.13	-0.13	0.34**	0.29**	(0.91)	
11.Exploratory innovation	3.76	0.93	0.06	0.09	-0.08	0.03	0.11	0.20**	-0.31**	0.21*	0.37**	0.74**	(0.94)

n=121. Cronbach's alpha coefficients on the diagonal

Logarithm of the number of full time employees

Table 4-4. Hierarchical Regression Analyses: Mediating roles of Managerial Attention and Management Innovation

	Managerial Attention (MA)		Management Innovation (MI)			Exploratory Innovation (EI)			
Controls	Model 1	Model 2 CC→MA	Model 3	Model 4 CC→MI	Model 5	Model 6 CC→EI	Model 7 CC→MA→EI	Model 8 CC→MI→EI	
1.Size	-0.03	-0.04	0.05	0.04	0.06	0.05	0.06	0.02	
2. Cloud provider	0.21	0.20	-0.20	-0.22	-0.02	-0.04	-0.10	0.12	
3. Cloud buyer	-0.27**	-0.32**	-0.08	-0.20	-0.10	-0.21	-0.11	-0.06	
4. Cloud broker	0.11	0.11	0.06	0.06	0.07	0.07	0.04	0.03	
5. Cloud enabler	0.07	0.13	0.13	0.26	0.17	0.28	0.24	0.09	
6. Strategy: expansion	0.31**	0.30*	0.12	0.09	0.03	0.01	-0.08	-0.05	
7. Strategy: defensive	0.03	0.01	-0.08	-0.12	-0.28	-0.32*	-0.32*	-0.23	
Variables									
8. Co-creation(CC)		0.20**		0.44***		0.35***	0.29**	0.05	
9. Managerial attention(MA)							0.30**		
10.Management innovation(MI)								0.69***	
Adjusted R^2	0.25	0.28	0.01	0.19	0.08	0.19	0.25	0.58	
Δ Adjusted R^2	0.25	0.03	0.01	0.18	0.08	0.11	0.06	0.39	
F	5.85***	5.95***	1.09	3.93***	2.29**	4.07***	4.86***	16.73***	

Standardized coefficients are reported

$* \rho < 0.05; ** \rho < 0.01; *** \rho < 0.001$

Furthermore, models 7 and 8 show that the relation between co-creation and exploratory innovation was mediated by managerial attention and management innovation. Hierarchical regression analysis (Baron and Kenny, 1986) was used to test the potential mediation effects. In the first step, we test the direct effect by regressing co-creation on exploratory innovation (Table 3, model 6). In the second step, the mediator management innovation is added to determine whether it mediated the previous significant relation (Table 3, model 3). After adding managerial attention, the standardized coefficient and significance level of the relationship between co-creation and exploratory innovation drop from $\beta = 0.35$ and $p < 0.001$ to $\beta = 0.29$ and $p < 0.05$. This indicates a partial mediation effect for managerial attention on the co-creation-exploratory innovation relationship and supports Hypothesis 3. Similarly, when management innovation is added to the model, the relationship between co-creation and exploratory innovation is no longer found to be significant, while results do show that management innovation is significantly related to exploratory innovation ($\beta = 0.69$; $p < 0.001$) and supports Hypothesis 4. In addition, the change in Adjusted R square is quite high and statistically significant (**Δ Adjusted R^2** = 0.06 and 0.39 in models 7 and 8 both at $\rho < 0.001$). This indicates that the first two conditions needed for a mediation effect, as identified by Baron and Kenny (1986), are met. Also the last condition needed for mediation is present in our model, since co-creation is significantly related to exploratory innovation. So also Hypothesis 3, which posited that management innovation fully mediated the relation between co-creation and exploratory innovation, is supported.

Post-hoc analysis

Despite the advantage of ordinary last square regression over structural equation modeling (SEM) in providing the possibility for including multiple control and dummy variables (Fletcher et al., 2006), SEM has some advantages in testing complex mediation relationships that is central to this research. Hence, in order to ensure the robustness of the findings of regression analysis and also verify the concurrent mediation effects of managerial attention and management innovation, we build and

run a structural equation model using AMOS 20. Figure 4-3, illustrates the effect sizes for the estimated path and t-values in parentheses.

The figures on the path are consistent with the findings of regression analysis in confirming the first and second hypotheses on the direct relationship between managerial attention and management innovation with the measure for exploratory innovation. The direct link between co-creation and exploratory innovation is not significant (t-value of -1.14) which rejects a possible direct effect of co-creation on exploratory innovation in the organizations. Co-creation, however, significantly influences managerial attention (t-value of 2.32) and management innovation (t-value of 4.52) which in turn influence exploratory innovation. We test the proposed mediation effect through bootstrapping algorithm in AMOS and with 2000 bootstrap samples and 95% bias-corrected confidence intervals and the results indicate that the mediated effect of co-creation on exploratory innovation is significantly different from zero at the 0.001 level (p=.001 two-tailed). We check for model fit measures and with *GFI* of 0.98, *NFI* of 0.95, and *CFI* of 0.97 the model indicates a very good fit. Given the sample size (N<250), The *RMSEA* value of 0.09 and *CMIN/df* value of 2.25 are also reasonably low (Hu and Bentler, 1999).
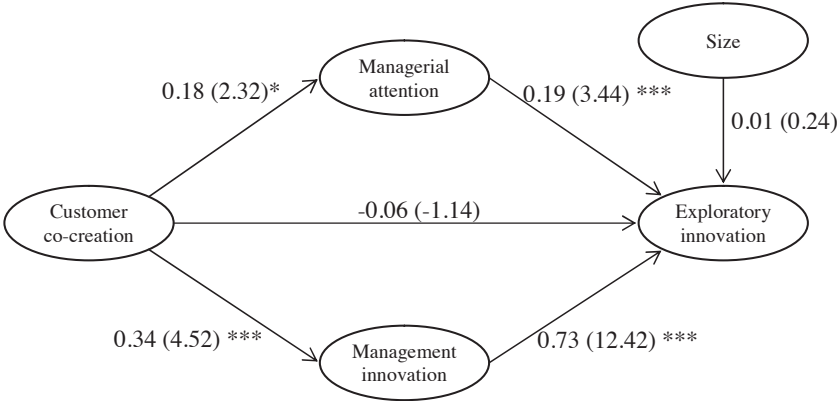
 t-Values are given in parentheses

* Significant at 5%, ** Significant at 1%, and *** Significant at 0.1%; two-tailed t-test

Figure 4-3- Results of Structural Equations Analysis

4.11 Discussion and conclusion

Research that connects customer co-creation to innovation has grown, yet our understanding is primarily limited to more apparent effects of customer involvement, such as innovation speed, quality, and effectiveness. Although prior research has considered a role for co-creation in extending knowledge search and adaptability of organizations to change, contradictory evidence convinces some scholars to contend that customer intimacy may hinder radical innovations by paying too much attention to satisfying customer requests and neglecting technological disruption. A number of scholars have tried to explain this disagreement by examining organizational and environmental factors that influence the relationship between co-creation and breakthrough innovations. In the same line, we focused on the overlooked roles of managers' cognition and initiatives in utilizing customer-generated knowledge to increase a firm's ability for exploration. By studying industry dynamism related to the emergence of Cloud, this research has sought to provide a better understanding on the relationship between co-creation and radical innovations, and the roles of senior managers in this relationship.

Our study resonates with the prior studies that suggest a positive effect for customer involvement and co-creation on knowledge search and boundary spanning activities of organizations (e.g., Belderbos et al., 2004; Baker and Sinkula, 2007; Nambisan and Barron, 2011). These studies demonstrate positive effects of customer collaboration on achieving radical innovations, but the mechanisms of this relationship remain a black box. By discussing the key roles of senior managerial cognition and initiatives in supporting and enabling radical innovation in a new business context and by explaining how these roles may be affected by intimacy with the customers, we examined a specific mechanism of the relation between co-creation and breakthrough innovations.

Our findings are useful in explaining the diverging research findings on the failure of customer-oriented companies in achieving radical innovations (Brown and Jones, 1986; Christensen and Bower, 1996; Knudsen, 2002). Rather than discussing a direct effect between co-creation and

exploration, we built our key arguments around two managerial dynamic capabilities for sensing the shifts in the markets and customers through managerial cognition, and aligning the organization according to such perceptions. We discussed customer interaction as a precursor of such capabilities, but many other individual and organizational characteristics influence the presence and intensity of such capabilities. Hence, when senior managers are unable to focus their attention on disruptive forces and introduce novel initiatives that facilitate exploration, the failure of customer-oriented organizations becomes more likely. The intermediary role of managerial dynamic capabilities seems to be a promising opportunity to understand the sources of variance in success or failure of organizations in linking customer co-creation and other organizational and business model design elements to the industry dynamism.

With regard to the role of managerial attention, we found a positive relationship between close collaboration with customers and senior managers' perception of the importance of the potential sources of industry dynamism. Such a perception in turn triggers organizations' focus on exploratory innovative activities. Radical innovations are unlikely to pay off in the short term (Jansen et al., 2006) and senior management attention is crucial for mobilizing required resources and generating sufficient motivation for exploration. A growing body of literature is dedicated to examining the link between managerial attention and technological change (Eggers and Kaplan, 2009; Maula et al., 2012; Li et al., 2012). In this research, we identified customer interactions as an enabler of receiving weak market signals, a capacity that is essential for detecting unprecedented shifts in the market (Schreyögg and Kliesch-Eberl, 2007).

With respect to management innovation, our findings complement and extend the prior findings that interaction with customers results in the introduction of new practices that enhance the innovative performance of the organization (Fleming, 2002; Foss et al., 2011; Khanagha et al., 2013). Compared to previous studies that focused only on a few specific structural or process initiatives, we utilized a management innovation construct that incorporates prevalence of adaptations and change in

the organization on a more general level. We provided empirical support for enabling the role of management innovation in enabling exploratory innovations in a new technology and business context, i.e., Cloud. Prior research has indicated the importance of an organization's flexibility on its tendency for deviating from existing business models (Bock et al., 2012). In the same line, we argue that an organization's tendency to change and to adapt is nurturing to exploration in unfamiliar knowledge areas.

Our findings suggests that adaptation and change of a business model, in our case adoption of value co-creation practices, is likely to act as a source of dynamic managerial capabilities that in turn determine a firm's effective response to dynamism. As such, business model innovation can be understood as a tool that enables companies to become more prepared to deal with an ever increasing rate of change. Customer involvement in value creation and value capture influences a firm's activities in a number of ways. Focusing on external sources of knowledge, increased flexibility, experimentation focus, involvement of senior management in exploration are some of the implications that we discussed in this paper. As such, business model innovation can increase the ability of the organization for exploration and influence the innovative and overall performance of the organization.

Our analysis has some managerial implications. First, our findings suggest that customer co-creation may act as leverage for breakthrough inventions. There is a general belief among practitioners that customers are incapable of providing valuable input to radical innovations. The impression that customer inputs and involvement is unlikely to directly affect the design process of a radical product seems to be reasonable, but the indirect effects of closeness to customers in understanding the shifts in markets are invaluable. Second, managers should consider that, although customer involvement in the innovation process appears to enhance exploratory capabilities of their organization, unwillingness to change and to adapt organizational factors might completely decrease the positive effects. This implies that managers need to ensure the possibility and promote the adoption and implementation of management innovations alongside the decision to involve customers

in their respective organization's value creation activities. This consideration becomes more important in situations of uncertainty, where the costs of customer interactions inflate and, as contended by Almirall and Casadesus-Masanell (2010), may exceed the potential benefits.

This study has some limitations that should be considered when interpreting the results. In order to facilitate measurement of exploratory innovation, we focused on the Cloud context and Cloud adopters who had a choice between an efficiency-oriented utilization of Cloud in contrast with a radical redefinition of their product offerings based on Cloud. Despite the unique benefits that this approach provided, it would be interesting to know if in other industries and other sources of dynamism a similar pattern will be present. Future studies may look into environmental changes with a different nature or in different industries to verify the importance of senior managers' cognition and initiatives for linking co-creation and radical innovations. Moreover, although we followed managerial attention through asking the respondents about factors that have been already tested in connection with cognition and attention, it seems valuable to develop more accurate tools of measuring managers' attention and to increase the accuracy of measurement by performing longitudinal studies that involve access to senior manager-related data.

5 Study IV: Sensing and seizing emerging technological opportunities: The moderating role formal coordination mechanisms[4]

In this paper, we examine how managerial capabilities and organizational characteristics interact and influence a firm's ability for sensing and seizing emerging opportunities. Prior research provides inconsistent results concerning the effects of key organizational characteristics, namely centralization and formalization, on competitiveness in changing environments. We argue that the variation in the findings can be in part explained by consideration of differences in individual level managerial capabilities, particularly managerial attention to the source of change. To develop this argument, we combine qualitative and quantitative data and investigate a population of companies facing a similar technological change, i.e. emergence of Cloud computing. Through concurrent consideration of managerial as well as organizational antecedents, our analysis highlights that the level of senior managers' attentiveness to a particular technology alters the patterns of relationship among centralization, formalization, and organizations' ability for sensing and seizing emerging opportunities. The subsequent contingency perspective contributes to the development of a more complete view on the microfoundations of dynamic capabilities.

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[4] This Chapter is based on: Khanagha, S., Volverda, H., Oshri, I., Sensing and seizing emerging technological opportunities: The moderating role formal coordination mechanisms (Submitted to *Research Policy*)

5.1 Introduction

The effect of organizational characteristics on firms' responsiveness to the changing environment has been a topic of repeated scholarly enquiry. In particular, studying the effects of structures and routines on adaptability has been a key theme in the prior research work on strategic renewal. Despite the advancements in this field, the results are somewhat inconsistent and unclear, especially when it comes to the discussions on exploratory activities such as adoption of emerging technologies. Studies on centralization and formalization, two of the most frequently studied organizational antecedents of adaptability, have indicated contradicting positive and negative influences on adaptability of the firms (see Baum and Wally 2003; Jansen et al., 2005; Sosna et al., 2010). A possible approach to explain such differences is consideration of the role of senior managers and their individual capability concurrent with organizational factors (Eggers and Kaplan, 2009). As noted by Gavetti (2005), joint consideration of routines, cognition, and hierarchy is a crucial but overlooked requirement when studying microfoundations of capabilities.

Research on microfoundations of capabilities underscores the role of senior managers' cognition and subsequent decisions in enabling an effective organizational response to the dynamicity (Adner and Helfat, 2003; Thomas, 1988; Tushman and Rosenkopf, 1996; Virany et al., 1992). This stream of research argues that senior managers have such a key role that in many cases failure of organizations are caused by their managers' misinterpretation of the environmental dynamism (Holbrook et al, 2000; Rosenbloom, 2000). Nevertheless, the effects of senior managers are not always similar (Hambrick and Quigley, 2014) and there are instances of organizations that successfully adapt to external forces without notable involvement or even despite negative perception and disapproval of their senior managers (Karlsson and Lugn, 2009; Augsdorfer, 2005; Grimpe, 2006). Therefore, studying organizational antecedents of organizations' adaptability without inclusion of individual level factors seems to be severely limited.

In order to address this limitation, along with centralization and formalization as representations of hierarchy and routines, we consider a specific managerial cognitive capability, namely managerial attention to technological change. The ability of managers to focus their attention-based resources to changes in the external environment underpins opportunity recognition and creation within organizations (Eggers and Kaplan, 2009; Helfat and Peteraf, 2014). We develop a framework that encompasses both direct and interaction effects of senor managers' attentiveness and organizational attributes on the firms' ability in recognition and timely commitment to an emerging technology (Sensing) and early commercialization of that technology (seizing). In line with the prior research the focuses on the timing of response to environmental change (e.g. Eisenhardt, 1989; Baum and Wally, 2003), we utilize two measures that concern relative speeds for making the decision to invest on the Cloud and for realizing commercial benefits from such investments. The framework is empirically examined through multiple case studies and a survey among Dutch adopters of Cloud computing.

This research responds to the call for further research in the relationships between organizational attributes and cognition (See Gavetti, 2005; Eggers and Kaplan, 2009; Ocasio, 2012) and attempts to connect the two streams of discussions on the individual and organizational antecedents of strategic renewal. First, we seek to clarify the direct effects of hierarchy, routines, and cognition in the presence of the others factors. Second, we hypothesize and test four moderating relationships to examine the ways in which the level of managerial attention to emerging opportunities influences the relationship between formalization and centralization and timely sensing and seizing emerging technology opportunities.

This paper is structured as follows: first, a review of the relevant literature concerning dynamic capabilities and their organizational and cognitive antecedents will be presented. Then, by combining the results of the qualitative study and prior research findings, we develop the research framework and the hypotheses. The qualitative data has been acquired using semi-structured interviews with 40 middle and senior managers in 16 organizations. The generated hypotheses will be tested in the

quantitative analysis of a questionnaire-based survey as well as additional complementary data acquired through secondary sources. The findings are presented in the final section, which concludes with a discussion of the limitations and implications of the study.

5.2 Sensing and seizing emerging technologies – organizational and individual level antecedents

Organizational characteristics

The effects of organizational characteristics on strategic change have been repeatedly studied. Prior research work has focused on centralization and formalization as two central attributes that succinctly capture organizational sources of variation in firms' performances (e.g. Zmud 1982, baum and Wally 2003; Jansen, van den Bosch, Volberda 2006). This research work provides sufficient evidence on the effects of Formalization and Centralization on exploitation of exiting knowledge and innovation in familiar areas. However, when it comes to distant knowledge and exploration in new areas, the empirical evidence and theoretical discussions on the effects of centralization and formalization are not conclusive. In the following paragraphs, we provide a summary of these discussions.

Centralization refers to concentration of power and authority and locus of decision-making in organizations. When the degree of novelty and the scope of impact of the external change are low, centralization is suggested to be more effective in speeding the innovation process (Sheremata, 2000; Jansen et al., 2006). This relationship is less clear when it comes to the cases of change with high level of novelty and extensive scope of impact. On the one hand, decentralization facilitates exploration in emerging fields by fostering non-routine problem solving and deviation from exiting practices and knowledge (Jansen et al. 2006). Because of the characteristics of emerging technologies, such deviations form existing routines and knowledge are crucial for innovation in emerging fields (Day and Schoemeker, 2000). On the other hand, centralized authority of senior managers can have a positive effect on decision-making and resource allocation by managers (Phan, 2000; Baum and

Wally, 2003). Therefore, high level of centralization has the potential to be both beneficial and detrimental when dealing with emerging technologies.

Formalization, defined as the degree to which explicitly articulated and written policies, rules, procedures, instructions, and communications exist in a firm (Khandwalla 1977). Prior discussions consider formalization a hindrance for dealing with unfamiliar areas of knowledge. Formalization has the potential to constrain variation-seeking behavior and to direct innovation efforts toward restricted aspects of the external environment (Jansen et al. 2006). Formalized organizations tend to discourage deviation from existing knowledge and inhibit adaptability and rapid competitive response in a changing environment (Baum and Wally 2003). Nevertheless, the empirical evidence does not always support this negative relationship between. Failing to demonstrate any meaningful relationship between formalization and exploratory innovation, Jansen and his colleagues (2006) discuss the potential benefits of formalized rules and procedures that may compensate for the above-mentioned negative effects. The benefits include better mastery of tasks by employees in the presence of well-designed rules and procedures (Adler and Borys, 1996). The above discussion highlights the challenges of explaining firms' adaptability by means of organizational attributes and the need for a better understanding of the conditions under which centralization and formalization are beneficial for adaptability of the organizations.

Managerial attention

Attention concerns focused awareness on a subset of available information. In the context of this study, we define managerial attention to emerging technology as awareness and focus on particular emerging technologies. Attention results in managers' orientation to specific events, detection of related signals and maintaining an alert (Posner and Petersen, 1990). Emergence of a new technology is often associated with uncertainty, complexity, and rapid rate of change that in combination,

engender the need for cognitive capabilities with respect to attention. A crucial component of managerial behavior in rapidly changing environments is problem sensing, the process of noticing and constructing meaning about environmental change so that organizations can take action (Barr, Stimpert and Huff, 1992). Mangers need to focus on relevant stimuli and scan the environment that surrounds the change, to stay alerted so as to detect the direction of technology change and to create new opportunities whenever it is possible, and to orient (and reorient) their attention only to the relevant information (Helfat and Peteraf 2014). As such, addressing technological change is associated with important cognitive challenges to top managers who quite often focus their attention on familiar information sources such as existing competitors and partners (Capron, 2009; Maula, Keil and Zahra, 2012). As contended by Sosna and his colleagues (2010), managers' mental models of the environment is formed based on limited or imperfect cognitive representations and such mental models limits them to their own bounded rationality. (Sosna et al., 2010). Managers using existing heuristics, cognitive frames and knowledge based on past experience often fail in situations of discontinuous change (Maula, Keil and Zahra, 2012). Such limitations in cognitive abilities may constrain the firm's search capabilities to the neighborhood of its current technological position.

Hence, organizational responses depend on what issues and answers decision makers focus their attention on and the effectiveness of strategic actions is shaped by how managers notice and interpret change and make the decisions (Eggers and Kaplan, 2009). Although many of the organizations' members play some role in scanning the environment and interpreting the changes, the point where information converges and is interpreted for organization action is assumed to be at the top management level (Cho and Hambrick, 2006). In other words, organizational renewal requires that firms' top managers make timely adjustments in their mental models to follow significant changes in the environment (Barr, Stimpert and Huff 1992).

Above discussion highlights the importance of managerial attention as a key antecedent of the capability of a firm in sensing emerging technology opportunities. During our qualitative phase, we

noticed that in many of cases it is indeed senior managers who recognize the value of the emerging technology (Cloud) as an important phenomenon and stressed the benefits of adopting it. As one of the interviewees mentioned, senior managers are often the ones who have a better perspective on the long-term impacts of an emerging technology on their respective organizations' competitiveness and survival:

"... [senior managers] often recognize the need to adapt to the changing environment, otherwise they will be out of business in a couple of years."

When moving towards a disruptive technology, risks and threats are involved and should be considered. However, management should stimulate learning and experimentation to develop capabilities that are required for working with the new technology. It is top management's role to support employees and give trust. As the head of innovation in one of the focal companies stated:

"For the management this requires a change in control; the management should not focus on execution but on learning. [...] Management must give the confidence to realize this. Failure is [being considered] learning and should not be penalized; thinking in [terms of] sales does not fit here. [...] Open innovation and learning must be stimulated, an open mind is needed and the management needs to give trust, and should not be risk averse. People should learn from mistakes."

Furthermore, top managers' involvement is essential in mobilizing the firm to embrace the change (Gilbert 2005). Top management support is important for facilitating the adoption by involving and motivating different departments and layers of the company. A solution architect of one of the focal companies stated:

"In most cases it is the top management level that sees the potential and starts to drive the change, [...] the top management level initiates the change towards the Cloud, and in time they involve the entire organization and sometimes even their customers to explain/implement the Cloud activities."

Top management has the power to push through new ideas and developments and spread them through the organization. Top management attention can ensure a fast and smooth adoption by allocating the required resources for a fundamental change. As an account manager of one focal company stated:

"If the company really believes in the Cloud they will take this change seriously and you will talk to top-level management or CEOs. These people often quite quickly see what the Cloud can offer them and they will then start the process of spreading it throughout the company, [...] the key players are the higher level management and the CEOs, they are the ones that can make this adoption of the Cloud go fast and smooth."

Therefore, based on theoretical discussion and analysis on the exploratory qualitative analysis we argue that:

Hypothesis 1: Managerial attention to an emerging technology positively influences the firm's ability in sensing and investment on the emerging technology opportunities.

Even when the organizations' managers and other related employees sense the opportunity, it is not guaranteed that they will be able to commercialize it and the company needs to go through a challenging process to turn the investment into offerings to their customers. Transformation and exploitation of knowledge indicate the nature of key activities that enable firms to commercialize externally generated knowledge (Zahra & George, 2002). Organizations need to facilitate combining internal and external knowledge (Zahra and George, 2002; Jansen et al., 2005) and such abilities are even more important in the cases of emerging technologies. In order to exploit knowledge on an emerging technology, new competencies and specialized complementary assets become crucial (Taylor and Helfat, 2009). For a successful transition, companies need to build and leverage linkages across organizational units to utilize and adapt valuable pre-existing capabilities that can be combined

with new external knowledge. Senior management's attention to the new technology can clearly facilitate and speed up such risky moves (Eggers and Kaplan, 2009).

The qualitative analysis also confirms that CEO attention is necessary for commercialization of the emerging technology opportunities. For instance, aligning the organization by creating a new business unit or department which focuses on the new technology is among the means for enabling technological change. Facilitating resource allocation is a common theme that interviewees referred to. Interviewed managers maintained, that this kind of wholesale change and design of important elements was largely driven by strong leaders at the top of the organization:

[…], it was basically decided from the top-down to go for it[Cloud adoption]. And then a team was set-up […], [but] they didn't develop the business model; that was done by the CEO…

The requirement for support is not limited to the early stages of setting up the new initiative. As a director of the Cloud initiative in one of the companies discussed, there is a continuous need for sponsorship from the management team to support the new business activities and to ensure enough flexibility and freedom to successfully adapt to the new core technology:

"Our current CEO is […] personally involved in what we are doing. You can see that the whole management wants to know and understand what is happening with the Cloud within […], they support what we do and that's very nice."

Finally, top management needs to motivate employees to embrace the change by developing a clear vision and strategy. Setting goals and developing a strategy were among the factors that were repeatedly mentioned in the interviews as an important role for top management. As the account manager of one of the focal companies stated:

"It often involves a management team that is really on top of things and makes a clear guide in where they want to go and how they will get there, […] if you have such a management that has a true vision

of what they want with the Cloud offerings it has a major positive influence on your adoption process."

Therefore, managerial attention also seems to have a positive influence on the capability of a firm to transform and exploit the acquired knowledge and incorporate it into the firms operations to create value and we argue:

Hypothesis 2: Managerial attention to an emerging technology positively influences the firm's ability in seizing the emerging technology opportunities.

In the previous sections, we discussed the findings of the prior research concerning the effects of centralization and formalization on innovation in an emerging technology field. In this section, we discuss how managerial attention may play and important role in determining the nature and the magnitude of the effects of organizational characteristics on an organizations' speed to recognize and to benefit from opportunities that are associated with an emerging technology.

5.3   Interaction of Centralization and managerial attention

We discussed how Centralization has the potential to hamper exploratory activities by narrowing communication channels and reducing the quantity of the ideas and knowledge retrieved for problem solving (Cardinal 2001, Sheremata 2000). However, when the senior managers in centralized organizations are directly attentive to a phenomenon, they have a better possibility to define business strategy and resolve power and communication hierarchies (Jung and Avolio, 1999; Kirkman and Rosen, 1999; Locke and Latham, 1990). Managerial attention to an emerging technology, when accompanied by high levels of centralization, enables the organization to overcome multitude of organizations' power centers that are fighting for preeminence of their interests and impede reorientation and exploratory activities in an emerging context (Sosna et al., 2010). Volberda (1996)

contends that, under the influence of hyper-competition and a turbulent environment, successful renewal requires increasing speed in managerial decision making as well as increased controllability of the organization. Both of these requirements are positively related to centralization (Baum & Wally, 2003). This effect seems to be particularly strong for the speed of technology commercialization because of the need for intensive investment and effort.

The reflections from the practitioners in our qualitative study suggest a less negative effect for centralization in the presence of attentive strategic leaders. The existence of this complex effect is theoretically justified by pointing to issues such as decision speed, flexibility, and clear leadership, which are associated with concentration of decision-making authority. Particularly, those companies operating as Cloud providers repeatedly voiced that centralized decision-making authority significantly boosts the ability to transition a Cloud based solution. For example, one of the drivers of Cloud initiative states:

It definitely is always the "dream" of the provider to have one contact person in Germany that is responsible to push the whole thing through all around the globe. Preferable you also only send one bill in Germany and the customer then spreads out the cost internally.

Hence, it is reasonable to argue that when managerial attention is secured, keeping authority in a limited number of hands helps in successfully establishing the Cloud driven renewal. Therefore, we argue:

Hypothesis 3: Centralization is negatively related to a firm's ability to (a) sense and to (b) seize the emerging technology opportunities.

Hypothesis 4: Managerial attention weakens the negative relationship between Centralization of decision-making and a firm's ability to (a) sense and to (b) seize the emerging technology opportunities.

5.4 Interaction of formalization and managerial attention

Formalization supports the retrieval of knowledge (Lyles & Schwenk, 1992) and enhances the causal understanding of sets of tasks within and across organizational boundaries. Therefore, formalization enables organization's' members to identify opportunities for the transformation of new external knowledge (Galunic & Rodan, 1998). Additionally, formalization of best practices makes it easier to utilize and implement knowledge (Jansen et al. 2005: Lin & Germain, 2003; Zander & Kogut, 1995). Therefore, formalization has the potential to compensate the negative effects of dis-involvement of managers, at least to some extent. This may explain why many organizations survive technological changes without direct involvement of their senior managers.

Our qualitative study also indicated that the presence of formal routines for dealing with new technologies is in general favorable to the organizations' ability to sense and to seize Cloud computing and its related opportunities. As one of the Cloud managers of our case studies indicated, such provisions support recognition and commercialization of externally generated knowledge:

"We have developed something that is called a 'product development request', and basically that is a request from an employee to innovate or improve a product… In our culture and management systems it is so embedded that you work with PDR's that it needs no stimulation anymore of managers."

Furthermore, emerging technologies often cut through the existing functional organizations and require cross-discipline collaboration. Although informal collaboration can be important in this regard, having formal means for collaboration and communication becomes crucial in enabling change. As one of the senior managers of the companies who were perceived to be successful in dealing with the Cloud stated:

"We have structures to facilitate cross-departmental communication, this is very important to make sure that you get products out of ideas. One of these things is, for instance, the central database used for ideas for innovations…."

Moreover, formal rules and procedures help employees to find the right ways for dealing with opportunities, especially when they require interactions with the customers and, therefore, are of a sensitive nature. As another senior manager of our case companies stated:

"…We made procedures to see how our Cloud solutions are used and then proactively approach the customer to understand them better, provide them help, and look for ways to provide our customers with more functionality or see how we can collectively create new products."

Thus, we argue that:

Hypothesis 5: Formalization is positively related to a firm's ability to (a) sense and to (b) seize the emerging technology opportunities.

Hypothesis 6: Managerial attention weakens the positive relationship between formalization and a firms' firm's ability to (a) sense and to (b) seize the emerging technology opportunities.

Figure 5-1 illustrates the theoretical framework in accordance with the generated hypotheses.

5.5   Data and method

In order to examine multiple individual level as well as organizational effects on sensing and seizing an emerging technology, we applied a multi-method approach. Using a multi-method approach is useful for gaining an in-depth understanding of a phenomenon (Hodson, 2004). Combining strengths from both quantitative and qualitative techniques of data collection and analysis is particularly advantageous for understanding interaction effects and for enhancing the understanding and robustness of the results (Creswell, 2008). This study started with a qualitative study based on a number of in-depth case studies that in the previous sections were used in conjunction with the findings from the relevant prior research to develop hypotheses.
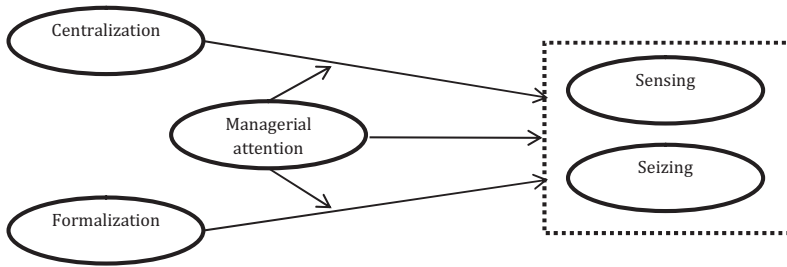
Figure 5-1- Theoretical Framework

Next, we performed an online-survey among the population of Dutch adopters of Cloud computing to test the proposed theoretical framework. Through collaboration and interaction with a large professional Cloud computing community in the Netherlands, a sample of 962 companies active in Cloud computing was identified. 299 of members of the population were accessible through email and a total of 131 completed the survey. The respondents had an average tenure of 6.76 years (S.D. = 5.99). 25.1% of the companies represented had 48 or fewer employees, while 50.3% of the companies had 160 employees or fewer, and 79.0% had 3000 employees or fewer.

To control for varying responses between early and late respondents, model variables were compared for these two groups of respondents. T-tests did not reveal any significant differences (p<0.01). Additionally controlling for single-source bias, second respondents were included, first and second respondents were compared but no significant differences (p<0.05) were found. To control for non-response bias, company size for respondents and non-respondents were compared; also here no significant differences were found (p<0.05). Additionally, secondary data from company reports, press and news, and official websites were used to triangulate some self-reported scales.

5.6   Research context

Over the last few years, utilizing Cloud to innovate and to provide new offerings to the customers is becoming more and more prevalent. Cloud can be understood as enabler of flexible and accessible solutions that extend or replace IT capacity. This technology has evolved to a set of highly practical solutions for today's complex IT landscape with growing requirements on the IT departments. In the current business environment, with high cost pressures and the need to explore new market ideas quickly, the adoption of the Cloud is rapid. High possibilities for scalability and delivery of the offerings over the Internet to multiple companies has made Cloud an attractive option for a wide range of industries (Berman et al., 2012).

One trigger for adoption of Cloud computing is related to huge costs associated with the complex IT infrastructure and makes computing solutions excessively expensive (Marston, Li, Bandyopadhyay, Zhang & Ghalsasi, 2011). Advent of Cloud computing indicates a possibility for dramatic reductions in the cost of entry for smaller firms. This is due to the immediate access to hardware services without upfront capital investments, leading to a faster time to market in many businesses (Marston et al., 2011). It makes it easier for enterprises to scale their services according to client demand and it lowers IT barriers to innovate. Cloud computing represents two major trends in IT: efficiency and business agility. The power of modern computers is utilized more efficiently through highly scalable hardware and software resources. Next to that, Cloud computing can be used as a competitive tool (Marston et al., 2011). Most studies have explored the importance of technological factors affecting Cloud computing adoption. However, the influence of environmental and organizational factors on Cloud computing varies across different industry contexts. *"Therefore, there is a need to analyze the determinants of Cloud computing adoption in different industries to acquire a better understanding of Cloud computing adoption"* (Low et al., 2011, 2009).

5.7 Measurement

Managerial attention: This construct is based on several studies about management cognition (Barr, 1998; Eggers and Kaplan, 2009; Gerdes, 2003; Kaplan, 2008; Kaplan et al., 2003; Osborne et al., 2001; Schnatterly, 2003; Mula et al., 2012). We asked the respondents to indicate the extent to which Cloud computing is being referred to in internal and external communication (such as annual reports, exhibitions, internal speeches, communications, etc.) by senior managers on a Likert scale. We further asked if the respondents believed their senior managers considered the Cloud as a strategic priority in their organization. This results in a three-item measure for managerial attention (α= 0.85), which reflects the degree to which senior managers perceive Cloud computing as a strategic priority for their organization. In order to verify the validity of responses, we used the company publications and reports, press news, and senior management-related contents in the websites of some of the respondents who opted to reveal their company affiliation. We scored indications of senior management involvement in the Cloud in each of the three sources into three categories, Low, Medium, and High, and calculated an average score for managerial attention according to this measure. Contrasting the calculated scores with the self-reported scale indicated a high degree of correlation between the two measures (r = 0.73, ρ < 0.001).

Sensing and seizing capabilities: Strength in technical knowledge has been shown to help a firm recognize new information, assimilate it into the organization, and translate it into a new product in the face of radical technical change, meaning absorptive capacity. An important dimension of decisions to adapt is timing and speed of decision-making has been considered a key determinant of performance in high velocity conditions (Bourgeois and Eisenhardt, 1988). Fast decision-making is already a known mediator between formal coordination mechanisms (i.e. centralization and formalization) and firm performance (Baum and Wally, 2003). Therefore, we measure the sensing capability of organizations' relative timing of recognizing the potential of Cloud computing and

making the decision to invest on the technology. We asked the respondents if they considered their organization to be early, concurrent, late, or very late in adopting the Cloud when compared to their direct competitors. About 41% of the companies reported to be earlier than their direct competition in investing in the Cloud, while 59% were at the same time or later than competitors in deciding to adopt Cloud computing.

In addition to early investment in the new technology, it is very important for firms to enter the market early enough, not only to benefit in commercial terms but also to influence the market formation and dominant design without being forced to follow competitors' driven standard. Hence, the timing of market entry is known to play a significant role in a firm's success (Schilling, 2002). For seizing capability, we focused on the relative timing of benefiting from Cloud technology, by asking the respondents if they had any commercialized products already on the market. About 57% of the firms reported that they already had commercial offerings based on the Cloud, while 43% were yet to commercialize their Cloud-related activities or have not had any investment at the time of the survey.

The validity of questions was also assessed through comparison between the survey results and archival data from press and company websites on the timing of adoption and the timing of commercialization of Cloud-based offerings among our companies. The correspondence between the archival data and survey data is quite high. Most of the cases that reported an early adoption were indeed very early in their investment in the Cloud (~86% before 2004). Similarly, the ones who reported an early commercialization had indeed commercial products based on the Cloud in the time of our analysis, while the other groups did not have any product or services available.

Formalization: The building block of this construct is based on the study of Deshpande and Zaltman (1982), which is adopted by Jansen et al. (2006). They represented a scale based on five building blocks related to formalization. The respondents answered five questions related to (1) rules and procedures, (2) centrality of rules and procedures, (3) written records of performance, (4) rule violation checks and (5) written job descriptions.

Centralization: This construct consists of five building blocks, based on the study of Hage and Aiken (1967) and Dewar et al. (1980). In 2006, Jansen et al adopted this scale. The respondents were asked five questions about supervisor approval of actions and freedom of decision-making.

Control variables: To take into account potential alternative explanations, several control variables were included. Several studies claimed that the size of a company might influence its innovation outcomes. Large companies may have more resources, but size can also restrict flexibility to explore changes in the environment (e.g., Pierce and Delbecq, 1977). To take size into consideration, we included a question about the number of full-time employees within an organization to account for firm size. Furthermore, firm age is included as a control variable, which is measured by the year that the organization was established. Also, the Cloud role of the participating companies may influence the results. Four Cloud roles are identified, namely Cloud providers, Cloud brokers, Cloud buyers, and Cloud consultants. Cloud providers are companies developing cloud services and selling them directly to customers or Cloud brokers. A Cloud broker only sells Cloud services to customers; it is the middleman of the Cloud provider. Cloud buyers are the actual buyers of the Cloud services and Cloud consultants only advise customers about Cloud solutions. While each of these companies is active with Cloud computing, the implications of our empirical analysis may vary for them.

5.8   Data analysis

Table 1 shows the descriptive statistics and correlations between the variables of this study. Table 2 provides the results of the logistic regression analyses with sensing and seizing capabilities as dependent variables. The hypothesized relationships were tested through eight models. The first and the fifth models only include the control variables with the two different dependent variables namely. In the second and sixth model, two independent variables i.e. formalization and centralization were added to test the direct relationships. Moderator variable i.e. managerial attention was added in models 3 and 7. In the fourth and eight models, the interaction effect of formalization and

centralization on managerial attention was tested. Consistent with out hypotheses, models 2 and 6 show statistically significant direct effects of centralization and formalization on sensing and seizing capabilities; formalization has a significant positive effect on sensing capability ($\beta = 0.54$; $P < 0.10$) and seizing capability ($\beta = 0.80$; $P < 0.05$) and centralization has a significant negative effect on our measures of sensing ($\beta = -0.72$; $P < 0.01$) and seizing ($\beta = -0.85$; $P < 0.01$) capabilities. Models 3 and 7 show significant effects with ($\beta = 0.57$; $P < 0.10$) for sensing and ($\beta = 0.82$; $P < 0.05$) for seizing capability. These results support hypotheses 1a and 1b on the positive effect of managerial attention on sensing and seizing capabilities. Models 4 and 8 provide support for our hypotheses concerning moderation effects. Figure 5-2 provides an illustration of the moderating effects. As this figure depicts, higher levels of managerial attention weakens both the negative effect of centralization in sensing and the positive effect of formalization in seizing Cloud related opportunities.

Table 5-1- Descriptive statistics and correlation coefficients

		Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	Sensing capability	.58	0.49										
2.	Seizing capability	.58	0.49	0.00									
3.	Size (log)	2.18	1.27	-0.08	0.04								
4.	Age	22.40	24.35	-0.21**	-0.10	0.58**							
5.	Cloud provider	.65	0.48	0.21**	0.36**	0.11	-0.01						
6.	Cloud buyer	.25	0.43	-0.05	-0.02**	0.04	0.04	-0.21**					
7.	Cloud broker	.14	0.35	-0.16*	0.02	0.02	-0.03	-0.49**	-016**				
8.	Cloud consultant	.20	0.40	-0.01	0.02	0.06	-0.01	0.10	0.38**	-0.13*			
9.	Formalization	3.11	0.82	0.08	0.10	0.32***	0.28**	0.15*	0.08	-0.10	0.11		
10.	Centralization	2.32	0.86	-0.23**	-0.27**	0.14*	0.23**	-0.15*	0.04	0.05	0.05	0.26**	
11.	Managerial attention	4.13	0.90	0.27**	0.40**	0.04	-0.20**	0.26**	-0.44**	0.08	-0.01	-0.08	-0.41**

Table 5-2- Results of logistic regression analyses

		Sensing capability					Seizing capability		
	Controls	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
1.	Size	0.46**	0.38	0.28	0.40	0.14	0.05	-0.09	0.13
2.	Age	-0.03**	-0.03**	-0.02**	-0.03**	-0.01	-0.01	-0.00	-0.02
3.	Cloud provider	0.34	-0.00	-0.18	-0.63	3.90**	3.41**	3.19**	4.07**
4.	Cloud buyer	-0.21	-0.40	-0.03	-0.18	0.98	0.57	1.03	1.15
5.	Cloud broker	-1.62**	-1.75**	-1.93**	-2.29**	3.19**	2.98**	2.82**	3.58**
6.	Cloud consultant	-0.22	-0.22	-0.31	-0.34	-1.46	-1.44	-1.51*	-1.77*
	Variables								
7.	Managerial attention			0.57*	0.55			0.82**	6.07**
8.	Formalization		0.54*	0.57*	4.38*		0.80**	0.82**	9.23**
9.	Centralization		-0.72**	-0.54*	-5.36**		-0.85**	-0.63**	-2.17
10.	Attention × formalization				-0.85				-1.88**
11.	Attention × centralization				1.14**				0.34
	-2log likelihood	150.73	141.96	138.31	130.13	143.82	130.33	123.11	110.75
	Cox & Snell R^2	0.15	0.21	0.23	0.28	0.20	0.28	0.32	0.38
	Nagelkerke R^2	0.20	0.28	0.31	0.38	0.27	0.38	0.43	0.51

[a] Standardized coefficients are reported

[b] * $\rho < 0.05$; ** $\rho < 0.01$
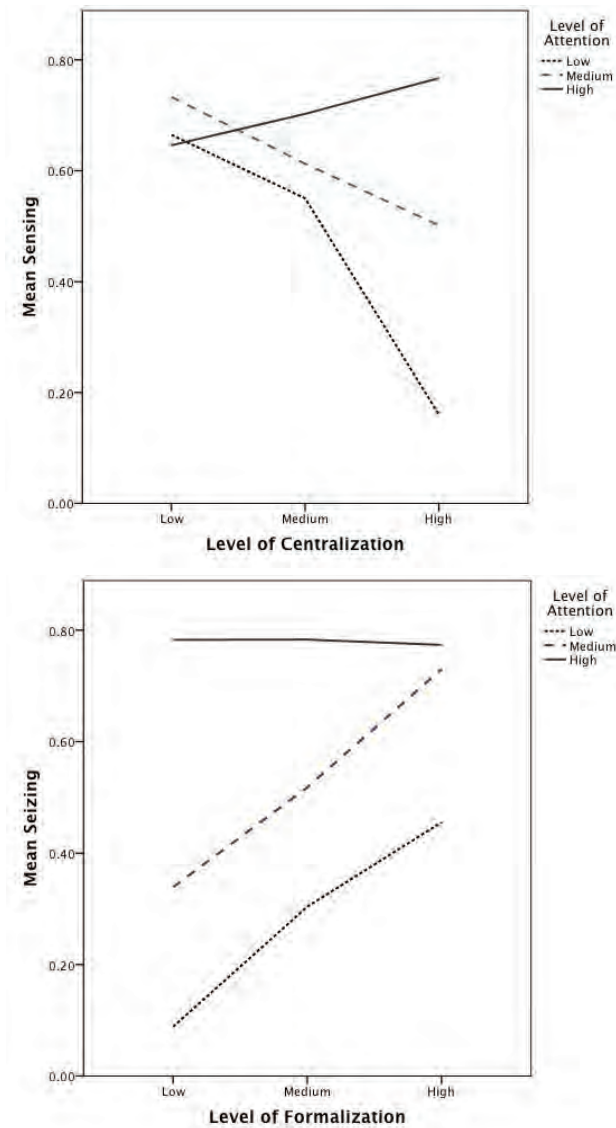
The moderating roles of centralization and formalization on the relationship between managerial attention and sensing and seizing capabilities. In all of the variables, Mean±å.5STDV is considered Medium range and High and Low indicate the higher and the lower values respectively. The vertical axes depict predicted values in logistic regression model.

Figure 5-2- Interaction effects

The 2-log likelihood value has decreased in the models, which reflects a potential gain in model fit. The Cox and Snell R-squared and Nagelkerke R-squared statistics are relatively high and show an increase by addition of variables.

5.9   Concluding discussions

The aim of this study was to investigate the complex inter-relationship between organizational characteristics and individual level managerial capabilities in enabling effective response to environmental change. Two contributions to research on strategic renewal were intended in this paper. First, we provided empirical evidence on the relationship between speed of organizational response and individual level managerial capabilities, particularly managerial attention. Second, our concurrent consideration of hierarchy, cognition, and routines was planned as means to provide a more complete perspective towards the enablers of adaptability of the established organizations. The results offer an explanation for the apparent inconsistency in the prior research concerning the effects of centralization and formalization on adaptability and responsiveness of the organization.

Centralization is mostly discussed and tested as a negative influence on the exploratory activities of organizations (Jansen et al. 2006). However, as discussed by Sosna and his Colleagues (2010), centralization is like a double-edged sword that in a changing environment, despite its negative influences, has potential to increase the speed of decision-making and renewal of an organization. We argued that presence of attentive strategic leaders is the factor that strengthens the positive influences of the centralization. Our hypothesis was supported in the case of sensing capabilities, while it was not supported for seizing of Cloud opportunities. This can be explained by the fact that when it comes to implementation and commercialization, there is a higher need for participation of middle level managers and front line employees. In line with what Baum and Wally (2003) contend, high level of centralization is likely to slow down the operational activities required for commercialization of Cloud activities. Concerning formalization, we discussed how the presence of established and well-designed

routines in expert organizations has the potential to compensate the need for managerial actions. When higher level of managerial attentiveness is secured, this effect is less strong. Our hypothesis was supported in the case of seizing capability, whereas the hypothesis for sensing capability was not sustained. The latter can be explained by the fact that rather than identification and assimilation of knowledge, formalization is suggested to be more related to transformation and utilization of the external knowledge. In fact Jansen and his colleagues (2005) discuss a negative influences of formalization through inhibiting rich, reciprocal knowledge interaction and hindering individuals' assimilation of new external knowledge. The combination of these negative influences with the positive ones, which were the basis for our hypothesis development, is likely to explain the weaker effect of formalization on sensing capability and absence of significant moderation role for managerial attention.

This study has managerial implications in terms of the characteristics of routines, organizational structure, and the importance of attentiveness of managers to emerging technological trends. Although practitioners may attempt to routinize technological gate keeping and boundary- spanning activities of their respective organizations, direct involvement of senior managers seems to be crucial for the speed of technology adoption. Such involvement enables overcoming organizational rigidities and ensuring the allocation of resources and incentives for working on emerging technologies. Lack of attention from senior managers to emerging forces may result in a preference to focus on familiar technologies and negligence towards new and unfamiliar ones. Even if the company manages to spot the technology in time, commercialization and benefiting from it mandates active involvement of senior managers to overcome rigidities in resources and to facilitate the development of new capabilities that often require cross-function and cross-discipline participation.

5.10 Limitation and future research

This study's findings should be considered in light of its limitations. First, the findings are based on cross-sectional data in a single industry and, as a result, we can neither strongly claim causality nor establish a high degree of generalizability in the findings. We have argued that high levels of managerial attention moderate the effects of formalizations and centralization on sensing and seizing emerging technologies. While our qualitative analysis and theoretical discussions provide evidence for inferring a causal relationship, it is also possible to offer alternative interpretations of our statistical results. Other research designs, for example a longitudinal study, may be useful in clarifying causality among the variables of this research.

Further research may also utilize a non-dichotomous measure for sensing and seizing abilities of organizations. It is possible to measure the timing of investment and the timing of commercialization using continuous variable and using actual times. We used dichotomous measures to allow for comparison between companies in an evolving market, whereas the study can be replicated in post-dynamism time and by using absolute measure of timing of investment and commercialization. Additionally, other than timing, it is crucial to measure other criteria such as actual performance of the adoption initiative. For example, as we discussed, formalization creates a tendency to explore the new technology in alignment with existing organizational routines, whereas such routines may prove to be ineffective for realizing the full potential of an emerging technology. Therefore, the nature of outcomes and degree of success in the adoption process can provide additional insights into the interrelation between structure, cognition, and successful adaptation. Although our sampling approach was valuable for its power in measuring the relationships during the dynamism, it is not possible to measure actual performance and competitiveness that results from the adoption of Cloud in the long term.

6 Discussion and Conclusion

6.1 Introduction

The studies presented in this dissertation were conducted in a logical sequence that helped to ensure the stated research goals could be met. The overall aim of this study was to scrutinize the concept of the dynamic capabilities in the specific context of emerging technologies. The first objective was to provide a dynamic perspective on how managerial initiatives such as management innovation and business model innovation, act as antecedents of effective organizational response to technological change. The first two studies were in-depth longitudinal exploratory studies which sought to identify these key determinants of organizational competitiveness. The results were analyzed in the light of prior research to make sense of the qualitative data and identify relevant theories. The second objective of this dissertation was to provide a more complete picture of the micro-foundations of dynamic capabilities by looking simultaneously at cognition, routines, and structures. Concurrent with the later stages of the longitudinal study, a multiple case study was initiated, and this was followed by a survey to develop hypotheses and provide quantitative evidence on some key observations made during the earlier studies. In the sections that follow, we provide summaries of individual studies followed by discussion of theoretical and managerial implications of the dissertation. The chapter ends with a discussion on limitations of this dissertation as well as ideas for future.

6.2 Summaries of the contributions of the four studies

Study I

The first study focused on the investigation of the antecedents, process, and outcomes of management innovation as a precursor to effective adoption by organizations of emerging technologies. Our in-depth case study revealed that most of the challenges that stop organizations from responding effectively to an emerging technology are managerial in nature. The study demonstrates that without identifying and implementing new organizational systems, processes, structures, and practices,

organizations would find it very difficult indeed to respond effectively to technological change. The notion of management innovation (Birkinshaw et al., 2008) is regarded as a specific dynamic capability that concerns managers' ability to identify and implement novel routines and structures within their organization. This study elaborated on the nature of such management innovations – i.e., new learning and experimental routines, resource allocation mechanisms, and incentive systems for dealing with emerging technologies. As such, this is study is one of the few to discuss changes in the organization laying the ground for technological innovation, and contributes to the emerging body of research on management innovation.

Study II

In the second study, the wider scope of the impact of technology was investigated in a case in which the core value creation and capture mechanisms of the firm – i.e., its business model – were undergoing radical change. We considered the changes in a core technology and its implications for a wide range of resources and complementary assets (Taylor and Helfat, 2009) in relation with a need for recursive alterations to the structure. The longitudinal cases study revealed that such alterations are consequences of the evolution of the organization's strategic intent. The findings contribute to the growing body of literature on business model innovation by clarifying the relationship between strategy and business models and by discussing the organizational antecedents of business model innovation. 'This study suggests that when organizations are attempting to manage two competing business models simultaneously (as may happen, for instance, during the transition to a new business model), it may be crucial for them to vacillate repeatedly between separated and integrated structures, rather than using structural separation – the approach suggested by prior research. We then discussed the implications for the literature on organizational ambidexterity.

Study III

In the third study, the role of managers in enabling and fostering variance-seeking and exploratory behavior in the face of an emerging technology were discussed. The findings highlight the importance of giving managerial attention to an emerging technology in order to facilitate and incentivize exploratory initiatives that are oriented toward the long term. Moreover, the ability of organizations to introduce new managerial systems, processes, and practices – i.e., management innovation – was discussed as another antecedent of exploration in emerging fields. The study also discusses the role of market orientation and co-creation with customers as a key antecedent of management innovation and managerial attention to new technologies. The finding of the study shows a link between the involvement and integration of customers in innovation processes and achieving breakthroughs in a new technology field. As such, the study provides further explanation of the diverging research findings on the relationship between customer involvement and achieving radical innovations (Brown and Jones, 1986; Christensen and Bower, 1996; Knudsen, 2002). The findings complement and extend earlier findings that interaction with customers results in the introduction of new practices that enhance the innovative performance of an organization (Fleming, 2002; Foss et al., 2011).

Study IV

This study investigated the complex interrelationship between organizational characteristics and individual-level managerial capabilities that enable effective responses to environmental change. Two main contributions were made to the literature on the micro-foundations of dynamic capabilities. First, individual-level managerial capabilities, particularly managerial attention, were hypothesized and examined empirically as key determinants of success in the early recognition and commercialization of emerging technological opportunities. The findings are in line with the stream of literature that discusses the role of senior managers in guiding the organizations through the reorientation process (e.g., Tushman and Rosenkopf, 1996; Virany et al., 1992). Second, giving joint consideration to

structures, routines, and managerial cognition provided a clearer picture of why firms varied in their adaptability and responsiveness to technological change.

This study also investigated the role of hierarchy in relation to strategic renewal. Centralization is generally discussed and tested as a negative influence on the exploratory activities of an organization (Jansen et al., 2006). However, as argued by Sosna and his colleagues (2010), it also has the potential to increase the speed of decision-making and renewal within an organization. Study IV suggested that attentive strategic leaders are important in strengthening the positive influence of centralization. With regard to formalization, we discussed how established and well-designed routines help expert organizations to reduce the negative effects managerial inattention. When a higher level of managerial attentiveness is secured, the positive effect of routines becomes less apparent..

Table 6-1 provides a summary of the research objectives, key findings, and implications of the four studies.

Table 6-1- Summary of the research objectives, key findings, and implications of the four studies

	Research objective	Key findings	Implications
Study I	• Identifying the drivers of successful technology adoption • Providing details of the mechanisms by which non-technical adaptations enable effective adoption of technology.	• Because of rigidity in routines and resources, established organizations need to introduce novel practices to ensure they have the motivation, capability and resources to allow them to experiment in a new technological field. • Such novel practices include experimental routines, resource allocation mechanisms, and incentive systems.	• Management innovation is a key enabler of technology adoption in the cases of disruption. • Experimentation is central to the adoption of a new technology. This holds true both in terms of technical experimentation and experimentation with new organizational routines and structures.
Study II	• Increasing understanding of effective structural approach for transition to a business model.	• Rather than using spatially separated or integrated structures, organizations may need to vacillate between these two modes in order to facilitate transition to a new business model. • Throughout the process of business model renewal, organizational learning and subsequent revisions in the strategic intent are the prime drivers of vacillation in structural form.	• Transition to a new business model is a learning process in which organization accumulates required knowledge and capabilities in a recursive manner. • Strategic intent is the main factor that determines the optimal structural choice for business model innovation initiatives. In the earlier phases of transition, the strategic intent may need to be updated repeatedly and so may the structural form of the initiative.

Study III	• Investigating the relationship between customer co-creation and exploratory behavior in emerging technologies. • Examining the role of managerial attention and initiatives as the links between co-creation and exploration.	• Managerial attention to the new technology and management innovation mediate the relationship between customer co-creation and exploration in the emerging field.	• Involvement of customers in innovation process has the potential to engender radical innovations. • This happens through (1) introducing of appropriate routines and structure within the organization, and (2) increased attentiveness by managers to shifts in both market and technologies.
Study IV	• Empirically examining the role of managerial attention in ensuring that the organization recognizes and commercializes emerging technologies at the appropriate point in time. • Giving joint consideration to cognition, structure, and routines when discussing organizational adaptability.	• Managerial attention has a crucial role in the timing of the recognition and commercialization of emerging technologies. • The levels of centralization and formalization within the organization moderate this effect.	• Centralized organizations may be quicker to respond to emerging technology opportunities. This happens only when attentive managers are acting as internal change agents. • Higher levels of managerial attention almost always result in faster identification and use of new technologies.

6.3 Theoretical contributions

The aim of this dissertation was to revisit the question of why some companies are more successful than others in responding to technological change. We discussed the limitations of prior research in terms of its static view of organizational antecedents and the scarcity of research that considers all three interdependent factors, namely routines, structures, and cognition. A main objective of this dissertation was to carry out empirical research whose design and dynamic perspective enabled us to consider a dynamic perspective towards the process of technology adoption.

From a different standpoint, this research was an attempt to contribute to the discussions on micro foundations of dynamic capabilities by providing clear empirical evidence and discussion relating to the particular context of cloud computing. Our attempt to address the ambiguities surrounding the nature of dynamic capabilities and how they originate (Scherogg and Sydow, 2010) was directed toward the role of individual managerial capabilities, structures and routines, and firm-level strategies such as customer involvement in innovation processes. As such, the four studies presented in this thesis addressed the antecedents, processes, and consequences of dynamic capabilities for managing emerging technologies. The focus on cloud computing as the context for all four studies provided an opportunity to study the same phenomenon from different angles. As a whole, the dissertation makes several key contributions.

Technology adoption and interrelationships between non-technical and technical capabilities

The interrelationships between the technical and non-technical capabilities that are required to deal with technological change were clarified using in-depth longitudinal process studies in combination with multiple case studies. Studies I and II highlight the complicated process of organizational adaptation (through the constructs of management innovation and business model innovation) that takes place before emerging technologies can be successfully adopted. The approach and findings of this research contrast with mainstream empirical research that prescribes certain organizational design

elements as being essential for competitiveness in the face of change (for a discussion and some exceptions, see Siggelkow and Levinthal, 2003; Gulati and Puranam, 2009; Boumgarden et al., 2012). The findings of this project highlight a dynamic process of adaptation and innovation that is driven by senior managers and other internal change agents and is aimed at collective learning and the development of new routines and capabilities.

Interaction between structure, routines, and managerial cognition

By studying individual-level and organization-level factors, all four studies provide a more complete picture of the organizational antecedents of adaptability. The analysis provides insights into on how routines, organizational structure, and the cognition of individuals interact and result in variance in the performance of firms dealing with an emerging technology. The findings suggest that these three factors interact and have remarkable influences on the process of technology adoption; they therefore need to be studied concurrently to provide a more complete picture. Gavetti (2005) and Eggers and Kaplan (2009) have stressed the importance of taking this three-pronged perspective, and have identified that this represents a significant gap in research. This dissertation has addressed some aspects of this gap, looking at the specific context of emerging technologies. Despite differences in their design and findings, all four studies were similar in their consideration of complementary or interaction effects of individual-level and organizational-level factors.

Managing complexity: the unique role of managerial cognition in enabling strategic change

Very high levels of complexity and uncertainty accompany emerging technologies. Exploring emerging opportunities while ensuring the continuation of existing businesses and activities imposes contradictory requirements on established firms. This makes it difficult for managers to rely on routine organizational responses, and demands that they come up with creative responses and

problem-solving. Although certain organizational forms and design elements (less centralization and more formalization, as suggested in Study IV) offer the potential to accommodate the change more easily and effectively, managerial cognition always matters in achieving competitiveness in a changing technology field. New incentive and resource allocation schemes to support experimentation, structural alteration to facilitate balanced pursuit of exploration and exploitation, and fine-tuning the organization's strategic intent are examples of what managers need to secure, according to the findings of this dissertation.

6.4   Managerial implications

This research project was designed and executed in close collaboration with a number of industry players. The intermediate findings were frequently presented to company stakeholders and their feedback was incorporated into subsequent phases of the research. Therefore, some of the theoretical findings are clearly applicable to practical contexts. Some of the managerial implications are outlined below and summarized in Table 6-2:

Table 6-2 – Summary of managerial implications

Main managerial implications

1. In dealing with complex and uncertain situations, managers need to prioritize trial and error learning and focus on technological and non-technological experimentations.

2. It is crucial for managers of large organizations to focus their attention on their organizations' initiatives concerning emerging technologies. This is even more important in centralized organizations.

3. Close collaboration with customers is a key to effective response to technological change.

4. When no single structural form (e.g. separate or integrated structural forms) fulfills the requirements of dealing with contradictions between existing and future businesses, alteration between different structures may prove to be effective.

Experimentation matters: both technical and organizational

Our studies in the context of cloud computing indicated that developing new offerings based on an emerging and radically new technology requires experimentation. In order to facilitate experimentation of this kind, new routines, structures and practices are crucial. Moreover, organizational resources need to be allocated, as undertaking experimentation typically makes heavy demand on resources. Appropriate incentive systems should also be put in place. All in all, organizations need to pay attention to experimentation and its requirements.

Besides technical experimentation, organizations should be prepared for organizational trial and error and experimentation to understand what organizational setting best supports their strategic intent at any given point in time. Developing new practices and routines also takes place through similar processes of trial and error. Hence, having the required skills for both organizational and technical experimentation is prerequisite of an effective response to technology change.

The role of attentive managers in the adoption of emerging technologies

Expert organizations tend to devise ways of regularly scanning, analyzing, and strategizing innovative activities taking place within the organization. Senior managers may therefore expect that organization will automatically identify emerging technologies and plan how to deal with them. Contrary to this expectation, the findings from this research suggest that even if the boundary-spanning activities of organizations are at their most effective, engagement and intervention by senior managers are still essential in order to overcome' organizational inertia in routines and resources.

Close collaboration with potential and existing customers: Key to effective response to technological change

Studies I, II, and III highlighted why and how input from strategic customers is crucial for securing managerial attention and initiatives that will facilitate the adoption of emerging technologies. Due to the cognitive limitations of senior managers, signals from internal gatekeepers are likely to be missed.

However, when a signal comes from a key customer, managers tend to prioritize and be responsive. However, timely response to such signals requires a considerable amount of effort – for example, involving customers in the innovation process. A by-product of customer involvement in the innovation process is a higher level of organizational flexibility and introduction of experimental practices, which are crucial for exploration in emerging technology contexts. As such, customer co-creation is an important factor in building the dynamic capabilities required to manage emerging technologies.

Structural alteration as a solution for dealing with contradictory requirements of emerging technologies and existing ones

Our findings suggest that while it is generally recommended that structural separation should be used with a new business model, this is in fact only valid in certain situations. The uncertainties associated with an emerging business model hindered deterministic decision-making on the nature of engagement with the new business model, and experimental activities thus became the key means through which the organization accumulated knowledge and engaged with the Cloud business model. The structure of experimental activities followed the dynamic nature of strategic intent during this period and alternated in cycles between separation and integration.

6.5   Limitations and agenda for future research

Despite the insights generated by this research, the work still has some limitations. The focus on a single technology in a single industry naturally limits the generalizability of the findings. The ICT industry has idiosyncratic characteristics in terms of its structure and dynamicity. The fact that transformation in ICT industry engenders shifts in other industries and sectors justifies the value of focusing on ICT as the context of the study. Nevertheless, when we discuss emerging technologies and the capabilities needed to manage them, it is crucial to consider also other sectors, industries, and

technology contexts. Synthetic biology, nanotechnology, wind energy, and so forth, are examples of other influential emerging technologies that may have different implications for organizations that decide to adopt them.

Combining qualitative and quantitative studies was considered to be a way of improving the validity and reliability of the data. However, when discussing variables such as managerial cognition and attention, closer interactions with senior managers during data collection process can substantially improve the quality of measurements and findings. In future research, it may be valuable to make direct measurements of management cognition. An experimental research approach could be used to give a clearer and more accurate picture of what role managerial attention plays in enabling an organization to respond effectively to emerging technologies.

Although the combination of qualitative and quantitative research methods in this dissertation provided the opportunity to consider time horizons throughout the processes of organizational adaptation, our survey was based on a cross-sectional design, In the next steps, panel data analysis might prove useful to provide additional and more precise insights into the relationships between organizational factors and the successful adoption of emerging technologies. Using objective data for the quantitative analysis would provide another means of verifying whether and when technology adoption activities will result in increased competitiveness.

This dissertation explored the role of individual cognition and attention, with a focus on senior managers. However, it is quite important to consider also the cognitive abilities of middle managers (as suggested by Taylor and Helfat, 2009) and all other strategic human resources within the organization (Volberda et al., 2010). Taking a more inclusive approach to studying the role of cognition on dynamic capabilities would provide a more complete picture of the sources of dynamic capabilities for dealing with emerging technologies. A multilevel research design seems to be a valuable approach to use in future research in that it should help to generate a more a deeper understanding of the drivers of individual cognition, emotion, and behavior and their relationship to

the sources of competitiveness in dealing with emerging technologies. Table 6-3 provides a summary of limitations of this dissertation.

Table 6-3 – Limitations of the dissertation

Limitations
• The focus on a single technology in a single industry • Indirect measurement of individual level constructs such as managerial attention • Cross sectional nature of the quantitative study • Limited usage of objective performance data • Absence of multilevel design in the quantitative study

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Appendix – Survey questions for Study III and Study IV

Please indicate to what extent the following statements are true for your company:

Centralization

	Fully Agree				Fully Disagree
There can be little action taken in my organization until senior management approves a decision.					
A person who wants to make his/her own decisions would be quickly discouraged.					
Even small matters have to be referred to someone higher up for a final decision.					
Unit members need to ask their supervisor before they do almost anything.					
Most decisions people make here have to have their supervisor's approval.					
People in my company go out of their way to ensure the company succeeds.					

Formalization

	Fully Agree				Fully Disagree
Whatever situation arises, written procedures are available for dealing with it.					
Rules and procedures occupy a central place in the organizational unit.					
Written records are kept of everyone's performance.					
Employees in our organization are hardly checked for rule violations.					
Written job descriptions are formulated for positions at all levels of our company.					

Managerial attention

	Fully Agree				Fully Disagree
In their speeches, conversations, and other communications, our senior managers frequently refer to cloud computing as an important phenomenon for our organization.					
We see frequent references to Cloud in our external communications (press releases, annual reports, exhibitions, etc.) as a focus area of our organization.					
Cloud is not being considered a strategic priority by our senior managers (reverse).					

Management innovation

In order to respond to market changes…	Fully Agree			Fully Disagree
…rules and procedures within our organization are regularly renewed/updated.				
…we regularly make changes to our employees' tasks and functions.				
…our organization regularly implements/updates new management systems.				
…the policy with regard to compensation has been changed in the last three years.				
…the intra- and inter-departmental communication structure within our organization is regularly restructured/updated.				
…we regularly alter/update certain elements of the organizational structure.				

Value co-creation

	Fully Agree			Fully Disagree
We collaborate with customers to collectively improve or develop new products/services.				
Customers directly communicate ideas for new product/service offerings to our firm.				
We share information with customers in a two-way communication to make our product offerings more valuable.				
Customers' inputs are used to determine which products/services should be offered further by the firm.				
We collaborate with customers to come up with solutions for problems related to our product offerings.				
We collaborate with customers to track changes in consumer needs, preferences and behavior.				
The relationship with external parties/customers has resulted in actual new/improved products or services.				

Exploratory innovation

	Fully Agree			Fully Disagree
Our company accepts demands that go beyond existing products and services.				
We invent new products and services.				
We frequently utilize new opportunities in new markets.				
We regularly search for and approach new clients in new markets.				
We commercialize products and services that are completely new to our unit.				
We experiment with new products and services in our local market.				
Our unit regularly uses new distribution channels.				

Early sensing of Cloud opportunities

Compared to your competitors, do you consider that you had/ will have adopted Cloud...

Almost too late	Slightly later	At the same time with the others	Quite early

Not Early ← → Early

Early seizing of Cloud opportunities

When it comes to cloud technology would you consider your organization to be in the phase of:

Currently considering its adoption, but no investment yet.	Some investment is made, but we are considering further investments in future.	We have sufficiently invested on Cloud, but the benefits are expected to be realized in future.	We have invested on Cloud and already benefiting from it.

Not commercialized ← → Commercialized

About the Author

Saeed Khanagha (Tehran, September 18, 1981) received his M.Sc. degree in Industrial Engineering-Management of innovation and product development from Linköping University, Sweden and M.Sc. in Management from University of Tehran. Saeed's PhD study was funded by a European Commission Marie Curie project entitled Management of Emerging Technologies for Economic Impact (MANETEI).

His research interests include dynamic capabilities, technological discontinuity and change, business model innovation and organizational ambidexterity. He is focused on combining qualitative and quantitative methods in doing empirical research in the field of management. His works has been published in international journals such as European Management Review and R&D Management. Moreover, he has presented his research at major international conferences, such as the Academy of Management, EGOS, and the Strategic Management Society. He currently serves as an ad-hoc reviewer for the R&D Management journal. He is involved in organizing sessions in academic conferences as well as in development of research proposals for national and European grants. He has co-lectured in a number of M.Sc. and B.Sc. courses as well as supervision of students in different levels.

Nederlandse samenvatting

De ontwikkelingen op het gebied van informatie- en communicatietechnologieën hebben een digitaal tijdperk ingeluid waarin aanzienlijke rekenkracht, hoge snelheid en universele toegang tot het Internet, en meer recentelijk cloud computing-technologie naar verwachting een transformatie tot stand brengen van een grote groep organisaties, industrieën, en samenlevingen. De complexiteiten en onzekerheden verbonden aan dergelijke transformaties creëren veel vragen voor mensen in de praktijk en management wetenschappers. Hoe kunnen organisaties rigiditeit van hun middelen en routines voorkomen en zich aanpassen om de mogelijkheden van dergelijke technologische veranderingen te benutten? Wat zijn de verschillende kenmerken van gevestigde bedrijven die er in slagen om hun concurrerend vermogen te behouden tijdens en na het transformatieproces?

Deze dissertatie combineert meerdere databronnen met betrekking tot de adoptie van cloud computing door organisaties. Op basis van een longitudinale studie, meerdere vergelijkende casestudies, en een enquête onder Nederlandse bedrijven geeft deze studie nieuwe inzichten in de micro-fundamenten van organisatorische vaardigheden voor het succesvol adopteren van opkomende technologieën. Op basis van de literatuur over dynamische managementvaardigheden geeft deze dissertatie een meer compleet beeld van de hefbomen om in te spelen op technische veranderingen door het onderzoeken van de interactie tussen structuren, routines, en management cognities.

Dit proefschrift begint met een onderzoek naar processen omtrent organisatorische adaptatie in reactie op technologische verandering. Ik bespreek welke management initiatieven nodig zijn voor het bewerkstelligen van effectieve adoptie van opkomende technologieën, evenals wat voorname factoren en management rollen zijn om deze initiatieven te kunnen realiseren. Vervolgens onderzoek ik de relatie tussen structuur, strategische intentie en technologie-gedreven bedrijfsmodel-innovatie en argumenteer dat, in tegenstelling tot een bepaalde structurele vorm, structurele verandering cruciaal is voor het faciliteren van transitie naar een nieuw bedrijfsmodel. Als derde bespreek ik het belang van een sterke betrokkenheid en samenwerking met klanten voor het stimuleren van enerzijds aandacht onder management en anderzijds initiatieven die de verkenning van opkomende technologieën ondersteunen. Tot slot is de relatie onderzocht tussen formalisatie, centralisatie en aandacht onder management met betrekking tot het faciliteren van vroegtijdige herkenning en toepassing van opkomende technologieën. De resultaten illustreren de mate waarin bepaalde organisatorische eigenschappen de aandacht onder management ten aanzien van reactie op technologische verandering kunnen beïnvloeden. Dit proefschrift levert nieuwe inzichten ten aanzien van de antecedenten en uitkomsten van dynamische vaardigheden voor het adopteren van opkomende technologieën.

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DYNAMIC CAPABILITIES FOR MANAGING EMERGING TECHNOLOGIES

ORGANIZATIONAL AND MANAGERIAL ANTECEDENTS OF EFFECTIVE ADOPTION OF CLOUD COMPUTING

The advancement of information and communication technologies has brought a digital age, where massive computing power, high speed and ubiquitous access to internet and more recently Cloud Computing Technology are expected to transform a wide range of organizations, industries, and societies. The complexities and uncertainties associated with such a transformation process generate numerous puzzling questions for practitioners and academic researchers. How can organizations overcome rigidities in their resources and routines and adapt in line with the requirements of such technological change? What are the distinct characteristics of the established firms that are more successful in maintaining their competiveness during and after the transformation process?

This dissertation combines multiple data sources concerning organizational adoption of Cloud Computing. It includes data from a 4-year intensive filed study, multiple comparative case studies, and a survey among Dutch companies, to provide a basis for better understanding of the micro-foundations of organizational capabilities for managing emerging technologies. Drawing on the literature on dynamic capabilities, this dissertation provides a more complete picture of the drivers of effective response to a technological change through investigation of the interplay between structures, routines, and managerial cognition.

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Tel.   +31 10 408 11 82
Fax   +31 10 408 96 40
E-mail   info@erim.eur.nl
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