TRANSFORMATION POTENTIAL OF CLOUD COMPUTING – UNDERSTANDING STRATEGIC VALUE CREATION FROM CUSTOMER AND VENDOR PERSPECTIVES

by

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DEDICATION

To the Almighty, to all my teachers for their passion and intellect and to my family for their unconditional love.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

While Cloud Computing is evolving as a major information technology phenomenon by redefining how IT capabilities are generated and consumed, the business value of this emerging model of IT capabilities delivery is anecdotal. Limited empirical research exists to my knowledge on what and how business value is created from these technologies. My dissertation devises three empirical studies to systematically investigate the business value of cloud computing technologies from the customer and vendor perspectives. In particular, I examine the transformation potential of these technologies in delivering strategic benefits that transcend beyond mere cost advantages often cited in practitioner literature. From the customer perspective, I investigate the strategic benefits these technologies create towards organizational and individual role effectiveness. In one study, I examine at the organizational level if adopting these technologies can be associated with the IT-enabled business innovation of the firms. At the individual role level investigated in another study, I examine the association between cloud computing adoption and the involvement of Chief Information Officers in strategic opportunities related to innovation and new product development. From the vendor perspective, I examine in my third study, the implications of cloud computing architectures for the vendor organizations. I attempt to understand what changes in the technical and organizational functions are needed in the vendor organizations to reorient themselves to create the expected business value and succeed in the cloud computing market. Through these three empirical studies, my dissertation is a systematic attempt to shed light on the strategic business benefits of cloud computing and the enablers of value creation in the cloud-based technology model.

Chapter I. Introduction

I-1. Motivation and Research Questions

Cloud computing technologies are being adopted in business and the phenomenon is gaining acceptance as a new delivery model for applications, infrastructure, and platforms as a service. According to the official National Institute of Standards and Technology (NIST) definition, "cloud computing is 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" (NIST TechBeat 2011).

The computing resources accessed as a service in the cloud computing based models have four defining characteristics - (1) Ubiquitous Connectivity and broad network access – capabilities are available over the network and can be accessed through standard mechanisms that promote use by heterogeneous platforms like laptops, PDAs, mobile phones, tablets etc. (Armbrust et al. 2009) (2) Centralization of resources by resource pooling – vendors pool their computing resources to serve multiple customers using a multi-tenant architecture model, with different IT resources dynamically assigned and reassigned based on each customer's demand (Marston et al. 2011). Services can be accessed anytime anywhere. Customers may not know the exact location of provided resources but may be able to specify the location at a higher level of abstraction. For example, customers have the option to specify that their data should reside in geographic boundaries if there are compliance requirements. (3) IT elasticity – Cloud computing allows to add or remove resources at a fine-

grained level and with a lead time of minutes rather than weeks allowing matching resources to workloads much more closely (Marston et al. 2011). For example, subscribers can add or remove connections to servers provided by vendors, one server at a time. The elasticity in the model eliminates the need for the customers to plan ahead for provisioning. (4) Measured Service - Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service. This implies that customers pay for the service as an operating expense without incurring any significant initial capital expenditure (Armbrust et al. 2009). These four factors collectively signify that there is an evolving model of service delivery wherein (a) IT applications which were earlier accessible only to large organizations can be made accessible to smaller organizations by deploying with the vendor and making them available without capital expenditures (b) customer organizations have the flexibility to use IT capacity and pay only for what they use and (c) vendors can generate economies by efficiently pooling resources and delivering them on demand.

Based on these characteristics, computing resources are being provided as services for access by the customers and these services can be broadly classified into three categories – Infrastructure-as-a-Service (IaaS), Platforms-as-a-Service (PaaS), and Software-as-a-Service (SaaS) (McAfee 2011). Under the IaaS model, companies are accessing basic IT capabilities such as servers and storage from the vendors without installation and maintenance responsibilities. An example is Amazon's Elastic Cloud (EC2) where customers can rent virtual machines from Amazon to host their software applications. PaaS environments offered by cloud vendors come equipped with operating systems, databases, servers and program execution environments like Java, Microsoft .Net, and Python. Hence these environments allow customers to use vendor's platforms to rapidly build their own custom applications that integrate with existing in-house applications (McAfee 2011: 6). For example, Google provides a platform called 'Google App

Engine' as a service and provides more infrastructure than IaaS to make it easy for customers to develop scalable software applications.

Under the SaaS model, service providers install and operate application software in the cloud and customers access the software from cloud clients. Applications vary from a single application to a suite of applications that reside in the cloud instead of on customers' own computers or data centers. An example is Salesforce Corporation's customer relationship management (CRM) application which is offered by Salesforce Corporation as a hosted service and as an alternative to in-house CRM implementations. Other examples include Microsoft Office 365 which is the hosted version of Microsoft Office suite of software applications that can be accessed by customers upon subscription rather than installing Microsoft Office on their machines. The services can be accessible over the internet anytime and anywhere based on customer requirements. Customers have the facility to use vendor's services on pay-per-use basis without high investment in IT assets and hence there is a potential to democratize access to latest technologies i.e. make possible world-class IT capabilities accessible and affordable even for smaller organizations as there is no up-front commitment of capital resources (World Economic Forum 2010).

Given the opportunity for these technologies to redefine how computing power is generated and consumed (McAfee 2011), the emerging Information Systems (IS) literature in this area (e.g. Clemons and Chen 2011; Xin and Levina 2008) has drawn comparisons or has subscribed to the view that cloud computing services sourcing is comparable to IT outsourcing (ITO). However, as described below, I build on the literature to argue that cloud computing models have distinguishing characteristics that separate it from ITO at several levels as described below.

First, ITO is a 'make vs. buy' decision and refers to whether to build IT capabilities internally or to use a third-party vendor to provide IT services that were previously provided internally (Lacity and Hirschheim 1995). Cloud

computing adoption is a hosting decision for the firm to host IT assets like software applications, servers and databases etc., internally or to host them externally with a cloud computing service vendor.

Second, ITO allows customizations of vendor offerings per the unique requirements of each customer. Cloud computing leverages multi-tenant architecture wherein a single instance of an application is hosted by the vendor to be collectively accessed by the customers. For example, for software applications like Microsoft Office 365 delivered under the cloud-based SaaS model, a single instance of the Microsoft Office application with common code and set of data definitions will be hosted by Microsoft for customers to access it over the internet rather than buying the licenses and installing the software on their machines. There is minimal customization possible due to the single instance hosting and the model gives more control over future development to the vendors as customers have to adopt future software upgrades without much flexibility to avoid them (Xin and Levina 2008).

Third, ITO contracts tend to be lengthy and are defined by a particular project or period of time with the focus being on service delivery. Cloud computing services can be availed with relative ease and in a short time frame with very short implementation cycles, without the need for lengthy negotiations and long-term contracts and thus making entry and exit easier (Marston et al. 2011). These models follow pay-per-use licensing wherein customers only pay for the services they have used. As the vendors host the IT assets as services, customers can avoid IT-related capital expenditures and have the advantage of no up-front commitment of resources (Willcocks et al. 2011). Vendors also maintain and administer the services without the need for customers to involve in administration. Put differently, the IT efficiency aspects related to system administration, maintenance and utilizing the power of computers more efficiently will be handled by the vendors by pooling in software and hardware resources and making efficient use of them based on capacity requirements (Armbrust et al. 2009). Further, cloud computing adoption can provide business

agility benefits as the IT elasticity inherent in the model to make IT systems available on demand can allow the customers to scale quickly and offer IT capacity at different speeds and times based on business requirements. Rapid IT application deployment, parallel processing and real-time scaling of resources to support business needs creates flexibility as enabled by cloud-based business models (Marston et al. 2011; Willcocks et al. 2011).

In this context, the distinguishing characteristics of these models can have significant implications for both the vendors and the customers. Vendors need to redesign their internal IT development and organizational business functions to be able to continuously upgrade their services and provide latest technologies to customers. Customers will have unprecedented access to world-class IT capabilities on-demand without the need to focus on IT efficiency aspects. Industry projections suggest that the global cloud computing market will triple from 2011 to 2017 and spending on cloud computing will reach an estimated $175bn by 2014 and $235bn by 2017 (Columbus 2014). Further, small and medium businesses are expected to spend over $100 billion on cloud computing by 2014 (Gartner 2013).

Despite the potential, evidence is largely anecdotal about the business value of these technologies and the existing literature has attempted to improve our collective understanding on the concepts and opportunities associated with cloud computing. Limited empirical research exists to my knowledge on the benefits and the business value these technologies can create. My dissertation devises three studies to attempt to fill the gaps in empirical research. In two of the studies, I attempt to investigate the business potential of these technologies in delivering strategic benefits to the subscribing customers. Investigating the impact of IT on two dimensions – individual role effectiveness and organizational effectiveness is important when understanding the success of customers' IT implementations (DeLone and McLean 2003).

Relatedly, in the first study, I focus on IT role effectiveness with specific emphasis on Chief Information Officer (CIO) role. In this study, I propose that cloud computing adoption is positively associated with the CIOs spending time on strategic opportunities related to innovation and new product development. I argue that the inherent IT efficiency benefits of cloud computing mitigate the CIO time spent on operational task demands and instead allow him/her to focus more on strategic activities related to innovation and new product development. I also suggest that the organizational complementarities in business process and systems capabilities and learning from the past outsourcing experience of the firm augment this effect. Empirical analysis with a large dataset mostly supported my hypotheses. Findings from a qualitative study by interviewing senior IT executives from the industry confirmed the empirical findings.

In the second study, I investigate the contribution of cloud computing towards organizational effectiveness by studying the role of SaaS in supporting IT-enabled business innovation of the firm. Building on the business innovation literature, I propose that the IT elasticity inherent in the SaaS model will be instrumental to provide necessary IT support to business process flexibility as the agility in the business processes influences the innovation outcomes. Hence I hypothesize that SaaS adoption is positively associated with the IT-enabled business innovation in the firm. Further, I investigate the impact of organizational complementarities in process management capability, IT architecture flexibility and past sourcing experience of the firm in enhancing the impact. Empirical results with a large dataset support my hypotheses. Findings from a qualitative study by interviewing senior IT executives from the industry confirmed the empirical findings and managerial insights based on my results are provided.

The underlying motivation for my work in these two studies from customer benefits perspective is to understand the strategic potential these technologies may offer. Establishing the strategic potential of emerging technologies is important to enhance their credibility (Agarwal and Lucas 2005).

Additionally, this outlook is important as practitioner literature emphasizes only the cost efficiency related benefits from cloud computing adoption and such narrow focus on cost advantages may eclipse the true strategic benefits cloud computing can offer (Willcocks et al. 2011; World Economic Forum 2010).

In the third study, I examine the implications of cloud computing architectures for the vendor organizations. I attempt to understand what changes in the technical and organizational functions are needed in the vendor organizations to reorient themselves to create expected business value and succeed in this market. Working through the revelatory case method and investigating through the lens of dynamic capability theory, I investigate the changes needed in the technical and business functions of an organization which is offering an Enterprise Resource Planning (ERP) application under the SaaS model. I intertwine my findings with a description of the various resource alteration modes: creating, modifying and extending resources to effect change in the technical and business functions. Understanding the implications of cloud computing architectures for vendors is important as the Application Service Provider (ASP) model which was considered as a predecessor to cloud computing had faced failures to gain traction in the market due to customer satisfaction issues. With cloud computing raising the same concerns about data security and systems reliability as in the ASP model, the findings of the study emphasize the need for creating new market understanding and the role of partnerships in developing the scale in the cloud-based market. Further, I elaborate the role of internal technical, process and people resources in effecting change and the revisions needed in the approach to product development, marketing and relationship management.

In sum, my dissertation is guided by two overarching research questions: First, what strategic benefits can the cloud computing technologies offer to business and do firm-level characteristics have a differential role in augmenting the benefits? Second, how can the vendors create business value for the customers and what changes are needed in their internal technical and business

functions to compete in the cloud computing market? By addressing these questions, my dissertation is a systematic attempt to shed light on the strategic business benefits of cloud computing and the enablers of value creation from the customer and vendor perspectives.

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Chapter II. Does Cloud Computing Adoption Enable CIOs to Focus More on Innovation and New Product Development Opportunities? - An Empirical Analysis

II-1. Introduction

The disruptive forces of digitization and their impact on organizational structures for partnering with internal and external stakeholders have increased the significance of Information Technology (IT) in enabling competitive advantage (Hagel and Singer 1999; Sambamurthy et al. 2003). IT is improving organizational performance through its impact on organizational business capabilities (Melville et al. 2004). IT has initiated a radical transformation of customer-producer relationships with important implications for new product development (NPD) and recent IT advances have improved product and process design capabilities (Kohli and Melville 2009; Nambisan 2003; Pavlou and El Sawy 2006). Relatedly, the subject of IT as an enabler of innovation and NPD capabilities is gaining increasing recognition in Information Systems (IS) literature (Saldanha and Krishnan 2011; Sambamurthy et al. 2003; Tarafdar and Gordon 2007).

As business dependence on IT in both operational and strategic perspectives is growing, Chief Information Officers (CIO) are gaining acceptance as members of the executive team (Ross and Feeny 1999). There is an understanding in most organizations that CIOs must transition from a technology manager responsible for managing IT into business leadership roles (Broadbent and Kitzis 2005; Carter el al. 2011). Prior IS research has emphasized the role of CIO as a strategic leader and attempted to examine how CIOs could be more effective and the factors influencing such effectiveness (Rockhart et al. 1996;

Smaltz et al. 2006). The primary argument here is that focusing on strategic opportunities will enhance CIO's value-added contributions and increase their credibility with colleagues in the management team (Banker et al. 2011; Peppard 2010).

In spite of the anecdotal evidence and academic research findings, it has been reported that a majority of CIOs are still spending a large amount of time on operational tasks (Weill and Woerner 2009). Firms want CIOs to spend double the amount of time with external customers to pursue innovation opportunities but 44% of their time is spent on managing the IT organization and running IT services to support business needs (Tata Consultancy Services 2010).[1] For example, in a 2007 survey of 155 CIOs from 26 countries, Massachusetts Institute of Technology researchers found that 54% of CIO's time was spent on operational tasks (i.e., providing IT services to business and supporting the organization's IT sourcing needs), while only 36% of time was devoted to working with business teams on strategy and innovation related opportunities (Weill and Woerner 2009). In a more recent 2011 survey of 188 CIOs from seven European nations, INSEAD Business School researchers found that 37% of the CIOs and 60% of the IT Groups interviewed were operationally focused on delivering IT services to the business units at the desired cost and service level. Moreover, around 65% of these respondents believed that their roles would not change over the next 3 years (Fonstad 2011).

These findings from practice are in contrast to our collective understanding in academic research that emphasizes CIOs to involve more in strategic opportunities related to innovation and NPD. Hence my motivation in this study is to understand how a CIO's time can be spent more effectively on strategic opportunities like on innovation and NPD rather than on the

[1] Similar opinions were expressed in my qualitative interviews with IT leaders that their managements want to pursue latest technologies but the IT team is occupied with operational activities and legacy systems. The findings from qualitative interviews are explained in a later section. I thank Dr. Gautam Ahuja for motivating this discussion.

organization's IT operational tasks. Prior research has also highlighted the need for an understanding of a CIO's balance of time between operational and strategic opportunities in order to gain business performance effectiveness (Chun and Mooney 2009; Karahanna and Watson 2006; Peppard 2010). My study is also motivated in understanding the balance of a CIOs time in the context of adopting the emerging technologies of cloud computing. I surveyed extant management literature in IS and other disciplines and found that 'attention' is an important construct widely studied in management literature to understand the focus of business leaders (Yadav et al. 2007). However, this has received limited investigation in IS research. I conjecture that attention can be an essential construct to understand what drives the strategic role of CIOs within the organization and hypothesize that adoption of cloud computing can enable CIOs to focus more on strategic opportunities related to innovation and NPD.

The cloud computing phenomenon is gaining acceptance as a delivery model for applications, infrastructure and platforms as a service. By definition, "cloud computing is 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" (NIST Tech Beat 2011). Industry reports indicate that customers are availing cloud based offerings for different benefits including cost and process efficiencies, and new business opportunities. For example, customers are using Salesforce Corporation's Customer Relationship Management applications under the Software-as-a-Service (SaaS) business model. Organizations such as Eli Lilly which function in industries where information is heavily governed by compliance requirements, are hosting pre-regulated data on the cloud to conduct scientific experiments (Foley 2010). Anecdotal evidence also suggests that cloud computing adoption delivers IT efficiency benefits and reduces the operational task-related burden on CIOs (Computer Associates 2012; McAfee 2011; PRWeb 2011). However, some industry reports highlight the security and privacy risks of cloud computing thus burdening the CIO with more operational responsibilities.

For example, Columbus (2013) found from CIO interviews that CIOs are spending time working with cloud-based vendors to define the physical location, contents and specific configuration of every server used, several revisions of the Service Level Agreements (SLA) to define performance measurements tied to business strategies, create highly specific privacy plans and running full-scale pilot tests of data extraction and deletion on vendor's servers. Hence there is a need for empirical research to validate the arguments and develop an understanding on the role of cloud computing adoption in enabling CIOs to devote more time to opportunities related to innovation and NPD. Thus in my study, I investigate two research questions: Can cloud computing adoption enable CIOs to focus more on opportunities related to innovation and NPD? Do organizational complementarities have a role in augmenting the ability of CIOs to focus more on innovation and NPD?

In line with past research, I broadly classify organizational priorities as strategic and operational where operational tasks refer to internal administrative concerns (Golden and Zajac 2001: 1093). As noted earlier, I draw from the theory of the Attention Based View (ABV) of the firm from Organizations literature and the IT business value literature to associate cloud computing adoption with CIO involvement in innovation and NPD. I suggest that the inherent efficiency advantages in the cloud computing model reduce the marginal cost of operational effort for the CIOs as the vendors handle the operational efficiency tasks and thereby creating scope for CIOs to attend to more important priorities of the organization (cf. Ramsey 1927). Further, I propose that with the emphasis on the CIOs to pursue strategic opportunities like innovation and NPD, cloud computing adoption creates a 'dual effect' by the inherent resource flexibility in the model reducing even the marginal cost of responding to strategic opportunities by bringing in higher agility in internal systems and platforms. My empirical findings show that cloud computing adoption can be associated with CIO involvement in innovation and NPD. I find that organizational complementarities in business process and systems capabilities augment this effect. I also conducted a qualitative field study that included interviews on this subject with 16 senior IT

executives. My qualitative study confirmed my empirical findings and managerial insights based on these results are provided.

There are three primary contributions of my study. First, in the context of existing literature emphasizing that CIOs spending more time on strategic opportunities like innovation and NPD is an important antecedent of CIO effectiveness, this study adds to CIO leadership literature by providing empirical evidence on how cloud computing as an emerging technology can be associated with enabling CIOs to focus more on innovation and NPD. In addition, this is one of the initial studies to empirically examine business benefits of cloud computing through CIO's ability to spend more time on strategic opportunities related to innovation and NPD. Second, this study establishes the role of organizational complementarities in business process and systems capabilities in enhancing the benefits of cloud computing. Third, to my knowledge this is one of the first studies that bring attention as a construct drawing from ABV to understand opportunities for enabling IT leaders to focus more on innovation and NPD and the resultant effectiveness. By doing so, this study highlights that technology can be an enabler to free up the attention demands of individuals and organizations.

The remainder of this paper is organized as follows. In the following section, I discuss cloud computing concepts and the characteristics of these business models. I briefly discuss the literature related to cloud computing, CIO role scholarship, and research on the theory of ABV of the firm and how it relates to CIO context in the following section. I then develop theoretical foundations underpinning my research and discuss hypotheses. I next elaborate on research methodology and results. Finally, I discuss the implications of my research, describe limitations, and suggest future research opportunities.

II-2. Cloud Computing – Concepts and Distinguishing Characteristics

Cloud computing technologies are being adopted in business and the phenomenon is gaining acceptance as a new delivery model for applications, infrastructure, and platforms as a service. According to the official NIST definition, "cloud computing is 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" (NIST Tech Beat 2011).

As McAfee (2011) described, services provided under the cloud computing model can be broadly classified into three categories – Infrastructure-as-a-Service (IaaS), Platforms-as-a-Service (PaaS), and Software-as-a-Service (SaaS). Under IaaS, companies are accessing basic IT capabilities such as servers and storage without installation and maintenance responsibilities. An example is Amazon's Elastic Cloud (EC2) where customers can rent virtual machines from Amazon to host their software applications. PaaS environments offered by cloud vendors come equipped with operating systems, databases, servers and program execution environments like Java, Microsoft .Net, and Python. These environments allow rapid software development by customers (McAfee 2011: 6). Customers can use a vendor's PaaS offerings to develop their own custom applications that integrate with existing applications. For example, Google provides a platform called 'Google App Engine' as a service and provides more infrastructure than IaaS to make it easy to develop scalable applications.

Under the SaaS model, service providers install and operate application software in the cloud and customers access the software from cloud clients. Applications vary from a single application to a suite of applications that reside in the cloud instead of on customers' own computers or data centers. An example is Salesforce Corporation's customer relationship management (CRM) application

which is offered by Salesforce Corporation as a hosted service and as an alternative to in-house CRM implementations. Other examples include Microsoft Office 365 which is the hosted version of Microsoft Office suite of software applications that can be accessed by customers upon subscription. Customers availing services under the three models have the facility to pay-per-use on a short-term basis and can scale services up or down based on their needs (Armbrust et al. 2009).

While anecdotal evidence and practitioner literature highlights the risks of cloud computing in such areas as security, reliability, compliance, and data management, the use of cloud computing for fulfilling organizational IT needs has significantly increased. Customers are availing cloud based offerings for different benefits including cost and process efficiencies, new business opportunities, and competitive advantage (World Economic Forum 2010). Firms are realizing that their CIOs and IT departments are freed up from operational tasks and spending more time developing new initiatives to drive organizational growth. For example, Enterasys Networks, an American networking company that offers wired and wireless infrastructure, initially began using cloud-based Salesforce.com CRM SaaS application. In 2010, the company accelerated cloud deployment with six new cloud-based applications in six months. By 2013, 70% of the company's application portfolio was cloud-based (Deloitte Insights 2013). According to Rich Casselberry, director of IT infrastructure at Enterasys, his IT teams spent 60% of time on operations and maintenance and 40% on new application development in 2010. By 2013, the ratio switched to a 60-70% focus on new application development and 30-40% on operations and maintenance. Additionally, IT operations staff members have moved into business analyst, application developer, and user support roles based on this switch in time allocations. *"Instead of worrying about patching systems and replacing failed hard drives, many members of the IT department are spending more time teaching business users the ins-and-outs of cloud tools and monitoring emerging cloud technologies we may be able to use in the future,"* said Casselberry. Speaking about his personal time allocations, he added, *"I spend*

more time talking with end users, business leaders and partners, industry analysts, external customers, and the media, which is a lot more interesting than watching tapes spin or backing up hard drives."

Similar observations were made by Raj Datt, CIO of Aricent Group, a global technology services company. With 14% of IT applications moved into the cloud and plans for more, Datt was able to shift some IT team members into business analyst and architect roles. "*They're creating the blueprints and workflows required to enhance business processes and operations,"* he said. Cloud computing has also eased some of Datt's operational and tactical concerns, freeing him up to focus more on analytics. *"I don't have to worry about the applications on the cloud from an infrastructure standpoint. Worrying about uptime and downtime is somebody else's headache"* (Deloitte Insights 2013).

While the limited academic literature on cloud computing has treated cloud computing as a form of IT outsourcing (ITO) (e.g. Clemons and Chen 2011; Xin and Levina 2008), in this study, I argue that cloud computing possesses some unique characteristics that differentiate it from ITO. I propose that there are differences at least at three levels– resource, architecture/delivery, and service/contract – that distinguish cloud computing from ITO. At the resource level, ITO has been associated with the "make or buy" or "insource versus outsource" decisions (Clemons et al. 1993). Cloud computing is a hosting decision underpinned by technology delivery and is essentially about IT services delivered from a virtual private or public source (Marston et al. 2011). Services can be delivered from a public or private cloud. Cloud computing can enable companies to buy or build IT capabilities as a service. Within each cloud delivery type, both private and public cloud services can be insourced or outsourced. I argue that the ability to deliver services from an insourced private or public cloud fundamentally separates cloud computing from ITO business models at the level of resource procurement. An anecdote from the industry provides a glimpse of the practitioner perception supporting our argument. Lien Chen, director of corporate IT at RAE Systems, a gas and radiation detection systems

manufacturer, acknowledges that using cloud computing is technically considered outsourcing but she doesn't think of it as outsourcing. *"Outsourcing has a bad name,"* she said, *"this (cloud computing) is nothing but a platform difference"* (King 2012). Relatedly, with cloud computing adoption being a hosting decision rather than a complex make-buy decision, cloud computing may help reduce CIO and IT department administrative tasks since vendors provide hosting services and address system administration issues (McAfee 2011).

At the architecture/delivery level, cloud computing differs from ITO in the degree of customization of the vendor offerings. While ITO allowed customizations per unique requirements of each customer, cloud computing models leverage multi-tenant architecture for vendors to deploy a single instance, leaving less scope for customization compared to ITO (Xin and Levina 2008). For example, for software applications delivered under the cloud based SaaS model, a single instance of common code and set of data definitions are hosted by the vendor with limited scope for customization by the adopter (Chong and Carraro 2006). In addition, the model gives more control over future development to the vendor as customers have to adopt future software upgrades without much flexibility to avoid them (Xin and Levina 2008).

At the service/contract level, I foresee at least two differences between cloud computing and ITO. First, cloud based services can be availed with relative ease and in a short time frame, without the need for lengthy negotiations and long-term contracts (Marston et al. 2011). ITO contracts tend to be defined by a particular project or period of time. Second, cloud computing offers IT elasticity with computing capacity available on demand to scale quickly and offer capacity at different speeds and times based on customer requirements (Willcocks et al. 2011). This flexibility creates more scope for consumerization of IT due to usage-bound pricing structures and lack of up-front commitment of resources (Willcocks et al. 2011). ITO is more pertinent about service delivery rather than about elasticity and scalability advantages. As elaborated by Chen of RAE Systems, she likes how quick cloud services can be installed and how easy they

are to maintain. *"If everything is equal, at this point in time I would definitely go to the cloud,"* she said (King 2012). Relatedly, cloud computing adoption can be lesser burden on CIOs and their IT departments compared to ITO in terms of contract administration since entry and exit criteria are relatively easier (Marston et al. 2011). Also that the resources can be scaled quickly, the flexibility in the model allows CIOs to quickly match IT capacity requirements of the business and hence better fulfill core expectations of the CIO role as an IT resource provider (Carmel and Agarwal 2002).

Table II-1 below summarizes the differences between ITO and Cloud Computing.

Table II-1: Differences between IT Outsourcing and Cloud Computing

	IT Outsourcing	**Cloud Computing**
Procurement Level	Make vs. buy decision	Hosting decision
Architecture/ Delivery Level	Unique customizations based on customer requirements	Less scope for customization • Multi-tenant single instance • Common code and definitions • Vendors control the updates
Service/ Contract Level	• Contracts defined by projects or length of time • Focus is more on service delivery	• Short timeframe contracts and pay-per-use licensing • Focus is more on scalability of resources

II-3. Literature Review

II-3.1. Literature on Cloud Computing

With cloud computing being an emerging phenomenon, there is limited academic research in this area to my knowledge. Existing literature has attempted to improve our understanding on concepts and opportunities associated with cloud computing adoption. In their theoretical paper, Marston et al. (2011) provided conceptual arguments about IT efficiencies and business agility benefits from cloud computing. Their core argument is that cloud computing is a convergence of two trends – IT efficiency and business agility.

They suggest that IT efficiency is enhanced when the power of computers is utilized more efficiently through highly scalable hardware and software resources. Further, rapid IT application deployment, parallel processing, and real-time response of IT resources can drive agility. With no up-front capital investment, immediate access to IT resources can be procured in cloud based models and makes it easier for enterprises to scale resources on demand. On the other hand, they argued that lack of standards leading to vendor lock-in and regulations to deploy storage within geographical boundaries may hinder adoption (Marston et al. 2010: 182). McAfee (2011) suggested through his qualitative work that cloud computing adoption can free up time of IT departments as the firms can get access to latest technologies from cloud based deployments. Hence internal IT departments need not spend time on reposing older technology for modern use (McAfee 2011: 4). The author explained that this will be useful to improve productivity of already stretched IT departments. In addition, he presented qualitative evidence that the ability of IT users to access applications without routing every request for sign up through IT departments is not only freeing up IT departments but also improving productivity of IT users in the firms (McAfee 2011: 5).

Regarding the strategic benefits of cloud computing, Aral et al. (2010) found qualitative evidence through case study research that cloud computing can create strategic benefits towards competitive advantage in addition to economic benefits. However, the benefits realization is contingent on fostering complementary capabilities including standardized infrastructure, data management, and business processes. They also found that firms with strong IT-business partnership and firms that excel at managing external vendors realize maximum value from adoption. Brynjolfsson et al. (2010) in their theoretical work cautioned against mere replacing of existing IT resources with cloud based IT solutions and suggested that complementary investments in process and organizational changes should accompany the adoption. Choudhary (2007) analytically modeled the impact of cloud based SaaS licensing models on the software firm's incentive to invest in software quality. By comparing SaaS

licensing model with perpetual licensing, the author found that firms will invest more in product development in SaaS business model. This increased investment leads to innovation, higher software quality, and higher profits. Koehler et al. (2010) was a notable exception with empirical evidence about consumer preferences for different service attributes in cloud computing. Studying the cloud computing adoption decisions, the authors found that the reputation of the cloud provider and use of standard data formats are more important for customers when choosing a cloud service provider rather than cost reductions or tariff structures.

Under practitioner literature and anecdotal evidence, a 2010 Davos World Economic Forum report indicated that cloud computing market grew at 30% in 2011, or more than five times the entire IT industry rate. The report highlighted the benefits cloud technologies can deliver and called for empirical research to better understand the benefits and contextual complementarities (World Economic Forum 2010). It has called for exploring if cloud technologies can deliver higher order benefits transcending beyond cost efficiencies. Gartner, a leading IT Advisory firm, has projected that global cloud computing market will grow at 18.5% in 2013 to total $131 billion, up from $111 billion in 2012 (Gartner 2013). A 2011 survey of 685 CIOs across 30 countries by Computer Associates (CA) has found that CIOs are spending more time on strategy and innovation upon cloud computing adoption (Computer Associates 2012). Among the CIOs surveyed, 54% thought that the focus of their role is shifting away from technology support to provision of business services. The reason was that cloud computing adoption was mitigating concerns related to procuring technology and administering it by cutting down procurement time and maintenance related administrative issues. Instead, cloud computing adoption is facilitating these enterprises to avail latest technologies that enable entering new markets in hours, scaling up resources to launch new product in minutes, and slashing development and testing time by days (Computer Associates 2012).

In summary, first, cloud computing adoption can deliver IT efficiency related benefits and can ease constraints on IT departments (McAfee 2011). Pertinent to my study, this implies that the inherent efficiency advantages in the cloud computing model reduce the marginal cost of operational effort for the CIOs as the vendors handle the operational efficiency tasks and thereby creating scope for CIOs to attend to more important priorities of the organization (cf. Ramsey 1927). Further, with the emphasis on the CIOs to pursue strategic opportunities like innovation and NPD, cloud computing adoption creates a 'dual effect' by the inherent resource flexibility in the model reducing even the marginal cost of responding to strategic opportunities by bringing in higher agility in internal systems and platforms. Second, organizations may vary in the extent to which they adopt and leverage cloud computing to enable CIOs to focus more on innovation and NPD. Hence, as informed by past research, there is a need to investigate the differentiating role of organizational complementarities in enhancing value from cloud computing adoption (Brynjolfsson et al. 2010). In particular, there may be a distinguishing role for systems, process, and vendor management capabilities in driving business value (Aral et al. 2010). Third, in spite of the potential of cloud computing technologies, to my knowledge, there is scant empirical research on the business value of cloud computing with existing literature being largely conceptual, analytical, or anecdotal.

II-3.2. Literature on CIO Role and CIO Contributions [2]

Information Systems leadership is a critical area for many organizations because of increasing dependence of business on IS both for operational stability and for enabling innovation and business strategy. The role of CIO is evolving from a manager of IT operations to a strategic business leader who can create competitive advantage (Ross and Feeny 1999). CIO responsibilities in interacting

[2] I limit my review to briefly present representative studies from CIO Leadership research. Please refer Preston et al. (2008) and Karahanna and Watson (2006) for a more comprehensive list of studies on CIO research.

with customers, other executives of the firm, and involvement in product development processes are becoming an imperative to drive technology-enabled innovation (Saldanha and Krishnan 2011).

The IS Leadership and IT-Business alignment research has increased our collective understanding around the CIO role and how CIOs can create organizational impact. One sub-stream of research has focused on the CIO effectiveness dimension. For example, Smaltz et al. (2006) demonstrated that CIO's personal characteristics as reflected in their business and strategic IT knowledge, interpersonal communication skills, and political savviness were significant predictors of CIO effectiveness. In addition, they found that the higher rank of the CIO in the organization, extent of networking with top management team (TMT) members, and ability to build trusting relationships with TMT will enhance CIO effectiveness. This study further highlighted how CIO capabilities mediate the relationship between CIO-TMT relationships and CIO effectiveness. Enns et al. (2003) found that successful CIOs champion IT initiatives that are consistent with the strategic direction of the firm. The authors identified that such CIOs possess a sophisticated understanding of the role of effective influence and thus leverage well established relationships to gain business commitment to IT initiatives. Wu et al. (2008) found that higher levels of technology and business management competencies are antecedents of CIO effectiveness which in turn will significantly enhance a firm's IT assimilation capability.

Another sub-stream of research has focused on how CIOs can support IT's contribution to firm performance. For example, Johnson and Lederer (2005) highlighted the role of convergence between the CIO and CEO to successfully exploit IT investments. Their study found that higher communication frequency between the CIO and CEO led to greater convergence on current priorities, future enhancements, and future differentiation role of IT investments. In addition, their study suggested that channel richness plays a role in CIO-CEO convergence regarding future differentiation capability of IT investments. Banker et al. (2011) suggested that firms should ensure that their CIOs report to appropriate

executive based on the firm's strategic positioning. Their study found that CIO-CEO reporting is beneficial for firms adopting a differentiation strategy while CIO-CFO reporting is recommended for firms aiming for cost leadership. Preston et al. (2008) found that CIOs have a greater influence on IT's contribution to firm performance when provided with strategic decision making authority. They further suggested that organizational climate, organizational support for IT, CIO's structural power, CIO's strategic effectiveness, and a strong CIO-TMT partnership strongly influence endowing CIOs with required decision-making authority. Sobol and Klein (2009) related CIO's background and attitude towards IT investment to firm performance and found that firm performance was higher when the CIO was from IT rather than from general management background. In addition, they found that CIOs who have a strategic orientation rather than utilitarian orientation were associated with more profitable returns.

While research has recognized the strategic importance of the CIO, there is a persistent debate on why CIOs are effective or ineffective. There is limited empirical research that has attempted to advance our understanding of antecedents that enable CIOs to be effective strategic leaders. The extant literature here is largely anecdotal or has attempted to understand the role of CIO personal characteristics and organizational relationships in driving CIO effectiveness (Karahanna and Watson 2006). The continuous changes in competitive landscape due to technology-enabled business models are further limiting our understanding as these changes are impacting the CIO role and potential sources of CIO value (Ross and Feeny 1999). Relatedly, it was pointed out that there may be other factors that are affecting CIO effectiveness and research may be progressing by placing too much emphasis on the CIO as an individual and his/her competencies (Peppard 2010). As Peppard (2010) questioned, *"Anecdotally, we hear of CIOs with big reputations, moving to new organizations and struggling. Why might this be? These individuals still possess the same competencies and skills and bring with them a wealth of experience to the role, yet do not seem to enjoy the same levels of success."* Given new found demands for a strategic role of the CIO towards driving business transformation,

the dominant diagnosis of why CIOs are struggling was that they are not being portrayed as strategic in their orientation i.e. focusing on strategic opportunities like innovation and NPD and hence are having little credibility with their business colleagues (Maruca 2000; Peppard 2010: 75).

In summary, there are several open questions in studying the antecedents of CIO effectiveness. Past research has focused on the CIO as an individual, their personal characteristics, and organizational relationships in understanding the effectiveness of the CIO role. However, the existing ways in which IT is managed may potentially force the CIO towards a strategic or operational role. This highlights disconnection in developing a complete understanding of antecedents of CIO effectiveness. There can be a significant role for other organizational complementarities that can define the functioning of the CIO (Karahanna and Watson 2006; Preston et al. 2008). CIOs orientation to focus on strategic opportunities like innovation was emphasized as an important enabler of CIO effectiveness which is needed to build credibility with business colleagues and to deal with the cut and thrust of organizational politics (Peppard 2010: 75). Hence I subscribe to the advocacy in past research that CIOs ability to focus more and spend time on strategic activities like innovation and NPD is a critical antecedent in making CIOs as effective contributors to the organization and I examine the enablers of such a CIO focus on innovation and NPD.

II-3.3. Literature on the Attention Based View of the Firm

I believe that the Attention Based View of the firm (ABV) from Organizations literature can provide theoretical guidance in IS context to examine the link between CIO attention and his/her ability to spend more time on strategic opportunities related to innovation and NPD. The core argument in ABV theory is "that to explain firm behavior is to explain how firms distribute and regulate the attention of their decision-makers" (Ocasio 1997). Herbert Simon's (1947) pioneering perspective on ABV highlighted the limits of human rationality in explaining how firms make decisions. The limited attention

capability of humans regarding consequences of their actions, how these actions are valued, and the range of alternatives available for acting, bounds the capacity of the agents to be rational (Ocasio 1997). Organizations influence individual decision processes by allocating and distributing the stimuli that channel the attention of administrators in terms of what selected aspects of the situation are to be attended and what has to be ignored (Simon 1947). Firm behavior is both a cognitive and structural process, as decision-making in organizations is the result of limited attention capacity of humans and structural influences the organization has on an individual's attention (Simon 1947). B

Building on Simon's work, literature has described how senior executives are steeped in the past or daily grind and fail to perceive strategic opportunities developing in the environment (Finkelstein 2005). As creativity requires some time and cognitive resources, high job demands hinder novelty and fresh thinking (Cho and Hambrick 2006). Put differently, freeing up senior managers from the organization's daily grind and facilitating to use their attention to value-added activities will enhance the strategic benefits to the organization. For example, Yadav et al. (2007) analyzed longitudinal data from 176 banks and demonstrated how the CEOs by exercising their discrete allocation of scarce attention resources could have significant implications on the innovation outcomes of the firm. Their study found that CEOs who exhibit more focus on future and on developments beyond the firm boundaries, rather than burdened by operational tasks, increase the chances for innovative outcomes of the firm. A significant implication of their study was that senior executives (i.e., CEOs, COOs, and CIOs) can influence the process of innovation in their firms by focusing on the future and on the external environment of the firm rather than narrowly focusing on internal operational priorities and current issues (Yadav et al. 2007).

ABV recognizes that managerial attention is the most precious resource in a firm and the decision to allocate attention to particular activities is the key in explaining why some firms adapt and innovate. Further, ABV emphasizes that a

firm's decision makers have limited cognitive ability to assimilate unlimited stimuli in the environment and hence decision makers need to "concentrate their energy, effort and mindfulness on a limited number of issues and tasks" to achieve successful strategic performance (Ocasio 1997: 203). In this context, Ocasio (1997) made explicit the structure of the ABV. In particular, his work explained how stimuli are noticed, encoded, and transformed into a limited set of organizational moves as a result of how a firm formally and informally structures the flow of attention to its boundedly rational decision makers. According to him, the ABV is based on three interrelated theoretical Principles: (1) focus of attention – which says that what a decision-maker is doing depends on what issues and answers the decision-maker focuses (2) situated attention – which says that what issues and answers a decision-maker focuses, and what the decision-maker does, depends on the specific context, setting, and situation decision-maker finds himself/herself in (3) structural distribution of attention – which says that the focus of attention among decision makers participating in the firm's procedural and communication channels is generated by the rules, resources, players, and social positions of the firm.

ABV has received wide adoption in management literature to improve our understanding on how the allocation of decision-makers' attention leads to differential organizational outcomes. For example, Koput (1997) reasoned why distractions from over-searching can have a negative influence on performance. This work explained that while there may be too many ideas for the firm to manage and choose from, only a few of these ideas are taken seriously or given the required level of attention and effort to bring them into implementation. In another study, Verona (1999) advocated how strategies designed by managers to gain improvements in firm performance will guide structuring the attention of the actors involved in strategy implementation. This study stressed that improving managers' understanding of an organization's priorities would help them shape organizational activities better by directing attention towards critical variables that matter to those priorities. Golden and Zajac (2001) found that a board's attention to strategy issues and that the extent of time and attention that

boards devote to strategic issues will determine the magnitude of strategic change in the organization.

However, ABV has received limited adoption in IS literature to my knowledge. ABV was leveraged in IS to study how to capture users' visual attention in organizational computing and e-commerce scenarios rather than looking at the strategic 'cognitive attention' perspective emphasized in ABV. For example, Shen et al. (2009) attempted to understand how online reviewers compete for the attention of book readers when writing online reviews. They suggested that reviewers are more likely to post reviews for popular but less crowded books to gain readers' attention. Carlsson (2008) theorized that ABV can guide effective decision support systems (DSS) design to gain attention of the systems' users. The author argues that the DSS field has been heavily influenced by several views with their own limitations and alternative views should be explored as the basis for design and management of DSS. He suggests that ABV can be an alternative view to consider and design DSS based on understanding of what users should attend to can provide personalized information for better decision-making (Carlsson 2008: 38).

In this study, I extend ABV to IS research to understand the role of cloud computing in enabling CIOs to spend more time on strategic opportunities related to innovation and NPD. There are two implications of ABV literature for my study. First, as ABV advocates, managing the limited attention of executives is important and firms should identify enablers that assist executives in focusing on strategic value-added activities rather than spending their time and effort on daily operational tasks. Second, pertinent to my study, cloud computing adoption may enable firms to mitigate operational task demands on CIOs as there is an opportunity to move services to the cloud and a likely reduction of IT personnel working on operational tasks. Thus cloud computing adoption has the potential to reduce the number of ideas a CIO has to work on and channel his/her attention to focus on strategic opportunities related to innovation and NPD.

Hence I draw and build on ABV to examine if cloud computing adoption can be associated with the CIOs involvement in innovation and NPD.

II-4. Research Questions

CIO contribution to organizational performance and enablers of CIO effectiveness has been an active research topic. As noted earlier, despite the emphasis on the need to better understand how CIOs can be more effective, the findings are mostly anecdotal and inconclusive. I surveyed extant management literature and identified that 'attention' is an important construct widely studied in management literature that could potentially be used in understanding CIO effectiveness. I conjectured that one of the reasons that can impact CIO effectiveness is his/her inability to focus more on strategic opportunities because of competing time demands of operational tasks. I believe the 'cognitive attention' perspective discussed in management literature can be used as a framework to study CIO's spending more time on strategic opportunities like innovation and NPD and on attention balance between strategic and operational tasks. My supposition based on my understanding from cloud computing literature is that cloud computing adoption can mitigate efficiency demands on CIOs, freeing them from routine operational tasks in order to focus more on opportunities related to innovation and NPD. However, this linkage may not be about adopting cloud computing but also the complementary capabilities that firms leverage. Hence, informed by past research, I foresee that organizational complementarities can create differential impact in enhancing the effect. Consistent with this discussion, I pose two research questions for systematic examination: Can cloud computing adoption enable CIOs to focus on more strategic opportunities related to innovation and NPD? Do organizational complementarities have a role in augmenting the ability of CIOs to focus more on innovation and NPD?

II-5. Theory and Hypotheses Development

The differential role of organizational capabilities in creating value from IT investments has been discussed in literature. My primary hypothesis in this study is that cloud computing adoption enables CIOs to focus more on innovation and NPD. However, organizations may vary in the extent to which they leverage the benefits of cloud computing adoption. Hence, along the lines of prior studies, I investigate the differentiating role of organizational complementarities in enabling CIO focus (Aral et al. 2010; Brynjolfsson 1993).

I draw upon the framework of Feeny and Willcocks (1998) to examine the complementary core capabilities needed to drive value from IT investments as in cloud computing. At a high level, Feeny and Willcocks (1998) highlighted the role of systems capabilities, the role of sourcing strategies supported by effective vendor management and a business thinking related to process orientation to support business initiatives. Relatedly, research has advocated two organizational capabilities - systems and process capabilities are essential to create value from IT investments (Gold et al. 2001). The complementarity between IT systems capabilities and organizational process capabilities was identified as key for increased productivity and performance in organizations (Aral and Weill 2007). For example, Rai et al. (2006) reported that when IT infrastructure integration capability is leveraged to develop a higher order supply chain process integration capability, it can lead to significant performance gains in inter-firm relationships. In addition to these two capabilities, organizational learning was found to be an important capability to leverage past experience in managing inter-firm engagements (Whitaker et al. 2010). As cloud computing adoption shares some characteristics of partnering arrangements, I study the relevance of business coordination-centric IT systems capabilities, business process management capabilities, and learning from past outsourcing experience in enhancing the effect of the association between cloud computing adoption and CIOs ability to involve in innovation and NPD (Aral et al. 2010).

II-5.1. Hypothesis 1: Associating Cloud Computing adoption with CIOs involvement in Innovation and NPD

Pervasive digitization and ubiquitous connectivity are rapidly enabling firms to move beyond organizational boundaries and co-create new products and services with partners and customers (Prahalad and Rawaswamy 2004). Firms are integrating IT with key business processes, knowledge, and relationships to nurture innovation in areas such as customer relationships, manufacturing, procurement, supply chains, etc. (Agarwal and Sambamurthy 2002; Barua and Mukhopadhyay 2000). Advances in IT have enhanced new product development and process design capabilities. IT is becoming instrumental in business innovation by enabling new capabilities in process and product design (Nambisan 2003; Pavlou and El Sawy 2006).

As IT emerges as an enabler of business innovation, the role of the CIO is also evolving. Traditionally, the IT function was viewed as a cost center and the CIO's role was to manage IT to provide reliable systems and service support to business functions (Applegate and Elam 1992). As a technology manager responsible for business operations, CIOs spent time on operational tasks related to IT management, licensing, contract management, etc. This implied that limited time was available to focus on strategic opportunities. However, with opportunities emerging for IT to provide new capabilities that can fundamentally change business processes and transform organizations, CIOs are evolving as an externally oriented executive responsible for aligning business and technology to deliver competitive advantages for the firm (Feeny and Ross 1999). Firms now expect CIOs to leverage IT to help drive business innovation (Chen et al. 2010). Hence it is becoming important that CIOs play an integral role as a strategic contributor of executive teams and facilitate in shaping conditions that leverage IT to pursue strategic opportunities. To accomplish new demands on the CIO role, CIOs need to balance operational and strategic priorities. They need enablers that mitigate operational tasks and which allow them to focus more on strategic opportunities (Karahanna and Watson 2006; Peppard 2010).

In this context, cloud computing based technologies are emerging as a promising option to mitigate CIO's attention to operational tasks in multiple ways. First, by shifting IT infrastructure to the cloud, these IT systems deliver efficiency benefits wherein computing power is more efficiently used through scalable hardware and software resources (Marston et al. 2011). Further, cloud computing adoption may reduce the number of IT personnel who work on operational tasks as vendors maintain systems on behalf of customers therefore reducing the need for systems administration (McAfee 2011). Second, cloud computing models endow business agility benefits wherein IT software capabilities can be procured through rapid software applications deployments. Business innovation research has argued that to create operational agility in responding to market dynamics needs thorough business process changes (Sambamurthy et al. 2003). Creating flexibility in the business processes needs support from backend software applications that digitize these processes (Prahalad and Krishnan 2008). Related IS research has argued that to foster this flexibility, firms need to develop an effective IT capability that can deliver systems when needed to support business process changes (Ross et al. 1996). Such a capability can be achieved through some cloud computing options such as SaaS. In sum, it can be construed that the inherent efficiency advantages in the cloud computing model reduce the marginal cost of operational effort for the CIOs as the vendors handle the operational efficiency tasks and thereby creating scope for CIOs to attend to more important priorities of the organization (cf. Ramsey 1927). Further, with the emphasis on the CIOs to pursue strategic opportunities like innovation and NPD, cloud computing adoption creates a 'dual effect' by the inherent resource flexibility in the model reducing even the marginal cost of responding to strategic opportunities by bringing in higher agility in internal systems and platforms.

I believe this has two important implications for the CIO. First, the CIO will be in a position to fulfill his role expectations by providing flexible IT systems support to business needs and thus enable agility in the organization. Second, and more importantly, the inherent efficiency advantages in cloud-based models

would reduce operational task burdens on CIO thereby allowing the CIO to focus attention towards value-added strategic opportunities like innovation and NPD. The CIO may be able to build more credibility with business colleagues by allocating more time and attention to provide guidance on strategic utilization of IT (Peppard 2010). Consistent with above discussion, I hypothesize that:

H1: Cloud Computing adoption is positively associated with CIO's focus on strategic opportunities related to innovation and new product development

II-5.2. Hypothesis 2: The Role of Past Outsourcing Experience

Organizational learning is a dynamic capability wherein firms acquire valuable knowledge and use it to build higher order capabilities towards competitive advantage (Bhatt and Grover 2005). Organizations build capabilities by learning from doing and thereafter reuse this learning to succeed in future activities. The reason being that successful execution of an action is a source of self-assurance that makes firms become more confident that they have the capabilities and knowledge required to be successful in a specific domain (Haleblian et al. 2006). This assurance makes firms explore opportunities to refine the action and increase the probability of reusing it in the future (Amburgey et al. 1993; Shaver et al. 1997). Relatedly, as the firm gains experience with an activity, it develops standard processes associated with the activity and systematizes them to reuse in the future. To exemplify, organizations that were engaged in IT outsourcing (ITO), and in coordination with vendors, learn from the experience of working with vendors and develop standard processes of vendor engagement based on the learning and extend it to other sourcing activities. Prior research has shown that such firms are more likely to engage in Business Process Outsourcing (BPO) by reusing the standard processes of vendor engagement from ITO due to similarities in both arrangements (Whitaker et al. 2010).

Relatedly, I posit that organizations with learning from ITO and BPO would have gained experience about vendor relationship management, developed standard processes for vendor engagement and would be better equipped to extend them to the context of sourcing cloud computing services. Hence these firms would be able to better coordinate and absorb cloud based delivery into their internal operations. My belief stems from the rationale that cloud computing shares some of the characteristics with ITO and BPO including the need to source services from an external vendor, the requirements for fulfilling contractual obligations and the nature of some of the risks associated with sourcing (Xin and Levina 2008).

Specific to the CIO role, research has suggested that creating a core capability in firms to manage external relationships, to possess enhanced vendor management capabilities and strong informed buying capability, would result from experience in past sourcing (Barthelemy and Adsit 2003). This maturity not only reduces risks in sourcing but also positions the CIO to be able to contribute to business innovation (Feeny and Willcocks 1998). This is because strong experience in similar activities decreases the intensity of search and experimentation while promoting persistent exploitation of actions that were proven successful (Greve 2003).

Consistent with these theoretical arguments, I argue that though cloud computing is an emerging concept, similarities with other sourcing arrangements like ITO and BPO will allow CIOs to reuse contextual learning from past sourcing experiences. This will ease the CIO's burden of elementary issues of managing service level agreements and contractual obligations when dealing with cloud-based service vendors if the firm has past ITO and BPO experience. This may enable the CIO to focus more on strategic opportunities like innovation and NPD as compared to a CIO who is devoid of such experience. Hence I hypothesize:

H2: Past experience of the firm with ITO and BPO positively moderates the relationship between Cloud Computing adoption and

CIO's focus on opportunities related to innovation and new product development

II-5.3. Hypothesis 3: The Role of Internal Business Process Management Maturity

Business process formalization has contributed to successful adoption and implementation of IT innovations (Ein-Dor and Segev 1978; Raymond, 1990). Formalized processes enhance the fit between existing business processes and prospective innovation (Raymond 1990). This is because the degree to which organizational processes are systematized and formalized through rules, procedures, and management practices provides greater control over innovation selection and its integration into internal operations (Hall 1982). This reduces risks associated with adoption of innovation and contributes to more successful outcomes (Chang and Chen 2005).

Particularly in partnerships, it was shown that higher internal business process management maturity is related to more efficiency and less ambiguity in vendor management and thus helps to avoid unexpected risks (Martin et al. 2008). There are two reasons that support this finding. First, standardized business processes can facilitate communications about how the business operates, enable smooth handoffs across process boundaries, and make possible comparative measures of performance. Since information systems support business processes, standardization allows uniform information structure within the companies as well as standard interfaces across different firms (Davenport 2000). These firms can use standard interfaces to quickly establish relational processes that enable timely sharing of information with external partners to schedule and synchronize tasks, clarify task outputs, and integrate outputs back into the firm's value chain (Mani et al. 2010). Second, firms with higher business process management capabilities codify the business process management activities and possess the capability to successfully coordinate transfer of business processes to vendors (Whitaker et al. 2010). Codification captures and

structures business process knowledge thus enabling transfer across process boundaries and decomposition along with distribution of business processes (Boisot 1986; Cohendet and Steinmueller 2000). The above reasons can be explained with an example scenario. If a firm has standardized its internal CRM business process based on industry best practices, it may be highly possible that process flows align with standardized CRM applications provided by SaaS-based CRM vendors like Salesforce.com. It allows the firm to first evaluate how its own processes measure in comparison to the offerings of vendors in order to make a decision on procuring the service. Additionally, industry standard interfaces allow smooth transfer of the business process, seamless integration with vendors, and a common understanding of the service levels if the firm decides to source CRM functionality.

Specific to the CIO, research has suggested that higher internal business process management maturity that fosters using standard tools, systematized methodologies, and work processes would reduce the project management burden on stakeholders of external engagements (Willcocks et al. 2006). Hence strong organizational oversight mechanisms, enabled by high internal business process management maturity, facilitate CIOs to lead and support sourcing activities towards proactive strategic results (Carmel and Agarwal 2002).

As cloud computing based sourcing involves working with external vendors, I propose that firms with higher business process management maturity are better positioned to enhance gains from cloud service procurement. There are three reasons for my argument. First, higher business process management maturity allows effectively working with vendors and minimizes unexpected risks in engagement. Second, high process management maturity enhances the level of fit between internal business processes and external service offerings allowing firms to better integrate vendor offerings. Third, higher internal business process management maturity, standard tools, methodologies, and work processes will facilitate benefits to accrue in spite of reduced project management burden on CIOs, allowing CIOs to focus on how to use external delivery towards strategic

results. Hence, based on the above discussion, I argue that high business process management maturity positively moderates the association between cloud computing adoption and CIO involvement in strategic opportunities related to innovation and NPD.

H3: High business process management maturity of the firm positively moderates the association between Cloud Computing adoption and CIO involvement in strategic opportunities related to innovation and NPD.

II-5.4. Hypothesis 4: The Role of Business Coordination IT Systems Capability

IT systems enhance communication and coordination within the firm and in inter-firm relationships (Malone et al. 1987). In particular, strong internal IT systems oriented towards business coordination are a key antecedent to coordination and collaboration. Business coordination related IT systems improve execution speed of collaborative tasks by faster information exchange with external partners and enable greater concurrency in inter-firm relationships (Banker et al. 2006). In addition, by enabling synchronous information exchange among various internal and external stakeholders of collaborative tasks like product design, coordination IT systems like collaboration software applications will facilitate greater visibility into the product design process while reducing latency of information and allowing tracking and monitoring of progress in collaborative partnerships (Bardhan 2007).

In the context of vendor engagements, it has been shown that strong business coordination IT applications base would allow disaggregating and outsourcing of business processes through standardizability and modularizability of internal business processes (Whitaker et al. 2010). These systems reduce coordination time and cost, which leads to faster and tighter coupling of processes that create and use information. Hence these systems lead to increased

use of transactions between firms (Malone et al. 1987). Further, business coordination IT systems serve as standard interfaces for business processes which reduces monitoring and enforcement costs to provide firms flexibility to integrate with multiple partners (Clemons et al. 1993). This enables increased outsourcing of business processes due to reduction in coordination costs, transaction risk, and asset specificity (Xin and Levina 2008). Hence organizations with systems capabilities related to business coordination IT applications are more likely to engage in sourcing services from vendors like cloud-based service providers as these applications enable communication, concurrency, and monitoring when working with partners (Whitaker et al. 2010).

Specific to the CIO role, CIOs need to provision appropriate IT tools and establish electronic linkages that foster collaboration within and beyond the firm to create a responsive organization (Sambamurthy et al. 2003). However, this is possible only by establishing enterprise-wide systems integration which enables firms to use IT for creating new products and alter linkages with customers and suppliers (Johnston and Carrico 1988). It has been shown that establishing this enterprise-wide business coordination capability will decrease the coordination demands on CIOs and ease the transition of CIOs from supply-side leadership (focus on efficiency) to demand-side leadership (focus on strategic opportunities) (Chen et al. 2010). Hence IT leader roles can become more strategic as firms transition from focusing on improving operational efficiency to enhancing market opportunities (Karimi et al. 1996).

Based on the above discussion, I suggest that strong business coordination IT capability in the firm would allow seamless working with partners and create engagements that have strong coordination and concurrency. This capability also reduces the coordination demands on CIOs in terms of monitoring and enforcement. Thus these systems will reduce the number of operational tasks a CIO has to focus in inter-firm coordination when compared to a CIO devoid of such coordination IT systems. Hence I hypothesize:

H4: Higher internal IT capability related to business coordination IT systems positively moderates the relationship between Cloud Computing adoption and CIO's focusing more on strategic opportunities related to innovation and NPD.

Figure II-1 depicts the research model summarizing the hypotheses.

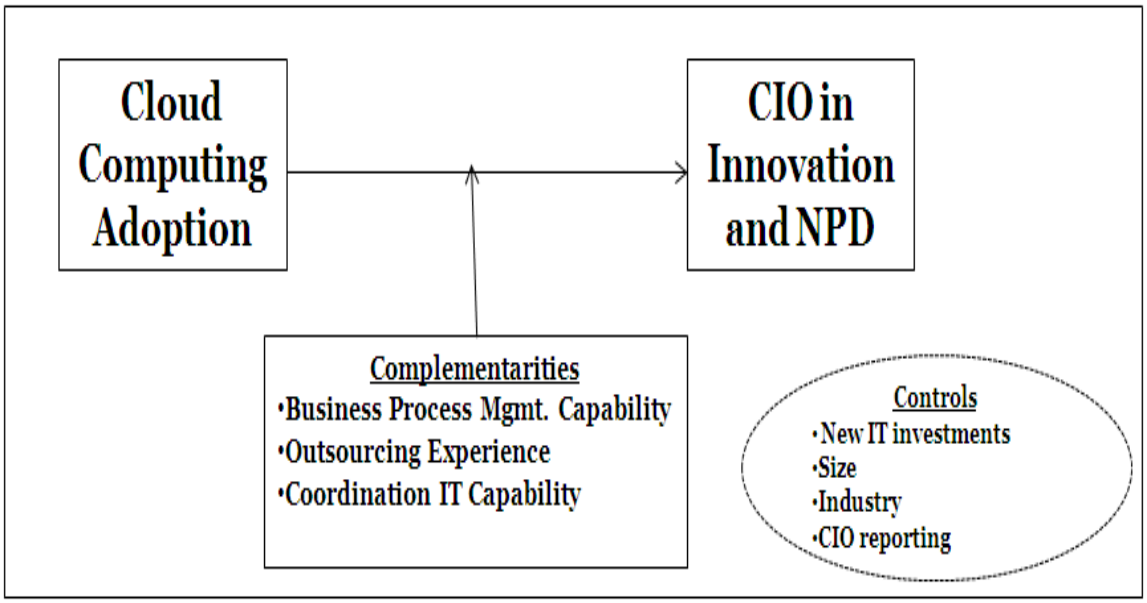

Figure II-1: Research Model

II-6. Research Design and Methodology

II-6.1. Data and Variable Definition

This study is based on data from InformationWeek 500 surveys. InformationWeek is a leading IT publication and previous academic studies have used InformationWeek survey data (e.g., Bharadwaj et al. 1999; Mithas et al. 2005). The InformationWeek 500 survey is an annual benchmarking survey that targets top IT managers in large firms. Respondents are in senior management positions with sufficient overview of their firm's IT operations and investments.

The data for all but three variables was drawn from the 2010 InformationWeek 500 survey which also included the variable on Cloud Computing Adoption. The data for three variables – ProcMaturity, coordIT, and Infra - was drawn from the 2008 InformationWeek 500 Survey.[3] As these variables correspond to business process management maturity and IT capability maturity, at least a two- to three-year lag is appropriate before the effects of investments in IT capabilities and business process management maturity are realized (Brynjolfsson 1993; Brynjolfsson and Saunders 2010).[4] The original data set for each of InformationWeek surveys had more than 500 firms. After combining data sets and matching them by organization name, I have dropped incomplete observations and outliers per Cook's distance. (Long and Freese 2003). The final sample comprised of data from 227 firms. The reduction in the sample size was purely due to missing observations and duplicate data for variables of interest. The firms surveyed in InformationWeek 500 are large companies and repeatedly find place in the survey year upon year being recognized as top spenders of IT in the USA. Hence survival is not an issue for these firms given their size.[5] The following sub-sections describe variables used in my model. The relevant items from the InformationWeek 500 survey are included in the ***Appendix A***.

Dependent Variable

CIOInnovNPD – An ordinal variable indicating CIO involvement in four strategic activities related to innovation and new product development (NPD): 'Innovation', 'Partner with business units to develop new products or services', 'Lead an R&D team accountable for new products and services', and 'Provide the

[3] As Cloud Computing is a nascent phenomenon, the 2008 Annual InformationWeek 500 survey did not capture user responses about cloud computing adoption. The 2010 Annual InformationWeek 500 captured user responses on cloud computing adoption.

[4] My data combination from 2008 and 2010 captures a lag as advocated by past research.

[5] I thank Dr. Robert Franzese and Dr. M.S. Krishnan for motivating this discussion.

system and support mechanisms for NPD'. The definition is informed by past research (Drazin and Schoonhoven 1996)

Independent Variables

- *CloudComputing* – A summative measure indicating the extent of adoption of cloud computing. This variable was formed by adding responses to binary indicators if the firm has adopted SaaS, IaaS or PaaS
- *ProcMaturity* - A four-item summative index of business process management capabilities: if the firm has 'Established business process frameworks/defined processes', 'Modeled Business Processes using CASE or related tools', 'Implemented Business Process Management software for enterprise-wide process management', and 'Reengineered existing applications'. A similar measurement approach was used in past IS research (Whitaker et al. 2010)
- *coordIT* - An eight-item summative index if the firm has implemented the following IT applications for business coordination: 'Collaboration applications like SharePoint and others', 'Content management applications', 'Business performance management applications', 'Service management software', 'Business intelligence tools', 'Mobile enterprise applications', 'Customer relationship management applications', and 'Scheduling software'. The variable definition and measurement approach were informed by past research to differentiate infrastructure applications from coordination applications (Aral and Weill 2007; Whitaker et al. 2010).
- *OutsourcingExp* – A two item summative index of binary variables indicating if the firm is engaged in IT outsourcing or business process outsourcing

Control Variables

- *Infra* - A 12-item summative index if the firm has deployed the following infrastructure technologies: 'Network access control technologies', 'Grid Computing', 'WAN optimization or application acceleration technologies', '802.11n Wireless LANs', 'Global storage management technologies', 'Storage virtualization technologies', 'VOIP technologies', 'desktop virtualization', 'video conferencing', 'unified communications', 'Quad core servers', and 'IP storage technologies'. A binary (=1/0) was created for each technology the firm has implemented. These binaries were summed together to create a variable ranging from 0 for firms that have not deployed any of these technologies to 12 for firms that have deployed all 12 technologies. This variable definition is informed by past research to differentiate infrastructure from coordination applications (Aral and Weill 2007; Whitaker et al. 2010).
- *CIOCEO* - This binary variable indicates if the CIO of the firm reports to the CEO. In firms with a direct CIO-CEO reporting structure, there is a higher tendency for IT to focus on strategic opportunities and CIOs have more strategic authority to pursue value-added initiatives (Banker et al. 2011; Preston et al. 2008)
- *Size* - Firm size measured as the natural log of annual firm revenue. Firm size may influence a firm's propensity to adopt cloud computing.
- *ITproj* - This measure pertains to the percentage of IT budget devoted to new IT projects. Investments in new IT projects can extend a firm's IT innovation capabilities compared to investments in ongoing projects. Hence I control for IT innovativeness as informed by past research (Cherian et al. 2009).
- *Industry Controls (Manuf, ITSectorControl, FinControl and InsControl)* - These are binary variables (1 = yes, 0 = no) for the firms in Manufacturing, IT, Finance and Insurance industries based on the North American Industry Classification System (NAICS) code. I control for the firms in these industries since they are at the forefront of cloud computing adoption (Gartner 2010).

II-7. Empirical Model

I estimate a cross-sectional model to test my hypothesis. As CIOs with more focus on strategic opportunities related to innovation and NPD may be more likely to adopt cloud computing, I accounted for the endogeneity in cloud computing adoption (Saldanha and Krishnan 2011).[6] To control for this endogeneity, I followed Bharadwaj et al. (2007) and Shaver (1998) to use the Heckman two-step estimation approach (Heckman 1979).[7] As a first step in this estimation, I created a binary variable to separate the firms based on intensity of cloud computing adoption. Firms with values of CloudComputing variable above the mean were coded as 1 and firms with a value below the mean are coded as zero. I then ran a probit regression of the CloudComputing binary variable on all control variables. The inverse mills ratio generated in this step was then included as a control variable in my final empirical model in the second step. Controlling for endogeneity using the two-step estimation gives consistent estimates (Heckman 1979; Shaver 1998). Additional variables included exclusively in this estimation related to firm's investments in upgrading the existing infrastructure and the adoption of latest technologies i.e. Web 2.0 technologies. One ordered variable captured if the firm has upgraded its infrastructure i.e. upgraded desktop PCs with newer models, upgraded PC operating systems or applications and upgraded email system. Another variable was capturing the extent of Web 2.0 adoption in the organization i.e. if the firm is using wikis, blogs or social networking tools for internal collaboration, using wikis, blogs, or social networking tools for external collaboration and is creating mashups that combine Web, enterprise content, and applications in new ways. These variables collectively signify the intent of the organization in subscribing to updated

[6] The common empirical approach is to regress a measure of performance on the strategy choice of a sample of firms. For example, in my study, it is to regress CIO focus on Innovation and NPD variable on cloud computing adoption variable. However, firms choose adoption or non-adoption of cloud computing technologies based on firm attributes and industry conditions (Shaver 1998). Therefore adoption choice is endogenous and self-selected. If a firm chooses a strategy that is optimal given other attributes of the firm and industry, empirical models that do not account for this self-selection are potentially misspecified (Masten 1993).

[7] I provided a brief explanation of the rationale for our approach to mitigate endogeneity in the above footnote. Please refer to Shaver (1998) for a detailed description of the issue and resolution.

backend infrastructural capabilities and web-based technologies respectively. These can influence cloud computing adoption as firms with experience in near-similar technologies will be most likely to adopt newer technologies (cf. Neo 1998). However, upgrading the infrastructural resources and collaborative applications can be reasonably expected to be transactional in nature rather than enablers of significantly mitigating the operational task demands on the CIOs, as can be done by adopting cloud computing per the arguments I made in the earlier sections.[8]

My dependent variable (CIOInnovNPD) captures the extent to which CIOs are involved in strategic opportunities related to innovation and new product development. Hence for each firm, CIOInnovNPD consists of four levels based on CIO involvement and can take any value between zero and three based extent of CIO involvement. The categories in this variable are ranked, but distances between categories may not be the same. This implies that the weight of each index item may not be the same in a count variable (Greene 2008). Hence I treat the dependent variable as ordered. A similar measurement approach was used in Banker et al. (2008) and Bardhan et al. (2007). Since the dependent variable is ordered, I use ordered logistic regression for estimation. Ordered Logistic or Ordered Probit models are used when the dependent variable is ordered (Greene 2008). The empirical model is as follows:

$$P(CIOInnovNPD) = \beta_0 + \beta_1 (CloudComputing) + \beta_2(ProcMaturity) + \beta_3(coordIT) + \beta_4(OutsourcingExp) + \beta_5 (CloudComputing \times ProcMaturity) + \beta_6 (CloudComputing \times coordIT) + \beta_7(CloudComputing \times OutsourcingExp) + \beta_8(Infra) + \beta_9(CIOCEO) + \beta_{10}(Size) + \beta_{11}(ITproj) + \beta_{12}(Manuf) + \beta_{13}(ITSectorControl) + \beta_{14}(FinControl) + \beta_{15}(InsControl) + \beta_{16}(InvMillsRatio) + e_i$$

[8] I thank Dr. Gautam Ahuja for motivating this discussion.

II-8. Results

Table II-2 below provides the descriptive statistics.

Table II-2: Descriptive Statistics and Correlations

#	Variables	Min	Max	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12
1	CIOInnovNPD	0	3	1.91	0.74	1.00											
2	Cloud Computing	0	3	1.46	0.89	0.15*	1.00										
3	ProcMaturity	0	4	1.73	1.02	-0.001	0.07	1.00									
4	coordIT	0	5	2.32	1.30	0.12	0.03	0.02	1.00								
5	ITBPOS	0	2	0.96	0.83	0.12	0.22**	0.17**	-0.02	1.00							
6	Size	5.52	11.7	8.43	1.334	0.06	0.11	0.08	0.001	0.32**	1.00						
7	ITproj	0.3	83.7	34.49	16.52	0.08	-0.05	0.07	0.04	0.01	0.03	1.00					
8	Manuf	0	1	0.25	0.43	-0.22**	0.09	0.02	0.01	0.10	0.13*	-0.14*	1.00				
9	ITSector Control	0	1	0.06	0.24	-0.02	0.16**	0.09	-0.01	-0.13*	-0.07	-0.07	-0.15*	1.00			
10	FinControl	0	1	0.10	0.30	0.13*	-0.04	0.05	0.04	0.11	0.02	0.10	-0.19**	-0.09	1.00		
11	InsControl	0	1	0.07	0.26	0.07	-0.01	-0.06	-0.03	0.01	0.07	0.10	-0.16*	-0.07	-0.09	1.00	
12	Infra	0	10	4.33	2.43	-0.03	0.09	0.20**	0.55**	0.01	0.03	-0.01	0.05	-0.04	-0.01	-0.02	1.00
*Significant at 1% level; ** Significant at 5% level																	

Table II-3 shows the results from empirical estimation. In Table II-3, Column 2 is the estimation model without interactions. Column 3 is full estimation with interactions.

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Table II-3: Estimation Results

Dependent Variable = CIOInnovNPD			
	Ordered Logit Model (1) Model with the dependent variable and only the controls	Ordered Logit Model (2) Model with all the independent variables without interactions	Ordered Logit Model (3) Full estimation model with all the interactions
CloudComputing		0.361** (0.162)	0.501**** (0.168)
ProcMaturity		-0.01 (0.14)	0.061 (0.144)
coordIT		0.32**** (0.128)	0.36**** (0.128)
OutsourcingExp		0.242 (0.18)	0.288 (0.182)
CloudComputing x ProcMaturity			0.342** (0.159)
CloudComputing x coordIT			0.264** (0.124)
CloudComputing x OutsourcingExp			-0.297 (0.196)
Infra	-0.02 (0.05)	-0.123* (0.07)	-0.12* (0.069)
CIOCEO	0.316 (0.272)	0.392 (0.28)	0.267 (0.285)
Size	0.146 (0.10)	0.546 (0.783)	0.591 (0.81)
ITproj	0.006 (0.008)	-0.01 (0.03)	-0.02 (0.03)
Manuf	-0.966**** (0.322)	0.97 (3.5)	0.994**** (3.63)
ITSectorControl	0.06 (0.57)	12.66 (21.38)	13.29 (22.15)
FinControl	0.48 (0.43)	0.33 (0.46)	0.291 (0.464)
InsControl	0.03 (0.54)	-1.03 (1.88)	-0.92 (1.92)
InvMillsRatio		19.73 (32.96)	20.77 (34.13)
Log Likelihood	-239.32	-231.32	-225.72
LR Chi-square	18.39	34.39	45.58
Prob > Chi-square	0.01	0.001	0.0001
McFadden's pseudo R-square	0.04	0.0692	0.09
Observations	227	227	227
Standard Errors are in parentheses. CloudComputing, ProcMaturity, coordIT and OutsourcingExp were mean-centered before interactions. Significant at *10%; **5%; ***2% and ****1% levels.			

Column 2 shows Model 2 - the model without interactions. In this model, the positive and significant coefficient on cloud computing variable ($\beta 1=0.36$, $p=0.03$) provides statistically significant initial evidence that cloud computing adoption is associated with more CIO involvement in strategic opportunities related to innovation and NPD.

In column 3, the full estimation model with interactions - the Likelihood Ratio Chi-square value of 45.58 ($p<0.001$) - indicates that we can reject the null hypothesis that coefficients of the model are jointly zero. The positive and significant effect of cloud computing coefficient ($\beta 1 = 0.501$, $p<0.01$) persists. This coefficient increased in both magnitude and significance in the presence of interaction with other complementarity variables. My results also show that the interaction effect between CloudComputing and ProcMaturity is positive and significant at 5% significance level ($\beta 5 = 0.342$, $p =0.032$) rendering support for my hypothesis H3. This provides evidence confirming complementarity between cloud computing adoption and business process management maturity in positive association with more CIO involvement in innovation and NPD. The interaction between CloudComputing and coordIT was also positive and significant at 5% significance level ($\beta 6 = 0.264$, $p=0.034$), confirming my hypothesis H4 about complementarity between cloud computing and business coordination IT capability. However, the interaction between CloudComputing and OutsourcingExp was contrary to my expectation ($\beta 7 = -0.28$, $p<0.15$).

Figure II-2 shows the marginal effect of the predicted probability of the CIO involvement in strategic opportunities related to innovation and NPD with Cloud Computing adoption when industry controls were held at a meaningful value of '0' and other variables are held constant at their means.[9] As depicted in Figure II-2, the probabilities of CIO involvement in two or more innovation and NPD opportunities increase with an increase in the adoption of cloud computing.

[9] Holding the industry controls at meaningful values was informed by past research (Hoetker 2007). Since variables are centered before interaction, it implies that Figure 2 is a plot of the main effect of cloud computing adoption.

In contrast, the predicted probabilities of CIO involvement in none or one opportunity, in general, decreases with the increase of cloud computing adoption.

Further, Figures II-3, II-4 and II-5 depict the marginal effects of interactions in the model. For example, in the Figure II-3, the interaction of Cloud Computing adoption and BPM capability shows that the pattern trends upwards for the predicted probability of CIO involvement in three innovation and NPD activities with higher BPM capability having higher probability.[10] Similarly, Figure II-4 and II-5 depict the interactions of Cloud Computing adoption with coordination IT capability and OutsourcingExp respectively. The pattern trends upwards in both the cases for the predicted probability of CIO involvement in three innovation and NPD activities with higher coordination IT capability and OutsourcingExp having higher probability.[11]

Among the results of my main estimation, two results showing the relationship of control variables with CIO involvement in innovation and NPD have implications for my study. The Inverse Mills Ratio coefficient is statistically not significant ($p = 0.54$), suggesting a lack of bias due to potential endogeneity (Heckman 1979; Shaver 1998). The CIO-CEO reporting relationship variable provides interesting insights for enabling CIOs to focus more on innovation and NPD. While past literature has suggested that CIO-CEO reporting relationship provides CIOs with strategic decision-making authority, and this in turn can positively influence IT's contribution to firm performance, my result of the CIO-CEO reporting relationship variable ($\beta 9 = 0.27$, $p=0.35$) is statistically not significant even at 10% significance level. One possible reason may be that while CIO-CEO relationship is necessary as argued in past research, it may not be sufficient. The structure of relationship and factors like how much autonomy is

[10] Graphs were generated for the highest and lowest levels of BPM capability.

[11] However, with OutsourcingExp being negative and insignificant in the main estimation, in the related graphs generated and not shown here for brevity purposes, the patterns trended downwards for the predicted probability of CIO involvement in less than three innovation and NPD activities along the expected lines to correspond to negative coefficient on this variable. Despite the insignificance of the coefficient, these graphs were generated purely for demonstration purposes.

given to CIOs may play a significant role in determining CIOs involvement in strategic opportunities like innovation and NPD. For example, if the IT funding model is controlled with a focus on efficiency, CIOs may not have many avenues to focus on strategic opportunities like innovation and NPD. I believe that further research is required to better understand the effect of CIO-CEO reporting structure. This also aligns with my initial motivation based on past research that there may be other factors that enable CIOs to focus more on strategic opportunities like innovation and NPD (Karahanna and Watson 2006; Preston el al. 2008).

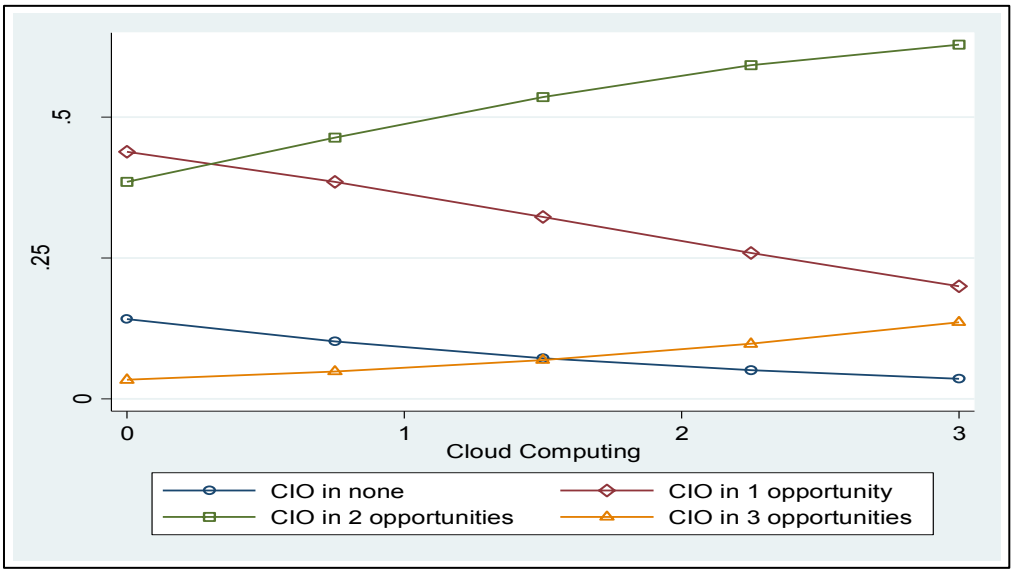

Figure II-2: Predicted Probabilities – CIO Involvement and Cloud Computing

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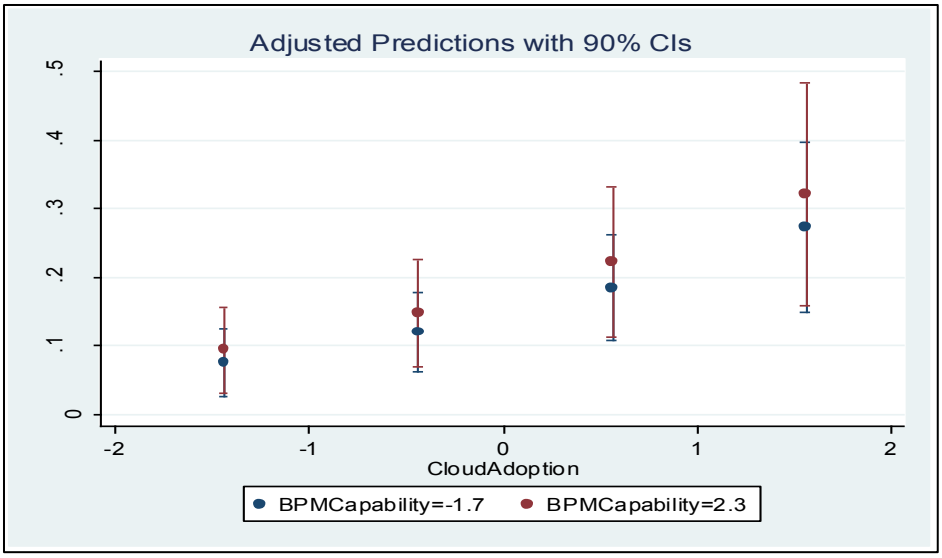

Figure II-3: Marginal Effects - Cloud Computing and BPM Capability[12]

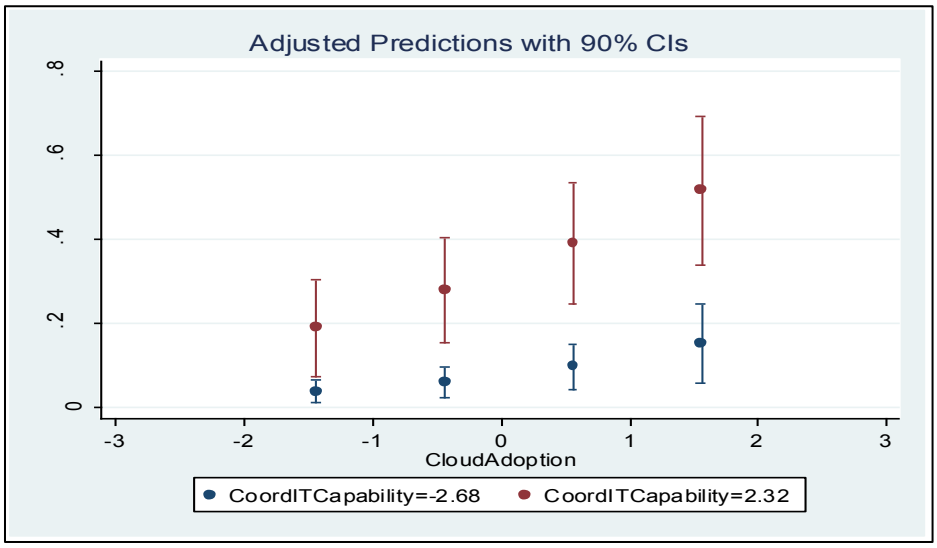

Figure II-4: Marginal Effects - Cloud Computing and Coord. IT capability

[12] BPMCapability values denote the lowest and highest values of this centered variable. Similar centered lowest and highest levels were used for ITArchFlexibility and OutsourcingExp variables.

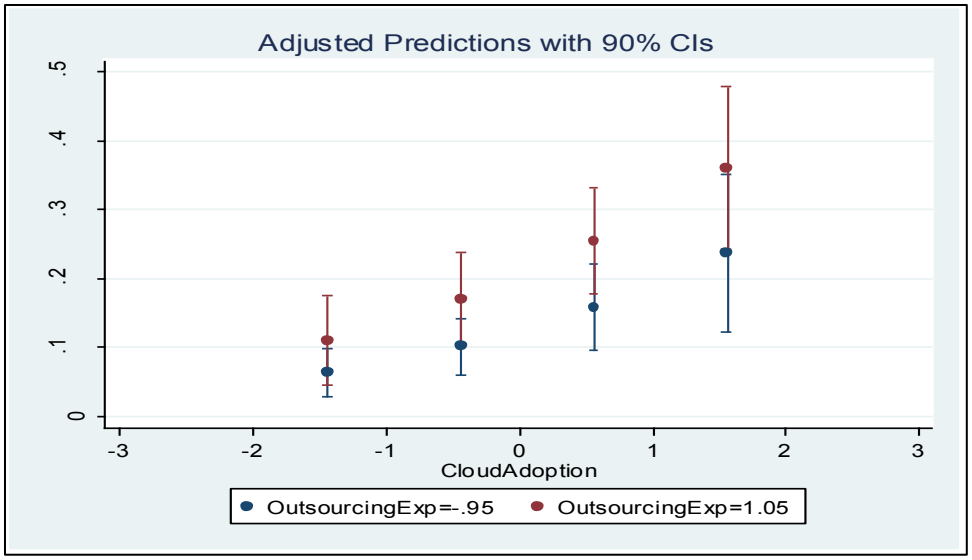

Figure II-5: Marginal Effects - Cloud Computing and Outsourcing

II-9. Econometric Robustness Checks and Supplementary Analysis

Since the dependent variable is ordered, I use ordered logistic regression for my main estimation. As an ordered probit model can be used for estimation when the dependent variable is ordered (Greene 2008), I ran ordered probit regression as a sensitivity check and the results of the estimation were qualitatively similar.[13] I tested the parallel regression or proportional odds assumption implicit in ordered logit models. A high chi-square value (38.67) and p-value (0.194) from the Wolfe and Gould LR test indicated that the proportional odds assumption has not been violated (Long and Freese 2003). The White's test (chi2 = 129.89, p=0.20) for heteroskedasticity failed to reject the constant variance of the error term and hence heteroskedasticity is not a serious problem with my data.

[13] For the sake of brevity, results were not furnished. However, they were qualitatively similar to my main estimation.

I tested for multicollinearity by computing the variance inflation factors (VIF) and condition indices. VIF were below 10, with the highest VIF being 8.59, indicating no serious problem with multicollinearity (Gujarati 2008). However, the condition number was 32.49 and condition numbers beyond 20 are suggested as indicative of a problem (Greene 2008). Higher condition numbers may indicate ill-conditioned matrices. To mitigate any multicollinearity issues, I mean-centered the variables. Centering does not change the estimated effects of any variables and the effect of marginal increase in the centered version of a variable is identical to the effect of a marginal increase in uncentered variable (Franzese and Kam 2003; Kraemer and Blasey 2004). My final estimation after mean centering had a highest VIF of 1.42 and a condition number of 18.64, both within prescribed limits and thus indicating no serious problems with multicollinearity. I conducted the link test to check for specification errors and the link test failed to reject the assumption that the model was specified correctly. Because data comes from two surveys, tests for common method bias are not applicable in my research. However, the Harman one factor test, conducted as a cautionary measure, produced four principal components together accounting for 49% of total variation with the first component accounting only for 17% of the variation (Podsakoff and Organ 1986). With no general factor accounting for over 50% of the variation, common method bias is not a significant problem.

II-9.1. Estimating the Effect of IT Outsourcing vs. Cloud Computing on CIO Focus

In my original estimation models in Table II-3, the CloudComputing variable was found to be statistically significant while OutsourcingExp variable by itself did not have a statistically significant effect on CIO focusing more on innovation and NPD. As 'OutsourcingExp' variable corresponds to the firm being engaged in outsourcing IT and/or BPO functions, this provides some evidence for my argument that cloud computing may be different compared to traditional IT outsourcing in enabling CIOs to focus more on strategic opportunities related to innovation and NPD. To empirically substantiate further about this position, I

conducted supplementary analysis to check if IT outsourcing can impact CIOs focusing more on innovation and NPD. I ran several models to test competing arguments. Table II-4 provides results from the regression of CIO involvement in innovation and NPD on a firm's ITO and BPO experience.[14] The 'OutsourcingExp' variable in Table II-4 corresponds to a firm having past ITO and BPO experience and is similar to the 'OutsourcingExp' variable in my original estimation. While I retained variables from the original estimation, I have modified the industry controls as informed by past IT outsourcing research to control for firms in Finance, Services, Trade and Logistics, and Other Industrial based on the NAICS code for each firm (Brynjolfsson et al. 1994).[15] In Table II-4, Column 1 provides results of the model without interactions. As the results exhibit, the OutsourcingExp variable was found to be statistically not significant at the 5% significance level. Column 2 shows the full estimation model with interactions for testing the effect of OutsourcingExp on CIOInnovNPD. In this model, the effect of OutsourcingExp was positive but was not statistically significant at the 5% significance level. Column 3 shows the results when I introduced cloud computing variable and its interactions. As can be seen, 'OutsourcingExp' continued to be statistically not significant at 5% significance level. However, the CloudComputing variable and its interactions with business process management capability and coordination IT capability continued to have statistically significant effect on CIOInnovNPD. The minor changes in significance levels can be attributed to revised control variables used in this estimation. One of the possible reasons why OutsourcingExp interaction with cloud computing is not significant is due to the kind of cloud computing adopted in my sample.

[14] Estimations with IT outsourcing variable instead of OutsourcingExp variable produced qualitatively similar results with IT outsourcing effect on CIOInnovNPD being positive but not significant at 5% significance level. For brevity, these results were not presented and are available upon request.

[15] Estimations with the industry controls as used in the original estimation provided qualitatively similar results and the OutsourcingExp variable continued to be statistically insignificant in the models (1) without interactions, (2) with interactions, and (3) when cloud computing variable and its interactions were introduced into the estimation. For brevity, these results were not presented and are available upon request.

Infrastructure cloud services often have simple SLAs and may not require frequent interactions with vendors. Another possible interpretation may be that the firms might have had an unfavorable experience with outsourcing and this resulted in not being proactive with cloud computing adoption[16].

Table II-4: Estimation of the Effect of Outsourcing Experience

IT and Business Process Outsourcing Experience as the Focal Independent Variable			
Dependent Variable = CIOInnovNPD			
	Ordered Logit Model (1) Model without interactions	**Ordered Logit Model (2) Model with interactions**	**Ordered Logit Model (3) Model includes cloud computing variable and its interactions**
OutsourcingExp	0.236 (0.171)	0.222 (0.175)	0.19 (0.186)
ProcMaturity	-0.001 (0.131)	-0.004 (0.14)	0.07 (0.14)
coordIT	0.308*** (0.124)	0.314*** (0.126)	0.36*** (0.13)
OutsourcingExp x ProcMaturity		0.106 (0.18)	0.03 (0.19)
OutsourcingExp x coordIT		-0.031 (0.124)	-0.09 (0.13)
CloudComputing			0.358** (0.173)
CloudComputing x ProcMaturity			0.37** (0.17)
CloudComputing x coordIT			0.243* (0.126)
CloudComputing x OutsourcingExp			-0.27 (0.19)
Infra	-0.119* (0.067)	-0.126 (0.098)	-0.09 (0.13)
CIOCEO	0.535* (0.283)	0.497 (0.43)	0.566 (0.436)
Size	0.10 (0.11)	0.162 (0.975)	-0.45 (1.01)
ITproj	0.006 (0.008)	0.006 (0.009)	0.005 (0.009)
InvMillsRatio		0.486 (8.25)	-4.8 (8.51)
Finance	0.735 (0.461)	0.79 (1.14)	0.215 (1.17)
Trade and	-0.314	-0.27	-0.65

[16] I thank Dr. Robert Franzese for his insights about the results of my estimation

Logistics	(0.42)	(1.02)	(1.03)
Services	0.537* (0.321)	0.53 (0.36)	0.67* (0.372)
Other Industrial	-0.223 (0.396)	-0.25 (1.05)	0.36 (1.08)
Log likelihood	-236.59	-236.4	-230.29
LR Chi-square	23.83	24.23	36.45
Prob > Chi-square	0.014	0.04	0.006
N = 227. SAAS, OutsourcingExp, ProcMaturity, coordIT and CloudComputing were mean-centered before interaction. * significant at 10%; ** significant at 5%; *** significant at 1%			

II-10. Qualitative Study – Interviews with IT Leaders

In order to better understand my results and also learn more about the association between cloud computing adoption and CIOs spending more time on innovation and NPD in practice, I conducted a qualitative study through interviews with senior IT executives in the industry. These semi structured interviews were conducted in person. I ensured the 16 CIOs and senior IT executives that I interviewed had sufficient involvement in cloud computing adoption at their organizations. The initial set of open questions and list of executive profiles covered in this qualitative study are presented in ***Appendices B and C*** respectively. Since cloud computing adoption context may vary across companies, I allowed enough latitude for interviewees to answer questions in the way it was appropriate to their context. Prior research has shown that this method of data collection is more flexible and can be adapted to fit different scenarios (Blumberg et al. 2008; Robson 2002).

The sample included four executives from vendor organizations who were interviewed to secure an alternate perspective as well as to leverage industry knowledge they accumulated from working with multiple customers. Interviews were conducted in two waves in November 2012 and November 2013, at a leading CIO Executive Summit and lasted on average from 15 to 20 minutes. Interviewees were informed the purpose of research and were requested to share their experience on cloud computing adoption, the benefits from adoption and particularly about my main research question on whether cloud computing

adoption did relieve them from handling operational IT efficiency issues and if it helped them focus more on opportunities related to innovation and NPD.

The interviewees were first asked if they have adopted cloud computing in their organization as this was the primary aspect of interest in my study. All but two of the interviewees confirmed adoption of cloud computing. Once they answered in affirmative, I followed with open questions to explore the work demands of their role and time allocations, the benefits of cloud computing adoption and particularly how it benefited their roles. All the interviewees answered that they are pressed for time due to operational task demands and seeing benefits of cloud computing adoption both at the organizational and individual role level. Elaborating on the time demands, the Vice-President of IT at an insurance company said, "It is a tough act. People in management teams ask different things. Our management asks whether we are looking at a particular technology. We cannot say no as we are supposed to evaluate them. These same people want to bring down the IT costs. Bringing down the IT costs means focusing to see that operations are efficient. If we focus there, it is at the expense of pursuing these latest trends." An Executive Vice-President and CIO of a major healthcare system said, “The point is that it’s easy for a CIO to get caught up in all the day to day operational requirements that they can’t see any room for a strategically important project. This is a really significant problem and one should be worried about as well. Are hospitals so overwhelmed with operational requirements that they’re not going to be ready for the future?”

Further, explaining the benefits of cloud, a senior executive of a Fortune 500 IT company described, “Adopting cloud gives impetus to innovation through flexibility and scalability of resources. It gives the capacity to execute change. The bonus here is that we have one less thing to worry about. If you send email to cloud, you save email dollars and also need not worry about it any longer.” This was supported by the CIO of another large IT corporation who said, “In addition to flexibility and scalability, there are innovation opportunities by saving dollars and moving them from IT investments to other innovation activities.”

The CEO of a leading cloud-based solution vendor corroborated the challenges and opportunities in adoption. As he described, “We cater to many customers and there are some areas where there can be compliance issues. For example, in some cases customers need a lot of financial compliance and we have cases where customers did not opt for our solutions in public cloud and we had to work on private cloud, in some cases the customer was not ready for cloud computing. But there are areas like email hosting which is a commodity job where cloud adoption can benefit the organization by moving these areas to a vendor.“ This was seconded by a Senior Vice-President (SVP), Global Strategic Technology Sales, of a leading cloud-based enterprise systems vendor. As this executive described, “Vanilla applications are good candidates for cloud and they can be turned on and off very quickly. There can be easy onboarding with such applications. In addition, we have seen the benefits of cloud computing quickly experienced when there are mergers or acquisitions. Our customers could quickly bring in their merger partners onto the cloud platforms and the vanilla applications could be quickly turned on to be availed by both the partners in the new merged entity.”

When asked about the benefits to their individual role, all interviewees cited IT efficiency related benefits from cloud computing adoption. As the CIO of a Fortune 500 automotive technology supplier informed, “It depends on the type of applications you want to avail. Steady state applications do not need time consumption any longer and you are not having a wise IT strategy if you do not use cloud as an option for such applications.” The CIO of another Fortune 500 technology company supported this viewpoint by saying, “While we get flexibility and scalability, it is a double bill as we are no longer worried about the thing we are sending to the cloud as the vendor will take care of it. Our time can be spent on other things that can add value to the company.” The CIO of a major regional Midwest bank added, “Things that are part of IT but of no value to the company are good candidates for cloud sourcing. For example, email is being deployed in the cloud as we felt that it can be safely moved to the cloud and also that we need not worry about it once it is moved to the cloud. Hence it is a lesser pressure on

me personally as the CIO as well as on my IT team to worry about email servers. " Another CEO of a leading cloud-based IT vendor said, "While CIO role was traditionally thought as for keeping the lights on, now the CIOs can focus more on more important things as someone else will step in to keep the lights on so that CIO can move on his/her priorities."

One of the interviewees, the CTO of a major educational system, emphasized that they began cloud adoption to try it for opportunity cost and found it to be much more rewarding personally for his role as well as for his organization than what they initially expected. As he said, "We started using cloud vendors as we did not want to lose an opportunity when all others around us are trying. So we started using cloud to try it and see what it is. We started with SaaS applications for transportation and email. Now we are using cloud for student administration, finance, HR and analytics. We are moving to cloud wherever it is possible so that my time can be spent on where it is needed the most. Cloud computing provides efficiency benefits by shifting some of the applications to the vendor, the service is up for 99% and our vendors keep us informed when that 1% downtime will be. In addition, we have quick access to new technologies that allows us to stay on top of the technology curve. With cloud computing, we are not only getting access without maintenance headaches, we are less worried about the currency and relevance of IT applications and infrastructure as we know that we have cutting-edge technologies all the time. We don't need space for hosting, hardware and we don't need staffing to meet our increasing IT needs. Without these issues, my team and I are working on innovation opportunities in education and looking at building online learning partnerships with other educational institutions as we feel that is where education is heading and that is where my time should be spent."

In response to my question on the role of facilitating conditions in realizing organizational and individual role benefits, most interviewees confirmed the importance of various conditions needed for cloud computing to be a success. In particular, interviewees stressed the need for strong internal

processes and strong internal IT base. As the CIO of a Fortune 500 automotive company said, "Returns on cloud computing depend on where you are in your IT lifecycle. If you have a large set of legacy apps, getting them integrated into the new cloud-based environment will be problematic. Having strong internal IT maturity and IT architecture flexibility will help here. I also see that having internal business processes standardized would help in extending them into vendor organization and create seamless collaboration. Having a robust base of standardized coordination applications gives you the ability to work easily with vendor as you will extend what you are doing in-house to beyond the organization. It will surely enable CIOs to focus more on strategic opportunities if they have strong process management, project management etc., in the organization. Having facilitating conditions will help realize quick benefits and gives bandwidth to CIOs as they can move commodity applications to the cloud and focus on the core."

Similarly, the IT Director of a State Government organization emphasized the importance of processes and internal culture. The director highlighted how cloud computing in fact increased the IT staff in his organization, "There is a cost to learn about cloud computing but this cost is low and it eventually comes down very quickly as dealing with vendors is not as demanding as when we were sourcing some other capabilities earlier. If you have past sourcing experience, it will help here to bring down the learning costs. You need not reinvent the wheel. In addition, business processes have to be efficient to deal with the new offerings or otherwise you will face new problems than solving existing issues. We insist on aligning the mindsets and aligning the strategic goals of the company. For example, while it is generally thought that sending your work to vendors lead to internal staff reduction, in our case, we actually expanded our IT staff to handle cloud computing. So cloud computing is not necessarily about staff reduction and making this publicized in the organization is crucial to manage change."

For the two executives who answered that they are not currently using cloud computing technologies in their organization, I asked for reasons for non-

adoption. One informant, CIO of a defense supplier said, “We supply to defense organizations including the United States Department of Defense and hence need a lot of compliance. The process of evaluation of cloud computing as an option itself is complex and has to pass through several compliance checks internally as well as with our business partners. Adoption and implementation is an even more complex process. So we are slow on cloud computing but do not rule out private cloud in the near future. We are still evaluating it.” Another informant, the IT Director of a major manufacturing corporation reasoned, “Though we are a big company, our IT budget is low and our infrastructure budget is further low. Our internal IT is able to cater to organizational IT needs as of now and we did not have a need to think about cloud computing till now.” Although it is a sample of two, I learned in these two cases that even though these two firms have not adopted cloud computing, it is not that they do not foresee efficiency related benefits from adoption. While one firm is constrained by administrative demands related to compliance, the other is narrowly balancing the budget and they could not allocate seed funding for initial setup costs of cloud computing.

In summary these interviews confirmed my findings that cloud computing adoption can provide efficiency benefits and help CIOs focus their attention on more strategic opportunities like innovation and NPD. The interviewees underscored the significance of organizational facilitating conditions in deriving value from cloud computing adoption. In particular, they emphasized the role of process competence and strong internal IT competence as crucial to work effectively with vendors and integrate their offerings without much oversight burden. These responses, taken together with practitioner anecdotes from Enterasys Networks and Aricent Group, corroborate my quantitative findings on the association between cloud computing adoption and more time spent by CIOs and senior IT leaders on strategic opportunities related to innovation and NPD.

II-11. Discussion and Implications

Table II-5 below provides a summary of my hypotheses and findings.

Table II-5: Summary of Research Findings

Summary of Research Findings		
Hypotheses		**Findings**
H1	Cloud Computing adoption is positively associated with CIO involvement in Innovation and NPD	Supported
H2	Past experience of the firm with ITO and BPO positively moderates the relationship between Cloud Computing adoption and CIO involvement in Innovation and NPD	Not Supported
H3	Business Process Management maturity of the firm positively moderates the relationship between Cloud Computing adoption and CIO involvement in Innovation and NPD	Supported
H4	Higher internal coordination IT capability positively moderates the relationship between Cloud Computing adoption and CIO involvement in Innovation and NPD	Supported

The role of CIO and its evolution over time has been a subject of increasing attention in IS research (Ross and Feeny 1999). My goal in this research was to examine enablers for CIOs to focus more on opportunities related to innovation and NPD from attention perspective and to understand if and how an emerging class of IT (i.e., cloud computing) can be associated with enabling CIOs to do so. I find that cloud computing adoption can in fact be associated with CIO involvement in strategic opportunities related to innovation and NPD. One stream in practitioner literature suggests that increasing commoditization of IT may diminish the role of CIOs in organizations (Carr 2007). However my results indicate that it is up to the CIO to find avenues to strategically contribute to business effectiveness and enhance his/her position in the executive management team and cloud computing adoption could be one such avenue.

My results also indicate that firms with systems capabilities endowed by a strong internal coordination IT applications base are more likely to see their IT executives pursue strategic opportunities related to innovation and NPD. Business coordination IT applications like collaboration tools, performance management software, CRM applications, etc., enable better coordination and

concurrency when working with partners. These applications assist in reducing transaction risks, provide better integration of external partner offerings into internal business operations, and enhance information processing efficiency to achieve strategic results. I also find that process capabilities related to strong internal business process management maturity have a positive moderating effect on CIO involvement in innovation and NPD.

Overall, my results largely support the initial expectations and provide empirical evidence on the impact of cloud computing adoption in enabling CIOs to involve more on innovation and NPD and how organizational complementarities can enhance the effect. The results of my supplementary quantitative analysis highlight the differential impact of cloud computing in enabling CIO involvement in innovation and NPD in comparison to other forms of past sourcing models like ITO and BPO.

From the research perspective, this study has three primary contributions among others. First, my study adds to the IT sourcing literature by investigating the business value of an emerging technology business model for IT capability delivery i.e. cloud computing through associating its adoption with more CIO involvement in innovation and NPD. It thus highlights one of the strategic benefits that can arise out of it. This is an important finding given that anecdotal evidence is narrowly focused only on the cost efficiencies that can accrue from cloud computing adoption. Ascertaining strategic potential of these technologies is important to establish credibility of an emerging phenomenon (Agarwal and Lucas 2005; World Economic Forum 2010). In particular, this research explores firm-level characteristics that can augment business value in sourcing contexts (Whitaker et al. 2010; Williamson 1999).

Second, my study adds to literature on the role of CIO in investigating antecedents that underlie CIO contribution to organizational performance (Karahanna and Watson 2006). While past research based on qualitative evidence suggests that CIO involvement in strategic opportunities is an important

antecedent to CIO effectiveness, my study provides empirical evidence on how technical and organizational resources can combine to enable CIOs to spend more time on innovation and NPD opportunities. In addition, while one stream of anecdotal evidence highlights risks from cloud computing adoption and argues that this may consume more CIO time and energy, my results are in contrast and suggest that cloud computing technologies can deliver value when deployed under right conditions with necessary organizational complementarities (Aral et al. 2010; Brynjolfsson et al. 2010).

Third, to my knowledge this is one of the first studies to bring attention as a construct to IS research by drawing from ABV to understand IT leadership focus and effectiveness. Management literature has emphasized that attention is a construct to be generalized to explain organizational behavior at various levels (Chen et al. 2005; Ocasio 1997). Further, there is a need to understand the enablers of attention at multiple levels (cf. Ekelund and Raisanen 2011; Ferreira 2011). With these gaps in past research, my findings explain the enablers of attention at the individual level (i.e. CIO) and particularly suggest that technology can be an enabler to free up constraints on the attention of individuals and organizations. More specifically, my results suggest that the technology trends like commoditization of IT and vendor-based sourcing can in fact be an avenue to disaggregate and delegate the efficiency-related IT tasks to vendors so that the internal talent can be used towards more important opportunities. Further, with the proliferation of data and several new technologies like social networking and analytics which can challenge the attentional demands of the executives like CIOs, my results suggest that CIOs may evaluate the flexibility of using technologies like cloud computing to address the efficiency-related demands and instead use the time from resulting mitigated operational effort towards capitalizing other newer technologies. Evaluating which technologies and which responsibilities can be delegated becomes crucial to free up the constraints on attention and effectively use it towards strategic benefits.

Within the background of technology as an enabler of attention, in his seminal article on the ABV of the firm, Ocasio (1997) theorized that the focus of attention is dependent on the situated attention shaped by the resources and processes in the firm. He further suggested that organizational variables such as context and resources will define the situation and predict attentional focus. Hence there is a need to investigate how the organizational resources moderate attention outcomes (Li et al. 2013). Ocasio (2012) also suggested that situated attention occurs in interaction channels that are more or less tightly coupled with each other.

Relatedly, by substantiating the contribution of organizational resources in shaping the attention, my study provides insights on the positive moderating role of internal resources related to IT systems capabilities, business process management capabilities and organizational learning – through a more nuanced investigation into organizational resources that can shape attention. I find these resources as the enabling moderators that shape the situated attention of the CIOs and empower them by creating situations with lesser focus on operational demands. In addition, my arguments also confirm that the role of technology and process resources i.e. the coordination IT systems and business process management capabilities can be key to foster an effective coupling and subsequent coordination. I suggest that these capabilities in fact create an empowering situation for the CIOs through effective structural distribution of attention.

My results also present several managerial implications. My results indicate that managers need to think beyond traditional efficiency advantages in cloud computing technologies to leverage strategic benefits. Organizations need to institute mechanisms and incentives to relieve their CIO and IT executives of non-urgent operational activities. Following this, organizations can leverage this talent in strategic activities to foster IT enabled innovation and new product development. My study also highlights that managers need to pay attention to enabling conditions and organizational complementarities such as business

process and systems capabilities in strengthening the impact of cloud computing technologies (Brynjolfsson et al. 2010). These enabling conditions may be more relevant to established organizations that may have legacy in processes and technologies.

II-12. Limitations and Future Research Opportunities

This study, being one of the first to study the empirical benefits of cloud computing, possesses several limitations. First, because of cross-sectional data, the findings are associational in nature and do not imply causality. Future research may use longitudinal datasets and appropriate modeling techniques to examine causality between cloud computing adoption and higher CIO involvement in innovation and NPD. My dataset comprises of large firms from the U.S. Future research may explore a mix of large and Small and Medium Enterprise (SME) firms from across different geographies. I use cross-sectional data to examine the role of organizational complementarities but these assets evolve overtime. Hence future research may use longitudinal data to better understand how the co-evolution of cloud computing adoption maturity and organizational complementary assets impact CIO involvement in innovation and NPD over time. Finally, my study uses self-reported survey measures in line with prior research (e.g., Leiponen and Helfat 2010). Future research may use more refined objective measures (Cherian et al. 2009; Saldanha and Krishnan 2011).

My study also opens new avenues for future research. In the CIO research context, examining the effect of individual technologies within cloud computing (i.e., SaaS, IaaS and PaaS) in supporting CIOs to spend more time on strategic opportunities may produce more granular results and each of these individual technologies may have differential impact. Future studies can also validate or contrast my results in the context of SME. There may be opportunities to examine the role of additional dimensions such as CIO personal characteristics, organizational support for IT, organizational relationships of the CIO, and CIO

structural authority etc., as moderating or mediating mechanisms in enabling CIO involvement in innovation and NPD. Relatedly, the role of other technical and organizational complementarities may enrich the investigation.

Given the emerging nature of cloud computing, I foresee several future research opportunities in this area. First, regarding the business value from cloud computing adoption, researchers can investigate the impact of cloud computing technologies on other forms of business value such as customer- and partner-centric capabilities. Investigating the impact of other organizational complementarities, such as IT-business alignment, customer and partner relationship management etc., can be an additional area to explore. While my study focuses on the moderating role of organizational assets, future research may investigate the mediation mechanisms that create higher order capabilities in cloud computing context (Mithas et al. 2011). Since cloud computing architecture is creating new models of service subscription and licensing, studying opportunities, challenges and constraints in cloud based implementations, vis-à-vis traditional IS implementations may need more exploration.

At the theoretical level, my study has employed attention-based perspective (i.e., ABV) to understand enablers of CIO involvement in strategic opportunities related to innovation and NPD. While the ABV may provide additional guidance for IS research, future research may reflect on the fit of this theory to other IS phenomena (Murray and Evers 1989; Tams 2010; Truex et al. 2006).

II-13. Conclusion

Despite considerable attention gained by the CIO role in IS research and a consensus emerging that CIOs need to be strategic leaders, there is a research opportunity to investigate the enabling mechanisms that can allow CIOs to focus more on strategic opportunities like innovation and NPD. Anecdotal evidence

suggests that cloud computing technologies deliver IT efficiency related benefits and hence there may be a possibility that cloud computing adoption may relieve CIOs of the daily grind of the organization to instead focus more on strategic opportunities as in innovation and NPD. My study provides positive empirical evidence that cloud computing adoption can in fact be associated with enabling CIOs to involve in innovation and NPD and suggests that necessary organizational support through organizational complementarities is vital to increase the benefit. The results of my qualitative study supplement these findings with new insights from the industry.

II-14. Appendices

II-14.1. Appendix - A: InformationWeek 500 Questionnaire Items used for this Study.

1. CIO Involvement in Innovation and NPD *(CIOInnovNPD)*

Summative index based on the responses to the important ways CIO is involved in innovation and developing new products for the company:

- Innovation
- Partner with business units to develop new products or services
- Lead an R&D team accountable for new products or services
- Provide the systems and support mechanisms for new product development

2. Cloud Computing *(CloudComputing)*

Summative index based on the web technologies adopted by the company:

- We're using software as a service
- We're using storage, compute, or other cloud computing services
- We're using platform as a service (e.g., Microsoft Windows Azure, Google App Engine)

3. Outsourcing Experience *(OutsourcingExp)*

Summative index based on the global IT strategies in place in respondent's organization:

- We do business process outsourcing with vendors outside the U.S.
- We do IT outsourcing with vendors outside the U.S.

***4.* Process Management Maturity** *(ProcMaturity)*

Summative index based on the response to the products or technologies deployed in the respondent's organization:

- Modeled business processes using CASE or related tool
- Established business-process frameworks/defined processes
- Reengineered existing applications
- Business-process-management software

***5.* Coordination IT applications** *(coordIT)*

Summative index based on the response to the products or technologies deployed in the respondent's organization:

- Deployed CRM or front-office products
- Deployed business-intelligence tools
- Deployed new types of collaboration software (Microsoft's SharePoint or other)
- Deployed employee scheduling software
- Business-performance-management software
- Content management software
- Mobile enterprise applications
- Service management software

***6.* Infrastructure applications** *(Infra)*

Summative index based on the response to the products or technologies deployed in the respondent's organization:

- Quad core servers

- Grid computing
- Network access control (NAC)
- IP storage
- WAN optimization/application acceleration
- Storage virtualization
- Global storage management
- Voice-over-IP
- Wireless LANs
- Desktop virtualization
- Unified communications
- Video conferencing

7. CIO Reporting to CEO *(CIOCEO)*

Binary variable indicating to whom the CIO reports in his/her organization:

- CEO/president
- CTO
- CFO
- COO
- Other senior corporate executive
- Line-of-business executive
- Other (please specify) _____

8. New IT Project Investments *(ITproj)*

Percentage of your organization's projected 2010 worldwide IT budget, including capital and operating expenses devoted to the following: (Estimates must equal 100%)

_____% Ongoing IT operations

_____% New IT project initiatives

9. Annual Revenue *(Size)*

Organization's annual revenue for its most recent fiscal or calendar year.

II-14.2. Appendix – B: Questionnaire for Qualitative Interviews

This section describes the themes explored during the interviews with IT Leaders, together with questions posed as mentioned below:

- *Adoption of Cloud Computing:* Have you adopted cloud computing technologies? What cloud computing technologies among SaaS, PaaS and IaaS have you adopted? If you have not adopted cloud computing, what were the reasons behind non-adoption?
- *Understanding the need for cloud computing:* Why did you adopt cloud computing? What benefits did you foresee in comparison to your existing model of IT capability procurement?
- *Understanding the benefits of cloud computing adoption:* What benefits are you seeing from cloud computing adoption? Are you seeing cost related benefits? Are you seeing any strategic? Do you think cloud computing can provide strategic and innovation-oriented benefits while this model is mostly thought about for its cost-related efficiencies? If you are seeing strategic benefits, what are they? If so, How? Do you see any specificity in terms of certain type of cloud computing applications delivering certain type of benefits (i.e., efficiency related benefits vs. strategic benefits)?
- *Understanding the role related cloud computing benefits:* What benefits are you seeing from cloud computing adoption specific to your role responsibilities and to your IT groups? Do you think cloud computing adoption is more work for your group or is it going to ease the work burden?
- *Understanding the facilitating conditions:* What factors are affecting value enhancement from cloud computing adoption? What should the firms possess in terms of IT maturity? What should the firms possess in terms of process management capabilities? Do you think the lack of these capabilities hinder the benefits to you and to your organization? Does prior experience with external sourcing help? Do you think cloud computing is a different type of sourcing in comparison to your earlier methods of sourcing like IT

outsourcing? What other technical and organizational/social factors do you think will affect deriving value from cloud computing?

II-14.3. Appendix – C: Profiles of the Interviewees

Table II-6 below provides an overview of the profiles of the IT leaders interviewed for my qualitative study and their organizations.

Table II-6: Profiles of the IT Leaders Interviewed

#	Designation	Organization Profile
1	Vice-President & Chief Information Officer	Fortune 500 Global Automotive Components Supplier
2	Senior Vice-President & Chief Information Officer	One of the leading media and marketing services companies in the United States; FORTUNE magazine's list of the "100 Fastest-Growing Companies"
3	Senior Manager, Global IT Business Applications	One of the largest wheel manufacturers in the world
4	Director, Business Application Services	Government - Economic Development Corporation of a US state
5	Executive Vice-President & Chief Information Officer	A leading regional bank in the United States
6	VP – Automotive, Aerospace & Defense, and High-Tech Enterprise Services	Fortune 50 IT Company
7	Global Account Manager – Strategic Automotive Products	A leading cloud-based IT solution vendor
8	Senior Vice-President of Global Strategy	Fortune 1000 IT vendor
9	Vice-President of IT	A leading Insurance Company in the United States
10	Executive Vice-President and Chief Information Officer	A major healthcare system in the United States
11	Chief Information Officer	One of the largest automotive parts manufacturer in the United States
12	Chief Information Officer – North American Operations	One of the world's largest supplier of driveline and chassis technologies for the automotive industry
13	Chief Technology Officer	State Government - Education Achievement Authority
14	Senior Executive - Technology	Fortune 500 IT services organization
15	Senior Director, Global Business Solutions	A leading supplier for the defense industry
16	Assistant Vice-President, Global Business Applications Division	A leading global Accounting firm

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Chapter III. Does Software-as-a-Service (SaaS) has a role in IT-enabled Innovation? – An Empirical Analysis[17]

III-1. Introduction

Software-as-a-Service (SaaS) is gaining acceptance as a model for delivering software applications over the internet. Defined as standard software owned, delivered and managed remotely by service providers, SaaS is a class of technologies under the cloud computing based business models (Gartner 2012). Anecdotal evidence suggests that customers are increasingly adopting SaaS for several organizational benefits including availing cost efficiencies, new functionality and new opportunities. For example, organizations are subscribing to Salesforce's Customer Relationship Management (CRM) functionality under the SaaS model to enable their sales teams to track end-to-end business processes related to customer service ranging from lead generation to lead conversion and continuous customer engagement thereafter. Quintiles, a pharmaceutical major, has floated a spin-off, Infosario, to host its internal software portfolio as a service for external drug makers to use Quintiles' expertise to govern their own drug development cycle (Hoover 2011).

Gartner Inc., a leading analyst firm, has forecasted that SaaS market would reach $12.1 billion in 2011 and a projected $21.3 billion by 2015 (Gartner 2011). Despite the potential and the increasing adoption, there is scant empirical research, to my knowledge, on what and how SaaS can generate business value

[17] The focus of the hypotheses in this study is on if SaaS can be associated with IT-enabled innovation. In Chapter 1, the focus was on what cloud computing and the role of organizational complementarities mean specifically for enabling the CIO role. Additional tests conducted to examine the association between CIO involvement in innovation and NPD and IT-enabled innovation did not yield statistically significant results. One possible explanation may be that there are several factors beyond CIO involvement in innovation and NPD that can influence IT-enabled business innovation in the firm.

for adopting organizations. Much of the existing literature is conceptual or analytical. Though conceptual studies are important, empirical studies are required to validate theoretical viewpoints and to develop a deeper understanding of the phenomenon (Whitaker et al. 2007). Evidence on positive impact may allay some of the fears around emerging technologies. Relatedly, the 2010 World Economic Forum meeting at Davos highlighted the benefits of cloud-based technologies like SaaS and has called exploring the potential of cloud technologies to deliver higher order benefits that transcend beyond cost efficiencies often cited in trade literature (World Economic Forum 2010). This echoes with past calls in IS research to highlight the transformational effect of IT and its real contributions to business (Agarwal and Lucas 2005). Further, anecdotal evidence is divided on the benefits of SaaS as an enabler of cost efficiencies vs. higher order benefits[18]. Hence there is a need for empirical research to validate the arguments and develop an understanding on the true benefits SaaS can deliver. Thus, in my study, I investigate two research questions: Does SaaS have a role in firms' IT-enabled innovation? If so, do organizational complementarities augment this effect?

While the extant literature has treated SaaS as a form of IT outsourcing (ITO) (e.g. Xin and Levina 2008), pertinent to my study, I argue that SaaS possesses some unique characteristics that differentiate it from ITO. ITO literature has suggested the potential to use vendors' expertise to execute new IT projects in the firm (cf. DiRomualdo and Gurbaxani 1998). However, in this study, I suggest on exploring the potential of IT to improve firms' products, processes and services, thereby examining the scope for IT-enabled business innovation. Further, I propose that the inherent IT elasticity in SaaS model whereby software capabilities can be available on-demand can provide flexible capacity to execute business process changes crucial for innovation. Hence I suggest that SaaS is about fostering the flexibility to support business innovation through IT rather than a complex make vs. buy decision innate to ITO.

[18] I thank Dr. Nigel Melville for motivating this discussion

Relatedly, I draw upon business innovation research to propose that SaaS has the potential to deliver higher order benefits among the various classes of cloud based technologies and I attempt to empirically examine the business value of SaaS through IT-enabled business innovation. In line with past research, I define IT-enabled business innovation as 'new products, services, or processes developed by a firm through the application of IT' (Agarwal and Sambamurthy 2002; Ahuja et al. 2008; Joshi et al. 2010; Saldanha 2013; Teo et al. 2007). Further, I leverage past IS research to examine the role of organizational complementarities in augmenting value from SaaS adoption.

My empirical findings based on data from 288 firms show that SaaS adoption can in fact be associated with IT-enabled business innovation in the firm. I also find that organizational complementarities in business process management maturity, systems capabilities related to flexible IT architectures and the firm's past experience with outsourcing augment this effect. I also conducted a qualitative field study that included interviews on this subject with 12 senior IT executives. The qualitative study confirmed my empirical findings and managerial insights based on these results are provided.

There are two primary contributions of my study among others. First, this study adds to the IT sourcing literature by investigating the business value of an emerging technology business model for IT applications delivery i.e. SaaS through associating its adoption with IT-enabled business innovation. It thus highlights one of the strategic benefits that can arise out of it. This is an important finding given that anecdotal evidence emphasizes only cost advantages from SaaS adoption. Ascertaining strategic potential of these technologies is important to establish credibility of an emerging phenomenon (Agarwal and Lucas 2005; World Economic Forum 2010). Second, this research explores firm-level characteristics that can augment business value in sourcing contexts like SaaS (Whitaker et al. 2010; Williamson 1999). In doing so, it contributes to the complementarity literature in IS research and shows how technical and organizational architectures should combine to foster business value through

emerging technologies. Relatedly, my findings prompt managers to think beyond cost efficiencies in SaaS model and caution them to pay attention to enabling conditions in the organization to derive true value from their SaaS investments.

The remainder of the paper is organized as follows. In the next section, I briefly discuss the literature related to SaaS. I develop the theoretical propositions based on complementarity literature in IS research and discuss my hypotheses. I next elaborate on research methodology and results. I will explain the findings from my qualitative field study in the following section. Finally, I discuss the implications of my research, describe limitations and suggest future research opportunities.

III-2. Literature Review

III-2.1. Literature on SaaS

With SaaS being an emerging phenomenon, there is limited academic research in this area to my knowledge. Existing literature has attempted to improve our collective understanding on concepts and opportunities associated with SaaS adoption. In their conceptual paper on studying the factors of SaaS adoption in organizations, Xin and Levina (2008) suggested that among other factors; customers with low cost of IT capital, low internal IT capabilities, low customization requirements and high demand uncertainty for IT functionality are more likely to adopt SaaS. They further suggested that firms with high enterprise IT architecture maturity are more likely to adopt SaaS as this maturity makes it easier to isolate individual processes from other activities and employ external service vendors' best practices for these processes. Choudhary (2007) analytically modeled the impact of cloud based SaaS licensing models on the software firm's incentive to invest in software quality. By comparing SaaS licensing model with perpetual licensing, the author found that firms will invest more in product development in SaaS business model. This increased investment leads to innovation, higher software quality, and higher profits.

Discussing the opportunities from SaaS, Cusumano (2010) highlighted that SaaS can be a new platform for computing by providing flexible software resources but the value of SaaS as an option can be contingent on how different vendors enable interfaces for disparate SaaS service providers' offerings to integrate. Regarding the benefits from SaaS adoption, Aral et al. (2010) found qualitative evidence through case study research that cloud-based technologies like SaaS can create strategic benefits towards competitive advantage in addition to economic benefits. However, the benefits realization is contingent on fostering complementary capabilities including standardized infrastructure, data management, and business processes. They also found that firms with strong IT-business partnership and firms that excel at managing external vendors realize maximum value from adoption. Brynjolfsson et al. (2010) in their theoretical work cautioned against mere replacing of existing IT resources with cloud-based software offerings and suggested that complementary investments in process and organizational changes should accompany the adoption. Koehler et al. (2010) was a notable exception with empirical evidence about consumer preferences for different service attributes in cloud-based IT solutions. Studying the adoption decisions, the authors found that the reputation of the SaaS-based cloud provider and use of standard data formats are more important for customers when choosing a service provider rather than focusing on cost reductions or tariff structures. They emphasize the importance of data integration issues when transacting with SaaS applications.

Under practitioner literature and anecdotal evidence, Gartner Inc., a leading analyst firm, has forecasted that SaaS market would reach $12.1 billion in 2011 and a projected $21.3 billion by 2015 (Gartner 2011). A related 2010 Davos World Economic Forum report indicated that 23% of high performing IT companies have already deployed SaaS by 2010 (World Economic Forum 2010). The report called for empirical research to better understand the benefits and contextual complementarities (World Economic Forum 2010). It has urged exploring if cloud-based technologies like SaaS can deliver higher order benefits transcending beyond cost efficiencies.

In summary, my literature review suggests that the business value of SaaS is largely anecdotal or conceptual. While qualitative evidence is emerging regarding the business value of SaaS, scant empirical research exists to my knowledge on what and how this technology model creates value. Second, organizations may vary in the extent to which they adopt and leverage SaaS to create value. Hence, as informed by past research, there is a need to investigate the differentiating role of organizational complementarities in enhancing value from SaaS adoption (Brynjolfsson et al. 2010). In particular, there may be a distinguishing role for capabilities related to internal systems (IT architecture maturity), processes (business process management capability), and vendor management (outsourcing experience) in driving business value (Aral et al. 2010; Xin and Levina 2008).

III-3. Theory and Hypotheses Development

The differential role of organizational capabilities in creating value from IT investments has been discussed in literature. My primary hypothesis in this study is that SaaS adoption can enable benefits related to IT-enabled business innovation. However, organizations may vary in the extent to which they leverage the benefits of SaaS adoption. Hence, along the lines of prior studies, I investigate the differentiating role of organizational complementarities in enabling value from SaaS adoption (Aral et al. 2010; Brynjolfsson 1993).

As explained here and in my hypotheses, I first draw on business innovation research to examine the role of SaaS in providing the IT flexibility to support business innovation needs. Further, I draw upon the framework of Feeny and Willcocks (1998) to examine the complementary core capabilities needed to drive value from IT SaaS investments. At a high level, Feeny and Willcocks (1998) highlighted the role of systems capabilities related to enterprise IT architectures, the role of sourcing strategies supported by effective vendor management and a process-oriented business thinking to support business initiatives through IT.

Relatedly, research has advocated two organizational capabilities - systems and process capabilities are essential to create value from IT investments (Gold et al. 2001). The complementarity between IT systems capabilities and organizational process capabilities was identified as key for increased performance in organizations (Aral and Weill 2007). For example, Rai et al. (2006) reported that when IT infrastructure integration capability is leveraged to develop a higher order supply chain process integration capability, it can lead to significant performance gains in inter-firm relationships. In addition to these two capabilities, organizational learning was found to be an important capability to leverage past experience in managing inter-firm engagements (Whitaker et al. 2010). As SaaS adoption shares some characteristics of partnering arrangements, I study the relevance of business process management capabilities, IT architecture maturity and learning from past outsourcing experience in enhancing the effect of SaaS adoption on IT-enabled business innovation (Aral et al. 2010).

III-4. Hypotheses Development

III-4.1. Hypothesis 1: Associating SaaS Adoption with IT-enabled Business Innovation

When firms in an industry are competing on nearly similar products and services, business processes are increasingly becoming the last source of differentiation among the firms and thus withering away the traditional sources of advantage like access to labor and capital (Davenport and Harris 2007). Business processes are the procedural articulation of the activities of the firm and are the core enablers of innovative capacity in the firm. Recognizing this shift in sources of competitive advantage, business innovation research has argued that to foster operational agility in responding to market dynamics needs thorough business process changes and by creating flexibility in the business processes

(Prahalad and Krishnan 2008).[19] Creating flexibility in the business processes needs support from backend software applications that digitize these processes (Sambamurthy et al. 2003). Software applications drive the modularization and atomization of business processes and enable their combination and recombination to create new business processes to address changing environment (Malone et al. 1999).

Related IS research has argued that to foster this flexibility, firms need to develop an effective IT capability that can deliver systems when needed to support business process changes (Ross et al. 1996). Firms need the ability to provide timely access to information and this can be accomplished through tailoring the IT infrastructure to emerging business needs and directions (Marchand et al. 2000). Delivering IT systems when needed positions IT as an enabler of reconfiguring business processes in response to market changes. For example, if a firm aspires to create new ways of customer engagement by providing more personalized services to the customers calling into its call center, the changes should reflect in the customer service business process. To execute personalization, it should create a backend IT capability that dynamically matches customer profiles with agent skill profiles so that the customer call is routed to an appropriately skilled agent. This backend capability provides the flexibility in the business process and ensures agile and accurate interactions with the customer.

In this context, cloud computing based models like SaaS can endow business agility benefits wherein IT software capabilities can be procured through rapid software deployments. SaaS can be a viable option to develop the flexible IT

[19] Business innovation research has argued that among the various classes of IT assets like software applications, infrastructure and software and hardware platforms, software applications are enablers of competitive advantage while infrastructure and platforms deliver standardization and efficiency (Prahalad and Krishnan 2008: 54). In the context of this study, it can be interpreted that SaaS as a delivery model for software can enable competitive advantage while other cloud-based technologies like IaaS and PaaS are geared towards standardization and efficiency.

capability to support business process changes (Armbrust et al. 2009). The inherent elasticity in the SaaS model to scale up software resources on need basis assists in dynamically delivering systems that support reconfiguring the business processes in response to market changes (Marston et al. 2011). This in turn enables the agility to launch frequent and competitive actions to innovate in the marketplace. Hence I hypothesize:

H1: Adoption of SaaS is positively associated with a firm's IT-enabled business innovation capability.

III-4.2. Hypothesis 2: The role of past outsourcing experience

Organizational learning is a dynamic capability wherein firms acquire knowledge and use it to build higher order capabilities that enable competitive advantage (Bhatt and Grover 2005). Organizations build technical and business capabilities by learning from doing and use this learning in future activities (Sambamurthy and Zmud 1997). For example, Neo (1988) found that new IT implementations are more likely to be successful if the firm has gained expertise in implementing similar systems in the past. The reason being that successful execution of an action is a source of self-assurance that makes firms become more confident that they have the capabilities and knowledge required to be successful in a specific domain (Haleblian et al. 2006). This assurance makes firms explore opportunities to refine the action and increase the probability of reusing it in the future (Amburgey et al. 1993; Shaver et al. 1997). Relatedly, as the firm gains experience with an activity, it develops standard processes associated with the activity and systematizes them to reuse in the future. To exemplify, organizations that were engaged in IT outsourcing (ITO), and in coordination with vendors, learn from the experience of working with vendors and develop standard processes of vendor engagement based on the learning and extend it to other sourcing activities. Prior research has shown that such firms are more likely to engage in Business Process Outsourcing (BPO) by reusing the

standard processes of vendor engagement from ITO due to similarities in both arrangements (Whitaker et al. 2010).

I extend the concept of organizational learning from other sourcing contexts to SaaS. I posit that organizations with learning from ITO and BPO would have learned about vendor relationship management, developed standard processes for vendor engagement and would be in a better position to apply them to SaaS sourcing. My belief stems from the rationale that SaaS-based service sourcing shares some of the characteristics with ITO and BPO including the need to source services from an external vendor, the requirements for fulfilling contractual obligations and the nature of some of the risks associated with sourcing (Xin and Levina 2008). Notwithstanding the concerns exclusive to SaaS, I suggest that firms with ITO and BPO experience would be able to better absorb external vendors' SaaS delivery into their internal operations as these firms are well equipped to coordinate with SaaS vendors due to the contextual learning from ITO and BPO. Consistent with the above discussion, I hypothesize:

H2: Past outsourcing experience of the firm positively moderates the relationship between SaaS adoption and a firm's IT-enabled innovation capability.

III-4.3. Hypothesis 3:The role of Internal IT Architecture Flexibility

Enterprise IT architecture is a critical foundation on which organizations can design and implement business strategy (Smith and McKeen 2006). A firm with mature IT architecture focuses on creating modular software architectures and leverages IT architecture to align IT and business strategy (Ross 2003). This alignment focuses on creating modular IT business components that enable critical business processes. The software modularity in turn fosters flexibility and agility by assembling the components to create functionality that addresses changing business needs. Further, firms with mature architectures develop

standardized interfaces so that they can readily absorb customized or industry-standard components and integrate third-party offerings better (Ross and Beath 2006). Such firms would foster standardization in business processes to develop standard interfaces that can be readily integrated with external providers. Standardization also allows isolating individual business processes that could be outsourced and thus avail vendor's best practices (Xin and Levina 2008).

Within this context of IT architecture maturity, Service-Oriented Architecture (SOA) approach is changing how internal and external systems interact (Laplante et al. 2008). In SOA, the basic element is a service (Papazoglou and Georgakopoulos 2003). A SOA enhances the flexibility and modularity of business processes and provides the ability to seamlessly integrate business processes across business units and partners (Lim and Wen 2003; Prahalad and Krishnan 2008). By exposing business services in an organization to external partners, SOA offers ways to integrate data and processes across organizations. Two aspects of SOA are relevant to enterprise architecture in SaaS scenario. First, the existence of SOA facilitates designing of modular business processes and this modular design in turn enables flexibility and agility (Prahalad and Krishnan 2008; Ross and Beath 2006). Second, using common standards in messaging in combination with SOA enables standardization in inter-organizational linkages and this standardization allows firms to develop interfaces for seamless integration with external providers (Gosain et al. 2005; McAfee 2005; Ross and Beath 2006).

Based on the above discussion, I suggest that firms with strong internal IT architecture flexibility as in SOA will be better positioned to integrate SaaS offerings into their internal systems. Further, the internal architecture flexibility can create organizational agility towards competitive advantage (Ross 2003). Thus I hypothesize:

H3: Higher internal IT architecture flexibility positively moderates the relationship between SaaS adoption and a firm's IT-enabled innovation capability.

III-4.4. Hypothesis 4: The Role of Internal Business Process Management Maturity

Business process formalization has contributed to successful adoption and implementation of IT innovations (Raymond 1990). Organizations with higher degree of process formalization are more likely to successfully adopt and implement IT innovations (Ein-Dor and Segev 1978). This is because formalized processes enhance the fit between existing business processes and prospective innovation (Raymond 1990). The degree to which organizational processes are systematized and formalized through rules, procedures, and management practices provides greater control over innovation selection and its integration into internal operations (Hall 1982). This reduces risks associated with adoption of innovation and contributes to more successful outcomes (Chang and Chen 2005).

Particularly, in partnerships, it was shown that higher internal business process management maturity is related to more efficiency and less ambiguity in vendor management and thus helps to avoid unexpected risks (Martin et al. 2008). There are two reasons that support this finding. First, standardized business processes can facilitate communications about how the business operates, enable smooth handoffs across process boundaries, and make possible comparative measures of performance. Since information systems support business processes, standardization allows uniform information structure within the companies as well as standard interfaces across different firms (Davenport 2000). These firms can use standard interfaces to quickly establish relational processes that enable timely sharing of information with external partners to schedule and synchronize tasks, clarify task outputs, and integrate outputs back into the firm's value chain (Mani et al. 2010). Second, firms with higher business

process management capabilities codify the business process management activities and possess the capability to successfully coordinate transfer of business processes to vendors (Whitaker et al. 2010). Codification captures and structures business process knowledge thus enabling transfer across process boundaries and decomposition along with distribution of business processes (Boisot 1986; Cohendet and Steinmueller 2000). The above reasons can be explained with an example scenario. If a firm has standardized its internal CRM business process based on industry best practices, it may be highly possible that process flows align with standardized CRM applications provided by SaaS-based CRM vendors like Salesforce.com. It allows the firm to first evaluate how its own processes measure in comparison to the offerings of vendors in order to make a decision on procuring the service. This clarity in the business processes can enable easier management when the business processes are procured from external vendors. Additionally, industry standard interfaces allow smooth transfer of the business process, seamless integration with vendors, and a common understanding of the service levels if the firm decides to source CRM functionality.

As SaaS involves external sourcing, I argue that firms with higher business process management maturity are better positioned to maximize the gains from SaaS procurement for two reasons. First, higher process management maturity allows working effectively with external vendors and minimizes risks in engagement. Second, process management maturity prepares the firms to better integrate external innovations into internal operations and enhances the fit between existing internal processes and external innovations. Based on this, I hypothesize that:

H4: High business process management maturity of the firm positively moderates the relationship between SaaS adoption and a firm's IT-enabled business innovation capability

Figure III-1 depicts the research model summarizing the hypotheses.

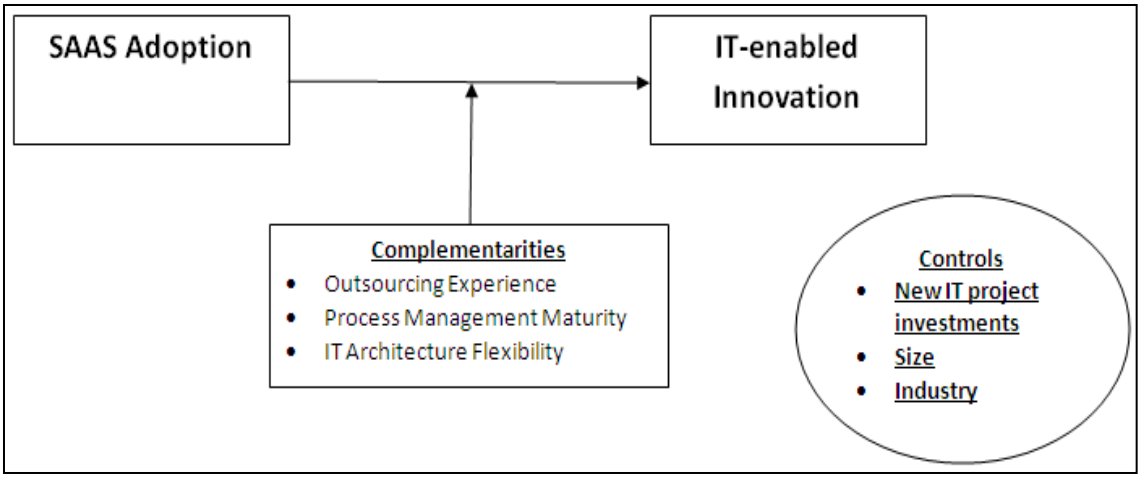

Figure III-1: Research Model

III-5. Research Design and Methodology

III-5.1. Data and Variable Definition

Empirical estimation is based on data from InformationWeek 500 surveys. InformationWeek is a leading IT publication and previous academic studies have used InformationWeek survey data (e.g., Bharadwaj et al. 1999; Mithas et al. 2005). The InformationWeek 500 survey is an annual benchmarking survey that targets top IT managers in large firms. Respondents are in senior management positions with sufficient overview of their firm's IT operations and investments. The data for all but two variables was drawn from the 2010 InformationWeek 500 survey which also included the variable on SaaS Adoption. The data for two variables – ProcMaturity and ITArchFlex - was drawn from the 2008 InformationWeek 500 Survey.[20] As these variables correspond to business process management maturity and IT Architecture Flexibility, at least a two- to three-year lag is appropriate before the effects of investments in process and systems capabilities are realized (Brynjolfsson 1993; Brynjolfsson and Saunders 2010).[21] The original data set for each of InformationWeek surveys had more

[20] As SaaS is a nascent phenomenon, the 2008 Annual InformationWeek 500 survey did not capture user responses about SaaS adoption. The 2010 Annual InformationWeek 500 captured user responses on SaaS adoption.

[21] My data combination from 2008 and 2010 captures a lag as advocated by past research.

than 500 firms. After combining data sets and matching them by firm name, I have dropped incomplete observations and outliers per Cook's distance. (Long and Freese 2003). The final sample comprised of data from 243 firms. The reduction in the sample size was due to missing observations and duplicate data for variables of interest. The firms surveyed in InformationWeek 500 are large companies and repeatedly find place in the survey year upon year being recognized as top spenders of IT in the USA. Hence survival is not an issue, given the size of these firms[22]. The following sub-sections describe variables used in my model. The relevant questionnaire items from the InformationWeek 500 survey are included in the ***Appendix A***.

Dependent Variable

Innov – This is a binary variable denoting "whether the firm sought to patent, trademark or copyright any IT-driven business processes, products or services in the 12 months prior" to the survey. The notion of IT-enabled business innovation captured by this measure is consistent with the definition of firm-level IT-enabled business innovation in the IS literature, defined as 'new products, processes or services developed by a firm through the application of IT' (Agarwal and Sambamurthy 2002; Joshi et al. 2010; Kleis et al. 2012; Teo et al. 2007). It is also consistent with the definition of innovation in the strategic management literature as the generation of "new ideas, processes, products or services" (Thompson 1965: 2). Self-reported and binary measures of innovation have been used in prior research (e.g., Aragon-Correa et al. 2007; Leiponen and Helfat 2010; Tsai and Ghoshal 1998; Veugelers and Cassiman 1999).

[22] I thank Dr. Robert Franzese and Dr. M.S. Krishnan for motivating this discussion.

Independent Variables

- *SaaS* – A binary variable indicating the adoption of SaaS by the organization.
- *ProcMaturity* - A three-item summative index of business process management capabilities: if the firm has 'Established business process frameworks/defined processes', 'Modeled Business Processes using CASE or related tools' and 'Implemented Business Process Management software for enterprise-wide process management'. A similar measurement approach was used in past IS research (Whitaker et al. 2010)
- *ITArchFlex* – A two-item summative index indicating the extent of SOA and Web Services implementation in the organization. In line with past research, I use SOA and Web Services implementation as a proxy for IT Architecture Flexibility (Kumar et al. 2007). The data for this variable comes from the 2008 Annual Information Week survey and imbibes the lag needed before the impact of implementation is felt (Brynjolfsson 1993).
- *OutsourcingExp* – A two item summative index of binary variables indicating if the firm is engaged in IT outsourcing or business process outsourcing. A similar measurement approach was used in past IS research (Whitaker et al. 2010)

Control Variables

- *FirmSize* - Firm size measured as the natural log of annual firm revenues (Mithas et al. 2005). Larger firms tend to have more resources for innovation (Ahuja et al. 2008). Hence firm size may influence a firm's propensity to adopt SaaS.
- N*ewProj* - This measure pertains to the percentage of IT budget devoted to new IT projects. Investments in new IT projects can extend a firm's IT innovation capabilities compared to investments in ongoing projects (Cherian et al. 2009). Hence I control for IT innovativeness as informed by past research.

- *Industry Controls (Manufacturing and ITSector)* - These are binary variables (1 = yes, 0 = no) for the firms in Manufacturing and IT sectors based on the North American Industry Classification System (NAICS) code. I control for the firms in these industries since they are at the forefront of SaaS adoption (Gartner 2010).

III-6. Empirical Model

I estimate a cross-sectional model to test my hypothesis. As innovative firms may be more likely to adopt new technologies first, I accounted for endogeneity in SaaS adoption (Saldanha and Krishnan 2011). To control for this endogeneity, I followed recommendations in Bharadwaj et al. (2007), Saldanha and Krishnan (2011) and Shaver (1998) to use Heckman two-step estimation approach (Heckman 1979). As a first step in this estimation, I ran a probit regression of SaaS variable on the control variables of the main estimation and additional variables created exclusively for this estimation. The inverse mills ratio generated in this step was included as a control variable in my main empirical model. Controlling for endogeneity using the two-step estimation gives consistent estimates (Heckman 1979; Shaver 1998). Additional variables included exclusively in this equation related to firm's investments in infrastructural technologies. One ordered variable captured the firm's deployment of videoconferencing tools, wi-fi networks, desktop virtualization infrastructure, smartphones and mobile applications. Another ordered variable captured the upgradation of infrastructure i.e. upgraded desktop PCs with newer models, upgraded PC operating systems or applications and upgraded email system. These variables capture the internal infrastructure capability and the propensity of the firm to work with newer technologies respectively which influence new technology adoption. These can influence cloud computing adoption as firms with experience in near-similar technologies and continued investment in IT capabilities will be most likely to adopt newer technologies (cf. Neo 1998, Xin and Levina 2008). However, these are infrastructural resources and are more

oriented towards standardization and efficiency. Hence these can be reasonably expected to be transactional rather than transformative resources in nature (Aral and Weill 2007; Prahalad and Krishnan 2008).

My dependent variable (Innov) is a binary indicating whether the organization has patented, trademarked or copyrighted any IT architectures, products, services, or IT-driven business processes in the 12 months. Since the dependent variable is binary, I use logistic regression for estimation. Logistic or probit models are used in binary choice models (Greene 2008). I control for share of IT investment in new projects, Firm Size and Manufacturing and IT sector industries at the 2-digit North American Industry Classification System (NAICS) level. I controlled for Manufacturing and IT Sector industries as these industries were at the forefront of SaaS adoption (Computer World 2010). The empirical model is as follows:

$$P(Innov) = \beta_0 + \beta_1(SaaS) + \beta_2(OutsourcingExp) + \beta_3(ProcMaturity) + \beta_4(ITArchFlex) + \beta_5(SaaSxOutsourcingExp) + \beta_6(SaaSxProcMaturity) + \beta_7(SaaSxITArchFlex) + \beta_8(FirmSize) + \beta_9(NewProj) + \beta_{10}(Manufacturing) + \beta_{11}(ITSector) + \beta_{12}(Inverse\ Mills\ Ratio) + e$$

III-7. Results

Table III-1 below provides the descriptive statistics. Results of my estimation are presented in Table III-2.

In Table III-2, Model 3 in Column 4 is the full model with interactions. The Wald Chi-square statistic of the full model with interactions is 65.39 ($p<0.001$) indicating that I can reject the null hypothesis that the coefficients are jointly zero. The positive and marginally significant coefficient ($\beta_1=0.65$, $p<0.10$) in Model 2 in Column 3, the model without interactions, provides initial evidence that SaaS can support IT-enabled innovation. Quantitatively, a unit increase in

SaaS is associated with an increase in the odds in favor of an IT-enabled innovation by exp (0.64) =1.90.

In Model 3, which is my full estimation model with interactions and the focus of this study, the positive and significant coefficient (β_1=1.353, p<0.001) of SaaS adoption provides ***support for Hypothesis 1*** that SaaS can be instrumental in supporting IT-enabled innovation. The coefficient on SaaS variable has increased in magnitude and significance in the presence of interactions. This suggests substantial increase in odds in favor of an IT enabled innovation when SaaS is deployed in the organization. The results further show the interaction term of SaaS and OutsourcingExp is positive and significant (β_5=1.16, p<0.02) and the interaction term of SaaS and ProcMaturity is positive and significant (β_6=1.11, p<0.05) thus ***rendering support for Hypotheses 2 and 4*** on the role of process maturity and outsourcing experience complementarities in augmenting the impact. The interaction between SaaS and IT architectural flexibility is positive and marginally significant (β_7=1.65, p<0.10) and provides ***partial support for Hypothesis 3***.

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Table III-1: Descriptive Statistics and Correlations

	Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9
1	Innov	0.44	0.50	1.00								
2	SAAS	0.75	0.44	0.11**	1.00							
3	Outsourcing Exp	0.94	0.83	0.07	0.04	1.00						
4	ProcMaturity	1.35	0.76	0.18*	0.11*	0.09	1.00					
5	ITArchFlex	0.48	0.70	-0.25*	0.08	-0.08	-0.07	1.00				
6	FirmSize	8.18	1.44	-0.03	-0.06	0.34*	-0.01	0.04	1.00			
7	Newproj	35.29	16.65	0.02	-0.09	-0.02	0.01	-0.05	-.01	1.00		
8	Manufacturing	0.22	0.42	-0.05	0.06	0.13*	0.08	0.17*	0.15*	-0.16*	1.00	
9	ITSector	0.1	0.3	0.25*	0.15*	-0.06	0.14*	-.11**	-0.13*	-0.08	-0.08	1.00
N = 243. *Correlation significant at p<0.05; **Correlation significant at $p < 0.10$.												

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Table III-2: Empirical Estimation Results

Dependent Variable = Innov			
	Logit Model 1 (Controls without focal variables)	Logit Model 2 (All variables without interactions)	Logit Model 3 (Full model with interactions)
SaaS		0.65* (0.321)	1.353**** (0.49)
OutsourcingExp		0.19 (0.172)	0.147 (0.182)
ProcMaturity		0.298* (0.178)	0.238 (0.193)
ITArchFlex		-0.75**** (0.21)	-1.00**** (0.263)
SaaS x Outsourcing Exp			1.16*** (0.44)
SaaS x ProcMaturity			1.11** (0.52)
SaaS x ITArchFlex			1.65* (0.87)
FirmSize	-0.037 (0.092)	-0.232 (0.20)	-0.208 (0.198)
Newproj	0.004 (0.008)	0.05 (0.04)	0.06 (0.05)
Manufacturing	-0.24 (0.311)	-1.38 (1.16)	-1.59 (1.17)
ITSector	1.87**** (0.481)	-2.03 (3.51)	-2.26 (3.52)
Inverse Mills Ratio		-11.25 (10.95)	-12.17 (10.96)
Constant	-0.348 (0.957)	5.02 (5.12)	4.92 (5.14)
Log likelihood	-184.31	-170.69	-162.21
Wald Chi-square	21.20	48.43	65.39
Prob > Chi-square	0.001	0.001	0.0001
McFadden's pseudo R-square	0.0544	0.1242	0.1877
N = 288. SAAS, OutsourcingExp, ProcMaturity and ITArchFlex are mean-centered before interaction. Standard errors are in parentheses. *significant at 10%; ** significant at 5%; ***significant at 2%; ****significant at 1%			

Figure III-2 shows the marginal effect of the predicted probability of IT-enabled business innovation with SaaS adoption when industry controls were held at a meaningful value of '0' and other variables are held constant at their

means.[23] As shown in Figure III-2, the probability of IT-enabled business innovation increases with SaaS adoption. Further, Figures III-3, III-4 and III-5 depict the marginal effects of the interactions in the model. For example, in the Figure III-3, the interaction of SaaS adoption and BPM capability shows that the pattern trends upwards for the predicted probability of Innov being 1 with higher BPM capability having higher probability. Similar interpretations can be made from Figure III-4 and III-5 which depict the interaction of SaaS adoption with Outsourcing Experience and IT Architecture Flexibility.

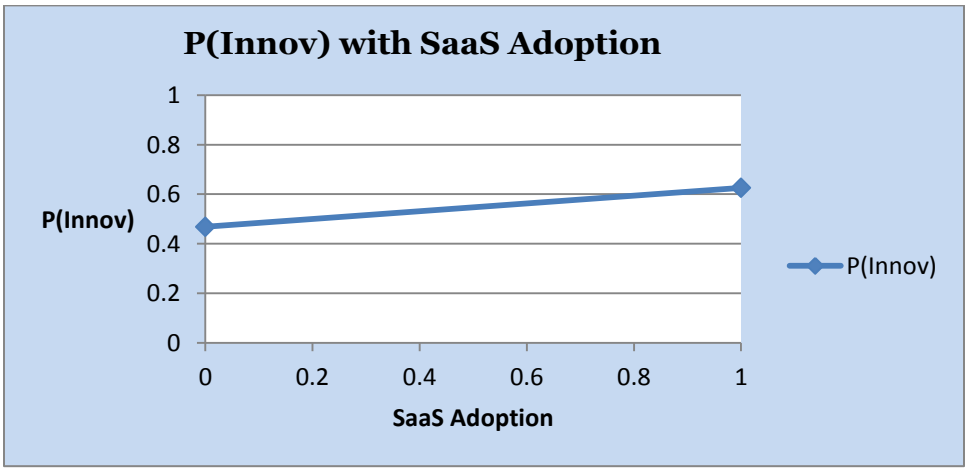

Figure III-2: Predicted Probability of IT-enabled Innovation & SaaS Adoption

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[23] Holding the industry controls at meaningful values was informed by past research (Hoetker 2007). Since variables are centered before interaction, it implies that Figure 2 is a plot of the main effect of cloud computing adoption.

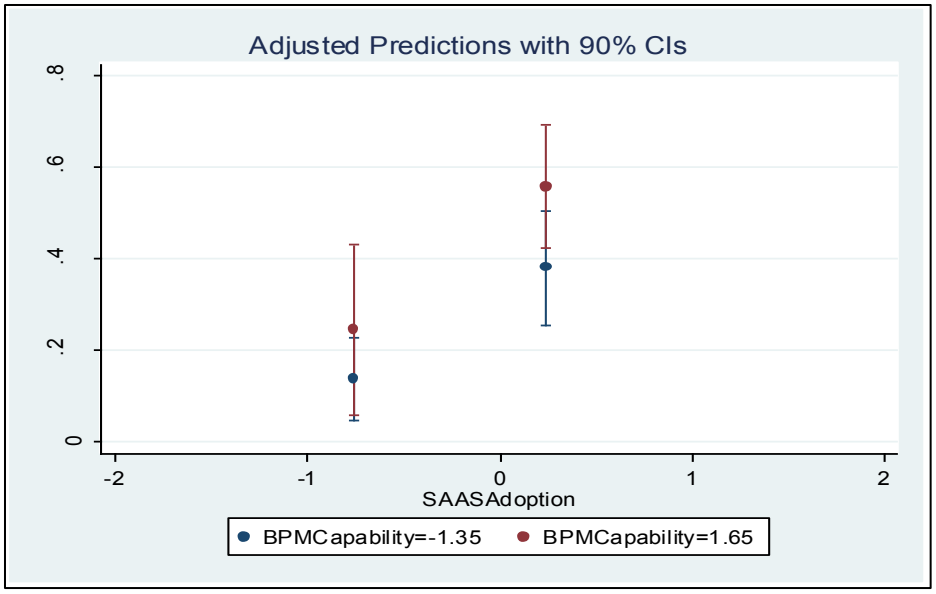

Figure III-3: Marginal Effects of Interaction - SaaS and BPM Capability[24]

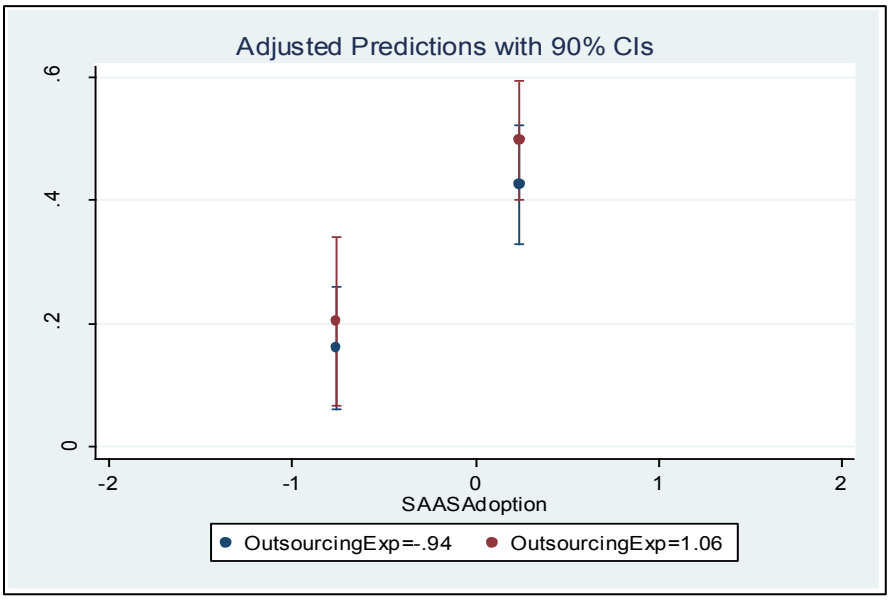

Figure III-4: Marginal Effects of Interaction - SaaS and Outsourcing

[24] The BPMCapability values denote the lowest and highest value levels of this centered variable. Similar centered values at the lowest and highest levels were used for ITArchFlexibility and OutsourcingExp variables.

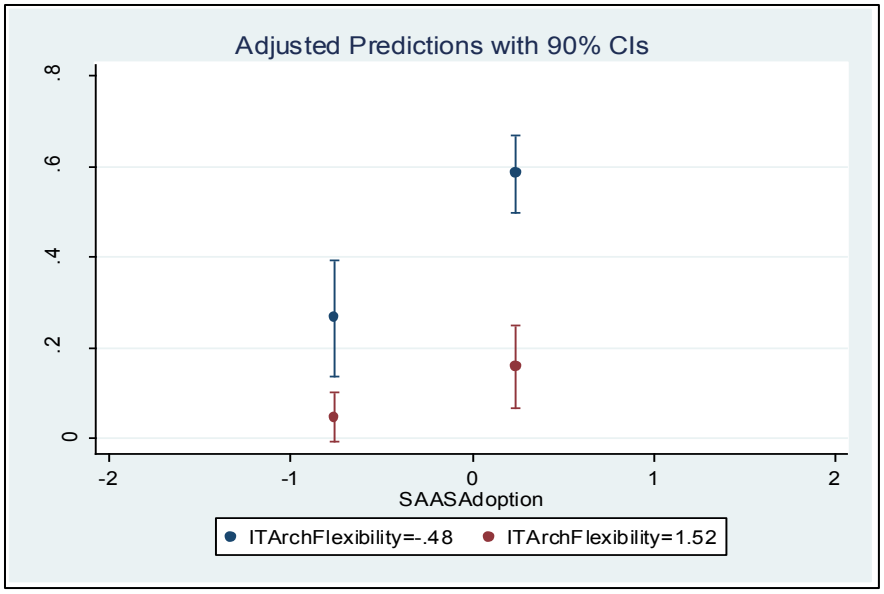

Figure III-5: Marginal Effects of Interaction - SaaS and IT Arch. Flexibility

III-8. Econometric Robustness Checks & Supplementary Analysis

Since the dependent variable is binary, I used logistic regression for my main estimation. As a probit model can be used as an alternative (Greene 2008), I ran a probit regression as a sensitivity check. The results not presented here for brevity purposes were qualitatively similar. The Breusch-Pagan test for heteroskedasticity failed to reject the constant variance of the error term and suggested that heteroskedasticity is not an issue. I tested for multicollinearity by computing variance inflation factors (VIF) and condition indices. The highest VIF was 6.31 being below 10 indicated no serious problem with multicollinearity. However the condition number was 24.37 and condition numbers beyond 20 may indicate a problem as they may result in ill-conditioned matrices (Greene 2008). To mitigate any multicollinearity issues, I mean-centered the variables. Centering does not change the estimated effects of any variables and the effect of marginal increase in the centered version of a variable is identical to the effect of a marginal increase in uncentered variable (Franzese and Kam 2003). My final estimation after mean centering had a highest VIF of 1.24 and a condition

number of 18.05, both within prescribed limits. The link test to check for specification errors produced significant linear predicted value (p=0.001) and insignificant linear predicted value squared (p=0.147). This suggested that there is no model specification error (Long and Freese 2003, UCLA 2010).

To assess the reliability of the self-reported measure of innovation, I examined the correlation in the sample between the Innov measure and if the firm has obtained a patent in the same year consistent with the question posed in the survey. Patents can be expected to correlate well with the inventive output (Griliches 1990) and patenting is considered a reliable measure of innovation widely used in past research (e.g., Ahuja et al. 2008; Joshi et al. 2010; Scherer 1965; Schilling and Phelps 2007). Patenting information was obtained from U.S. Patent & Trademark Office and was seconded by Justia Patents database. The correlation coefficient (r) is positive and statistically significant ($r = 0.36$, $p < 0.00$), thus serving as a validity check of my measure of innovation[25]. This approach is consistent with prior research that validates subjective measures against external measures to ensure data integrity (Kulp et al. 2004; Ravichandran and Lertwongsatien 2005). More specifically, it is in line with studies that validate subjective innovation measures by their correlation with quantitative innovation measures (Aragon-Correa et al. 2007).

III-8.1. Estimating the Effect of IT Outsourcing vs. SaaS on IT-enabled business innovation

In my original estimation models in Table III-2, the SaaS variable was found to be statistically significant while OutsourcingExp variable by itself did not have a statistically significant effect on IT-enabled business innovation. As 'OutsourcingExp' variable corresponds to the firm being engaged in outsourcing

[25] The correlation coefficient was statistically significant and not too high in magnitude. This is expected since the Innov variable refers to propensity for IT-enabled business innovation in particular, whereas the patent counts measure all innovations. Further, the self-reported measure was seeking information on patents, trademarks and copyrights all together while the objective data included only the patent information.

IT and/or BPO functions, this provides some evidence for my argument that SaaS may be different compared to traditional IT outsourcing in enabling IT-enabled business innovation. My argument is based on resource flexibility to support business needs rather than resource substitution. To empirically substantiate further about this position, I conducted supplementary analysis to check the association between Outsourcing Experience and IT-enabled business innovation. I ran several models to test competing arguments. Table III-3 provides results from the regression of IT-enabled Innovation on a firm's ITO and BPO experience. The 'OutsourcingExp' variable in Table III-3 corresponds to a firm engaged in ITO and BPO and is similar to the 'OutsourcingExp' variable in my original estimation. In Table III-3, Column 1 provides results of the model without interactions. As the results exhibit, the OutsourcingExp variable was found to be statistically not significant at the 5% significance level. Column 2 shows the full estimation model with interactions for testing the effect of OutsourcingExp on IT-enabled business innovation. In this model, the effect of OutsourcingExp was positive but was not statistically significant at the 5% significance level. Column 3 shows the results when I introduced SaaS variable and its interactions. As can be seen, 'OutsourcingExp' continued to be statistically not significant at 5% significance level. However, the SaaS variable and its interactions per my original estimation continued to have statistically significant effect on IT-enabled business innovation. The minor changes in significance levels can be attributed to the inclusion of interactions of OutsourcingExp with other complementarity variables.

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Table III-3: Estimation for ITO and BPO vs. IT-enabled Business Innovation

Dependent Variable = Innov; Focal Predictor = OutsourcingExp			
	Logit Model 1 (OutsourcingExp as the focal independent variable)	Logit Model 2 (OutsourcingExp and its interactions)	Logit Model 3 (Full model with OutsourcingExp and its interactions and SaaS and its interactions)
OutsourcingExp	0.20 (0.17)	0.71 (0.40)	0.60 (0.37)
ProcMaturity	-0.72**** (0.20)	0.298* (0.178)	1.02* (0.62)
ITArchFlex	0.34** (0.17)	-2.53** (1.26)	-2.69** (1.29)
OutsourcingExp x ProcMaturity		-0.03 (0.21)	-0.09 (0.22)
OutsourcingExp x ITArchFlex		0.38 (0.26)	0.27 (0.26)
SaaS			1.34**** (0.49)
SaaS x Outsourcing Exp			1.04*** (0.45)
SaaS x ProcMaturity			1.19** (0.52)
SaaS x ITArchFlex			1.61* (0.88)
FirmSize	-0.07 (0.10)	-0.21 (0.15)	-0.16 (0.15)
Newproj	0.003 (0.008)	0.01 (0.01)	0.01 (0.01)
Manufacturing	-0.22 (0.33)	-0.82 (0.50)	-0.89* (0.51)
ITSector	1.72**** (0.50)	4.88** (2.22)	4.62** (2.25)
Inverse Mills Ratio		3.41 (2.30)	3.17 (2.32)
Constant	-0.39 (0.88)	-3.14 (2.24)	-3.52 (2.26)
Log likelihood	-173.46	-170.96	-161.05
Wald Chi-square	42.89	47.90	67.71
Prob > Chi-square	0.001	0.001	0.0001
McFadden's pseudo R-square	0.1100	0.1229	0.1937
N = 288. SAAS, OutsourcingExp, ProcMaturity and ITArchFlex are mean-centered before interaction. Standard errors are in parentheses. *significant at 10%; ** significant at 5%; ***significant at 2%; ****significant at 1%			

III-9. Qualitative Study – Interviews with IT Leaders

In order to better understand my quantitative results and also learn more about how SaaS adoption is supporting IT-enabled business innovation in the firms, I conducted a qualitative study through interviews with 12 CIOs and senior IT executives in the industry. These semi structured interviews were conducted in person. I ensured the 12 CIOs and senior IT executives that I interviewed had sufficient involvement in SaaS adoption and also that they have an overview of how IT contributes to their organizational outcomes. Since SaaS adoption context may vary across companies, I allowed enough latitude for interviewees to answer questions in the way it was appropriate to their context. Prior research has shown that this method of data collection is more flexible and can be adapted to fit different scenarios (Blumberg et al. 2008; Robson 2002). The initial set of open questions and list of executive profiles covered in this qualitative study are presented in ***Appendices B and C*** respectively.

The sample included three executives from vendor organizations who were interviewed to secure an alternate perspective as well as to leverage industry knowledge they accumulated from working with multiple customers. Interviews were conducted in two waves in November 2012 and November 2013 at two leading CIO Executive Summits. Interviews lasted on average from 20 to 30 minutes. Interviewees were informed the purpose of research and were requested to share their experience from SaaS adoption, the benefits they are seeing and particularly about my main research question on whether SaaS adoption was providing them the ability to support business innovation goals of the organization.

The interviewees were first asked if they have adopted SaaS in their organization. Once they answered in affirmative, I followed with open questions to explore the benefits of SaaS adoption and particularly how it is enabling their IT goals to support business. All the interviewees answered that they are seeing new IT capabilities to support organizational innovation goals as SaaS is giving

them more flexibility. A Vice-President of IT at a major industrial gas manufacturer described, “These technologies are primarily about flexibility of resources as they are more scalable. When business needs change, we have to make changes to IT. But the procedure itself is long, very bureaucratic and we may even forego opportunities as IT cannot come up with solutions on time. With SaaS, we have the flexibility as we can procure capacity on demand.” This was supported by the CIO of a banking corporation who said, “While flexibility in resources is one advantage I am seeing, there are two other ways SaaS helps. You hear that these technologies save money. But they can enable funding innovation activities by saving dollars elsewhere. In addition, it is easy to bring in new technologies and you can pick and choose what technologies you want. Subscription is very easy. You can start using them immediately. You need not put up with legacy IT if technologies are available from outside so easily.”

One of the interviewees, the CTO of a major educational system, emphasized that they went for SaaS to try it for opportunity cost and found it to be much more rewarding than initially expected. As he said, “We started first as we did not want to lose an opportunity when all others around us were trying. We started with SaaS applications for transportation and email. Now we are using it for student administration, finance, HR and analytics. We have quick access to new technologies that allows us to stay on top of the technology curve. We are not only getting access without maintenance headaches, we are less worried about the currency and relevance of IT applications as we know that we have cutting-edge technologies all the time. Without these issues, my team and I are working on innovation opportunities in education and looking at building online learning partnerships with other educational institutions as we feel that is where education is heading and that is where my time should be spent.” A Senior Vice-President at a leading cloud-based enterprise applications vendor provided further insights from his collective experience on how some firms are using SaaS to further business goals. As this executive described, “Vanilla applications are good candidates and they can be turned on and off very quickly. There can be easy onboarding with such apps. In addition, we have seen the benefits of SaaS

quickly when there are mergers or acquisitions. Our customers could quickly bring in their merger partners onto the cloud platforms and the vanilla apps could be quickly turned on and availed by both partners in the merged entity."

In response to my question on the role of facilitating conditions in realizing benefits from SaaS, most interviewees confirmed the importance of various internal resources needed for SaaS to be a success. In particular, interviewees stressed the need for robust processes and IT architecture maturity. As the Vice-President & CIO of a Fortune 500 automotive company said, "Returns depend on where you are in your IT lifecycle. If you have a large set of legacy apps, getting them integrated with SaaS products will be problematic. Having strong internal IT maturity and IT architecture flexibility will help here. I also see that having internal business processes standardized would help in extending them into vendor organization and create seamless collaboration." This view was further supported by the VP of IT at a leading US insurance company, "If you are fit inside with good standards in your architecture, then you can easily bring in technologies from outside as long as they too follow standards. IT architecture flexibility is all about good standards. We follow latest standards and update our architectures. We are using SaaS for analytics and we could easily consolidate it with our data feeds as both talk to each other through standardized interfaces. In another case, our architecture flexibility came to the fore when we had to start a new portal for our business partners. We could hit scalable operations easily through plug and play as our architecture allowed it."

Similarly, the IT Director of a State Government organization emphasized the importance of standardized business processes and organizational learning. As he described, "There is a cost to learn about cloud and SaaS but this cost is low and it eventually comes down very quickly as dealing with vendors is not as demanding as when we were sourcing other capabilities earlier. If you have past sourcing experience, it will bring down the learning costs. You need not reinvent the wheel. Also, business processes have to be efficient to deal with the new offerings or otherwise you will face new problems than solving existing issues."

In sum, these interviews confirmed my findings that the flexibility in the organization through scalable resources as endowed by SaaS, using saved capital for pursuing innovation opportunities and access to latest technologies through SaaS is helping IT to support business innovation. The interviewees emphasized the significance of organizational complementarities in deriving value from SaaS investments. Process competence and IT architecture flexibility were emphasized to be key to work effectively with vendors and integrate their offerings into organizational processes. Further, past outsourcing experience manifests in reducing the learning curve when opting for SaaS and it quickly equips the firms to work with vendors. These responses taken together corroborate my quantitative findings on the association between SaaS adoption and IT-enabled business innovation and the supporting resources needed to enhance value.

III-10. Discussion and Implications

Table III-4 below provides a summary of my hypotheses and findings.

Table III-4: Summary of Research Findings

Summary of Research Findings		
Hypotheses		**Findings**
H1	SaaS adoption is positively associated with a firm's IT-enabled business innovation capability.	Supported
H2	Past outsourcing experience of the firm positively moderates the relationship between SaaS adoption and a firm's IT-enabled innovation capability.	Supported
H3	Higher internal IT architecture flexibility positively moderates the relationship between SaaS adoption and a firm's IT-enabled innovation capability.	Partially Supported
H4	High business process management maturity of the firm positively moderates the relationship between SaaS adoption and a firm's IT-enabled business innovation capability	Supported

With SaaS emerging as a major model of IT application delivery, the evidence of benefits from SaaS is largely anecdotal and is heavily skewed towards cost efficiencies from adoption. My goal in this research was to empirically examine the business value of SaaS and its transformation potential to support IT-enabled business innovation in the firms. I find that SaaS can in fact be associated with IT-enabled business innovation and firms are leveraging SaaS to create business advantage. With the emphasis in IT literature that IT should become an enabler of innovation and new product development capabilities (cf. Sambamurthy et al. 2003) , firms need to create flexible IT capabilities to support the changing business needs and SaaS can be a promising avenue to create such flexibility in IT.

Further, my results also indicate that firms with process capabilities endowed by a strong internal business process management maturity are more likely to see the innovation benefits upon adopting SaaS. Business processes defined per established frameworks standardize them and assist in extending the internal processes into vendor organizations and absorb vendor offerings to achieve strategic results. Further, I find that having past outsourcing experience can equip about standard processes for vendor engagement and minimize the risks in transactions, thereby allowing reusing the contextual learning and establishing faster relationships with the vendors. I find partial support for the hypothesis about the moderating role of internal IT architecture flexibility. One possible explanation may be that though flexible internal architectures are helping better integration of new technologies into the organization, firms may just be learning how to combine them to put to strategic uses like supporting business innovation. As SOA and SaaS are relatively new phenomenon, firms may be at early stages of realizing value from their co-existence. Overall, my results largely support the initial expectations and provide empirical evidence on the adoption of SaaS in supporting IT-enabled business innovation activities and how organizational complementarities can enhance the effect. The results of my supplementary quantitative analysis provide robustness to my empirical findings.

From research perspective, this study has two primary contributions among others. First, this study adds to the IT sourcing literature by investigating the business value of an emerging technology business model for IT applications delivery i.e. SaaS through associating its adoption with IT-enabled business innovation. It thus highlights one of the strategic benefits that can arise out of it. This is an important finding given that anecdotal evidence emphasizes only cost advantages from cloud-based technologies like SaaS. Ascertaining transformation potential of these technologies is important to establish credibility of an emerging phenomenon (Agarwal and Lucas 2005; World Economic Forum 2010). Second, this research explores firm-level characteristics that can augment business value in sourcing contexts (Whitaker et al. 2010; Williamson 1999). It contributes to the complementarity literature in IS research and shows how technical and organizational architectures should combine to foster business value from emerging technologies.

From the managerial perspective, my study prompts managers to think beyond cost efficiencies in SaaS adoption and explore the higher order benefits SaaS can offer (World Economic Forum, 2010). My study also highlights that managers need to pay attention to enabling conditions and organizational complementarities such as business process and IT architecture capabilities in strengthening the impact of SaaS adoption (Brynjolfsson et al. 2010). It cautions that mere adoption without complementary changes might not be sufficient to realize the true potential. These enabling conditions may be more relevant to established organizations that may have legacy in processes and technologies.

III-11. Limitations and Future Research Opportunities

This study, being one of the first to study the transformational benefits of SaaS, possesses several limitations. First, because of cross-sectional data, the findings are associational in nature and do not imply causality. Future research may use longitudinal datasets and appropriate modeling techniques to examine

causality between SaaS adoption and IT-enabled business innovation. Longitudinal data also provides insights into longer usage of SaaS which was not possible with the nature of my data. Second, my dataset comprises of large firms from the U.S. which may be more innovative than, for example, firms in other geographies. My findings may not be generalizable to other contexts though they are still assuring than anecdotal evidence. Future research may explore a mix of large and Small and Medium Enterprise (SME) firms across different geographies. Third, I use cross-sectional data to examine the role of organizational complementarities but these assets evolve overtime. Hence future research may use longitudinal data to better understand how the co-evolution of SaaS usage maturity and organizational complementary assets impact IT-enabled business innovation of the firms over time. Finally, my results are based on self-reported survey measures and even though self-reported survey measures were used in past research (e.g., Leiponen and Helfat 2010; Mithas et al. 2005), future research may use more refined objective measures (Cherian et al. 2009; Saldanha and Krishnan 2011).

Given the emerging nature of SaaS, my study also opens new avenues for future research. First, regarding the business value from SaaS, researchers can investigate the impact of SaaS adoption and usage on other forms of business value like market-centric or partner-centric capabilities that SaaS can deliver. Investigating the impact of other organizational characteristics like IT-business alignment, customer and partner relationship management etc., can be an additional area to explore. While my study focuses on the moderating role of organizational complementarities, future research may investigate the mediation mechanisms that create higher order capabilities in the SaaS context (cf. Mithas et al. 2011). Since SaaS-based product architectures are creating new models of service subscription and licensing, studying the opportunities, challenges and constraints in SaaS model/implementation vis-à-vis traditional IS product model/implementation may need more exploration.

III-12. Conclusion

With Software-as-a-Service gaining increasing acceptance as a model for software application delivery and thereby changing how IT applications are delivered and consumed, there is a research opportunity to investigate the benefits from SaaS adoption and if the benefits can be transformational contrary to mere cost advantages cited in trade literature. Anecdotal evidence highlights isolated instances of success from SaaS but is still devoid of generalizable conclusions about the benefits. My study, to the best of my knowledge, is one of the first to highlight the innovation potential in SaaS that transcends cost-efficiencies. It provides positive empirical evidence that SaaS adoption can in fact be associated with IT-enabled business innovation in the firms and suggests that necessary organizational support through organizational complementarities is vital to increase the benefit. The results of my qualitative study supplement these findings with new insights from the industry.

III-13. Appendices

III-13.1. Appendix - A: InformationWeek 500 Questionnaire Items

1. IT-enabled Business Innovation *(Innov)*

A binary variable indicating if the respondent's organization patented, trademarked, or copyrighted any IT architectures, products, services, or IT-driven business processes in the past 12 months (Yes/No).

2. Software-as-a-Service *(SAAS)*

A binary variable indicating the web technologies adopted in the organization.

- We're using software as a service

3. Outsourcing Experience *(OutsourcingExp)*

A summative index indicating the global IT strategies in place in the respondent's organization

- We do business process outsourcing with vendors outside the U.S.
- We do IT outsourcing with vendors outside the U.S.

***4.* Process Management Maturity** *(ProcMaturity)*

A summative index of the products or technologies deployed in respondent's organization:

- Modeled business processes using CASE or related tool
- Established business-process frameworks/defined processes
- Business-process-management software

***5.* IT Architecture Flexibility** *(ITArchFlex)*

A summative index based on the products or technologies deployed in the respondent's organization:

- Service-oriented architecture
- Web services (applications using Soap, UDDI, XML)

6. New IT Project Investments *(Newproj)*

Percentage of your organization's projected 2010 worldwide IT budget, including capital and operating expenses devoted to the following:

_____% Ongoing IT operations

_____% New IT project initiatives

7. Annual Revenue *(Size)*

Organization's annual revenue for its most recent fiscal or calendar year.

III-13.2. Appendix – B: Questionnaire for Qualitative Interviews

This section describes the themes explored during the interviews with IT Leaders, together with questions posed as mentioned below:

- *Adoption of SaaS:*
  - Have you adopted cloud computing technologies?

    - What cloud computing technologies among SaaS, PaaS and IaaS have you adopted?
- *Understanding the need for SaaS:*
    - Why did you adopt SaaS?
    - What capabilities were you looking for when you adopted SaaS?
    - Were these not available in-house?
- *Understanding the benefits of SaaS adoption:*
    - What benefits are you seeing from SaaS adoption?
    - The perception is that any of these cloud-based technologies are about cost efficiencies but I want to understand if you are seeing cost related benefits or if you are seeing strategic benefits beyond cost efficiencies.
    - Do you bundle SaaS along with other cloud-related technologies like IaaS and see the entire bundle as giving only cost-related benefits?
    - Are you seeing any strategic benefits from SaaS adoption? Do you think SaaS can provide strategic and innovation-oriented benefits?
    - How do you think SaaS can deliver strategic benefits?
- *Understanding the facilitating conditions:*
    - What factors are affecting value enhancement from SaaS adoption?
    - Do you think IT Architecture Flexibility helps in value creation from SaaS? What should the firms possess in terms of IT Architecture Flexibility?
    - Do you think business process management maturity helps in value creation from SaaS? What should the firms possess in terms of process management capabilities?
    - Does prior experience with external sourcing help?
    - Do you think the lack of these capabilities hinder the benefits to you and to your organization?
    - Do you think SaaS is a different type of sourcing in comparison to your earlier methods of sourcing like IT outsourcing?
    - What other technical and organizational/social factors do you think will affect deriving value from SaaS?

III-13.3. Appendix – C: Profiles of Interviewees

Table III-5 below provides an overview of the profiles of the IT leaders interviewed for my qualitative study and their organizations.

Table III-5: Profiles of the IT Leaders Interviewed

#	Designation	Organization Profile
1	Vice-President & Chief Information Officer	Fortune 500 Global Automotive Components Supplier
2	Director, Business Application Services	Government - Economic Development Corporation of a US state
3	Senior Vice-President of Global Strategy	Fortune 1000 IT vendor
4	Vice-President of IT	A leading Insurance Company in the United States
5	Chief Technology Officer	State Government - Education Achievement Authority
6	Senior Executive - Technology	Fortune 500 IT services organization
7	Senior Vice-President, IT	A global aviation company
8	Senior Vice-President	A global SaaS-based ERP vendor
9	Vice-President, IT	A major Midwest US utility company
10	Chief Information Officer	A regional bank in the US
11	Assistant Vice-President, IT (automotive applications)	A global IT consulting firm
12	Vice-President, IT	A leading industrial gas manufacturer in the US

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Chapter IV. Organizing to Compete in the Cloud Computing Market – A Revelatory Case Study of a Vendor Organization

IV-1. Introduction

Organizations continually reorient themselves to adapt and survive in the midst of changes in the external environment (Nystrom and Starbuck 1981). In the recent past, IT organizations have been transforming recognizing that the nature of businesses are changing and that new technologies are rapidly evolving (Rockart et al. 1996; Ross et al. 1996). Seeking efficiency, cost savings and tangible benefits were a frequent driver during organizational transformations. However, the recent emphasis for change has shifted to developing and using IT systems that offer competitive advantage to the firms (McFarlan 1984; Sambamurthy et al. 2003; Vaast and Levina 2006).

In this context, understanding the changes in the process models for information systems development during designing new products is an important dimension in examining organizational reorientation (Carmel and Becker 1995). However, several IT projects that were initiated subscribing to standard technical methodologies have failed. The dominant diagnosis of the failure was that systems development was frequently considered as an engineering problem, technical methodologies may be apt only for software engineering and systems programming and that the larger organizational context may impact IT project success. Relatedly, organizational factors were highlighted as being more important and needing consideration in the success of IT projects (Avison and Fitzgerald 1995). IS development during new product design has to consider a much bigger organizational change rather than merely confined to monitoring the technology aspects and there is a need to understand organizational

reorientation from both the technical and business perspectives (Klein and Hirschheim 1987; Vaast and Levina 2006).

With the cloud computing phenomenon gaining traction as a new model for IT capability delivery, anecdotal evidence suggests several benefits accruing to the adopters. Further, it was argued that the promise of cloud computing is to democratize access to IT capabilities as it dramatically reduces the upfront costs of computing that deter many organizations from using many cutting-edge IT products (Staten 2009; World Economic Forum 2010). The emerging research in this subject area has focused on the customer organizations, factors influencing adoption and the benefits that the customers are availing from using cloud-based services. The inherent characteristics of this model in enabling centralization of resources by pooling them, scalable IT capacity on demand, pay-per-use pricing structures and ubiquitous access suggest that there will be significant implications even for the vendors (Armbrust et al. 2009)[26]. However, limited research exists to my knowledge on the impact of cloud computing models on vendor organizations and in particular on how the structures and processes within the vendor organizations need to be revised to deliver per the architecture of this model. Gaining insights into vendor business model and what capabilities the vendors need to create when moving to cloud-based business models is important to contrast and compare it with earlier IT service delivery models. This is because past attempts to deliver software over the internet under the Application Service Provider (ASP) model did not meet customer expectations as the vendors could not reorient themselves to create value (Susarla et al. 2003). Among other commonly cited reasons for the failure of the ASP model were the concerns about data security, systems availability and service reliability etc., which were widely expressed even with cloud-based models (Campbell-Kelly 2009).

[26] ***Appendix A*** provides detailed explanation of these four defining attributes of cloud computing. I thank Dr. M.S. Krishnan and Dr. Nigel Melville for motivating this discussion.

In this context, as firms attempt to remap offerings and rethink strategies and structures to transition to service management as in cloud computing, there is a need to develop new functional perspectives on the dynamics of newer service models relative to traditional service models (Rai and Sambamurthy 2006). Relatedly, I ask two overarching questions to guide my examination. First, what are the implications of cloud computing architectures from the vendor perspective? How are the dynamics of IT systems development and IT systems delivery shifting i.e. how is the structure of product design, development is and delivery changing in the context of developing cloud computing based products? Second, what supporting changes in business functions are needed to reorient the business model to tap the cloud-based market?

Based on my literature review, I develop a framework of generalizable factors related to the organizational functions and the associated resources that need consideration during reorganization. I apply the framework in the packaged software i.e. Enterprise Resource Planning (ERP) context to examine how various functions are changing between traditional and cloud-based product contexts and how resources should be reconfigured relatedly. In the context of this framework, I interpret my findings through the lens of dynamic capability theory to investigate the resources needed for regular product development and its implementation and the dynamic capabilities needed to manage the transition to serve new markets through SaaS-based products and their implementation[27]. Dynamic capability refers to the ability of a firm to renew itself in the face of a changing environment (Teece et al. 1997) by changing its set of resources (Eisenhardt and Martin 2000). The term 'dynamic' refers to the renewal of resources and competences to address changing environments. Dynamic capability theory states that some firms thrive in the face of environmental changes because they have the ability to change their resources (Teece et al. 1997; Eisenhardt and Martin 2000). Changes in a firm's set of resources can be achieved by: creating, extending and modifying (Helfat et al. 2007). Here a

[27] I thank Dr. M.S. Krishnan and Nigel Melville for guidance on this perspective.

resource is defined as a tangible or intangible asset that the firm owns, controls, or has access to and from which it potentially derives rents (Helfat and Peteraf 2003). Some resources are fungible, that is, amenable to multiple applications (Teece 1982). For example, resources embedded in products such as brand, knowledge and technologies may be leveraged by applying them to other products. However, resources vary in the extent to which they are product-specific versus fungible, and hence can be leveraged only to a varying extent (Danneels 2002; 2007). I intertwine dynamic capability theory into my findings to explain how a firm had changed its organizational functions and how it revised its resource base i.e. created, extended and modified its resources to effect change.

Given the lack of prior research, I conducted a revelatory case study of organizational reorientation to examine my questions in the context of a leading global Enterprise Resourcing Planning (ERP) products and services company, hereafter referred to as ERPCo. ERPCo is delivering ERP software under traditional on-premise and newer cloud computing based Software-as-a-Service (SaaS) business models. I focus on ERPCo as this firm is providing ERP software under the SaaS model and is growing its customer base among small and medium businesses (SMB), in line with the propositions that cloud computing can provide access to capital-intensive technologies like ERP that were hitherto accessible and affordable only for large firms (World Economic Forum 2010). With ERP products and their implementations historically entailing elaborate product design with end-to-end business processes of large organizations in mind and large-scale systems development and implementation efforts (cf. Davenport 2000), ERPCo provides a unique context to systematically examine a very comprehensive set of organizational functions, resources and their dynamics when cloud computing was envisioned to effect change on all of these fronts.

My findings suggest that vendors' product design for cloud-based markets is characterized by focusing on only delivering generalizable functionality as the vendors have to hinge on rendering the functionality through a single instance.

Product development is organized in short cycles of iterative development to reduce time-to-market and to deliver the features instantly as enabled by the cloud model. Implementations are much shorter compared to traditional ERP and post-implementation maintenance and support are entirely handled by the vendors. Vendors need new capabilities for infrastructure management but these come with significant challenges unseen in traditional product-based scenario. Further, firms need to develop new knowledge about target customers and revise their marketing function to gain access to these customers. The characteristics of the target market imply that simplified relationship management and contract management are needed to develop scale in this model. In addition, while the capabilities I studied were largely from the vendor perspective, my analysis provides additional insights that there are certain customer-related capabilities as well which I will explain in the findings sections.

This study contributes by providing empirical evidence through case study research, the changes in the organizational functions of a vendor organization in the cloud computing context. Further, it explores the processes through which resources were altered to create a dynamic capability in the vendor organization to capitalize on the opportunities from cloud computing. It highlights the role of fungibility in resources and the ability to create new competences in supporting dynamic capability creation and mitigating organizational rigidities. Finally, this study contributes to product-service innovation research by emphasizing the role of complementary competences in effectively governing the technology-customer linkage which was determined in past research to be crucial for product innovation.

The rest of the paper is organized as follows. In the next section, I review the literature on cloud computing and Enterprise Resource Planning and develop a framework of factors that provided guidance for my revelatory case. Then I will provide an overview of the vendor organization, site selection criteria and data collection procedures. The next sections describe my findings in relation to the technical and organizational resources that were created, modified and extended

to manage transition to the cloud-based model. I conclude with a discussion of my findings, their contribution, limitations and suggestions for future research.

IV-2. Literature Review[28]

IV-2.1. Literature on Cloud Computing

With cloud computing being an emerging phenomenon, there is limited academic research in this area, to my knowledge. The existing literature has attempted to improve our collective understanding on the concepts and opportunities around cloud computing adoption and largely focused on benefits to customers. Marston et al. (2011) provided theoretical arguments about the IT efficiencies and business agility benefits from cloud computing. Their core argument was that cloud computing is a convergence of two trends – IT efficiency and business agility, wherein IT efficiency is enhanced when the power of computers is utilized more efficiently through highly scalable hardware and software resources, while the rapid deployment, parallel processing and real-time response of IT resources can drive agility. With no up-front capital investment, immediate access to IT resources can be procured and it would make easier for enterprises to scale resources on demand. Another advantage cited was that cloud computing would reduce the barriers to innovation and would lower the cost of entry for smaller firms to access new functionality which was hitherto available only for large enterprises. McAfee (2011) suggested through his conceptual work that cloud computing adoption can free-up the time of IT departments as the firms can get access to latest technologies from cloud based deployments and the internal IT departments need not spend time on reposing older technology for modern use (McAfee 2011: 4). He explained that this will be useful to improve the productivity of already stretched IT departments (McAfee 2011: 5).

[28] The literature review was abridged only to explain the relevant past research and the research opportunities pertinent to my study.

Regarding the strategic benefits of cloud computing, Aral et al. (2010) found from qualitative evidence that cloud computing can create value but the value is contingent on cultivating complementary capabilities including standardized infrastructure, data management and business processes. They further found that firms with strong IT-Business partnership and firms that excel at managing external vendors maximize value from cloud computing. Brynjolfsson et al. (2010) cautioned against replacing existing IT resources with cloud-based resources and suggested that complementary investments in process and organizational changes should accompany the adoption. Choudhary (2007) analytically modeled the impact of cloud based SaaS licensing models on the publisher's incentive to invest in software quality. By comparing SaaS licensing model with perpetual licensing, the author suggested that firms will invest more in product development in SaaS business model and this increased investment leads to innovation, higher software quality and higher profits. Koehler et al. (2010) provided empirical evidence about the consumer preferences for different service attributes in cloud computing. They found that the reputation of the cloud provider and the use of standard data formats are more important for customers rather than cost reductions when choosing a cloud provider.

In sum, while most of the existing research adopts the perspective of the customer, there is scant empirical research to explore cloud computing from the vendor standpoint. There needs to be an improved understanding on how vendors can structure their internal functions to successfully deliver cloud-based services to clients and foster customer satisfaction. This is important when past research has suggested that vendors in the ASP model could not reorient themselves to create value promised by the ASP model (Susarla et al. 2003).

IV-2.2. Literature on Enterprise Resource Planning

Enterprise resource planning (ERP) applications were one of the fastest growing and most profitable areas of the software industry during the late 1990s (Sprott 2000). ERP applications are expensive large commercial software

packages that promise seamless integration of information flows throughout an organization, by combining various sources of information into a single software application and a single database. By integrating the various aspects of the organization and streamlining the data flows, they overcome the fragmentation problems of legacy systems (Davenport 1998). Being packaged software, ERP is designed with large organizations in mind and is claimed to incorporate best business practices (Gattiker and Goodhue 2000).

ERP implementation involves a complex transition from legacy information systems and business processes to an integrated IT infrastructure and common business process throughout the organization (Davenport 2000). Implementing ERP systems is not as much a technological exercise as it is an organizational revolution (Bingi et al. 1999; West and Shields 1998). It involves a mix of business process change and software configuration to align the software with the business processes (Gibson et al. 1999; Holland and Light 1999). It requires standardization of data and transformation of business processes across an organization to enable integration (Gattiker and Goodhue 2000). Although ERP systems are customizable, they are difficult and costly to adapt to unique organizational procedures. Often an organization's business processes must be modified to fit the system. Reengineering existing business processes is a critical implementation concern and a key antecedent of ERP implementation (Bingi et al. 1999). Further, ERP systems depend on sophisticated IT infrastructure and supporting the application with adequate IT infrastructure, hardware and networking are crucial for an ERP system's success (Gupta 2000). Success of the implementation also depends on training and updating employees on ERP and lack of training is a major challenge during the implementation phase (Verville and Halingten 2003). Also, ERP installations entail high maintenance costs and the implementation concerns do not end once the system becomes operational (Davenport 1998). The users need on-going support and organizations face a variety of issues such as fixing problems, upgrading to new versions of the software, and managing organizational performance which require significant financial investments (Nah et al. 2001).

In sum, the above review suggests that ERP implementation projects are expensive projects entailing high product procurement and implementation costs, they need sophisticated internal IT infrastructure for effective implementation and they require extensive pre-implementation effort towards standardizing data and transforming the business processes. Customization tasks are difficult and costly and firms need ongoing support in the post-implementation phase which is often taken up as a separate project.

Synthesizing the literature suggests that there is limited exploration into the vendor organizations in the cloud context and scant empirical research exists about the changes affected in the vendor organizations to promote products and services to serve cloud-based markets. Further, the ERP literature suggests the role of packaged software design and development, implementation intensity, post-implementation demands, internal IT sophistication and business process reengineering etc., which can provide factors to create a rich framework that can be adapted and investigated in the cloud-based ERP context. Put differently, an investigation into the activities of an organization that is developing and delivering ERP products can provide rich insights into how an expensive proposition like ERP might change in its development and implementation when it has to be reoriented to serve cloud-based markets.

IV-3. Conceptual Framework for Examination

My literature review about ERP systems provides inputs that ERP system implementations depict a rich context of activities related to product development through implementation. These systems entail designing end-to-end functionality of business processes into the product. They require long cycles of product development that the products are launched in versions that decommission earlier versions. Further, the costs of product selling and implementation imply sales targeted towards large enterprises, extensive process redesign activities before implementation, heavy customization of functionality

and an intense change request process during implementation. Post-implementation support itself is taken up as a separate project. Given this intensity around ERP, the emergence of cloud computing promises that technologies like ERP can be accessible by smaller companies which hitherto could not access due to the expense of implementation. Further, customers do not need to maintain internal IT infrastructure and vendors will handle the implementation and support process for customers per the cloud model. Relatedly, given the scope of factors in ERP product development and implementation, it might provide interesting insights if the same set of factors can be examined in the context of cloud-based ERP development and implementation. Hence I create a framework of factors based on my literature review of ERP and examine how they are affected by the cloud-based architectures. Figure IV-1 below provides an overview of the framework. My belief in the comprehensiveness of the framework stems from the fact that packaged software provides a richer set of factors compared to standalone software context and with each of these factors believed to be affected by cloud computing, my examination will be thorough.

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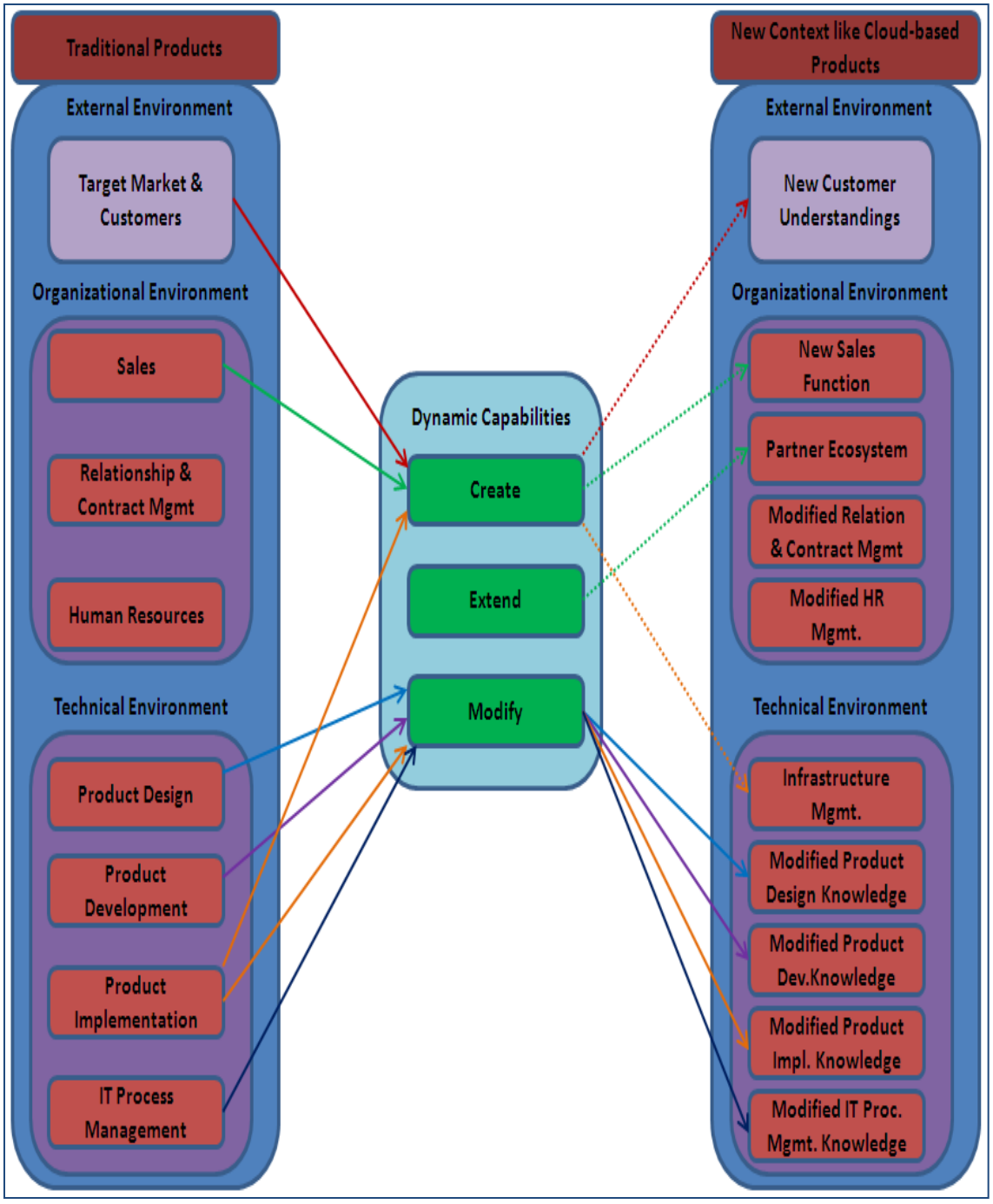

Figure IV-1: Conceptual Framework for Examination

Note: In the above diagram, different colored arrows were used to indicate similar resources and their transition. For example, a green colored arrow emerges from sales function and it needs creation of a new sales function as well as a partner ecosystem to reach out to new markets.

IV-4. Research Methodology

Given the lack of prior research, I conduct a revelatory case study of technological and organizational redesign at ERPCo, a leading ERP vendor offering traditional ERP and Software-as-a-Service (SaaS) based ERP products. The case study method is preferred *"when 'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context"* (Yin 2009). The case study is appropriate when few prior studies have been carried out and when it is used for "sticky, practice-based problems" (Benbasat et al. 1987). In addition, a revelatory single-case is apt when there is an opportunity to observe and analyze a phenomenon previously inaccessible to scientific inquiry and hence is worth pursuing as the descriptive information in the case by itself will be revelatory (Yin 2009: 49). Further, while past case study research of organizational design in IT organizations has mostly focused on post-hoc analyses of results from organizational transformation (Brown 1999; Cross et al. 1997), observing organizational reorientations in progress can be much more educative to learn about the dynamics of change (Pettigrew 1990; Vaast and Levina 2006). In this study, I used this approach to collect data about organizational reorientation at ERPCo, an organization redesigning itself to capture and sustain market share in the emerging cloud-based SaaS market. My goal is to understand how the technical functions and the business organization supporting the organizational vision have changed and evolved as the firm has redesigned its product offerings to tap an emerging market for its ERP products per the SaaS model.

IV-4.1. Overview of ERPCo

ERPCo is a software products and IT services company focusing on ERP products and is part of a $1.2bn business conglomerate. Founded in late 1980s and with offices in 21 global locations, ERPCo is a vendor of IT products and platforms and Business Process Outsourcing (BPO) services to customers across

the world. ERPCo is assessed for ISO 9001:2008, ISO 27001:2005 information security standards and for SEI CMMi Dev 1.3 at Maturity Level 3 for its internal IT processes for developing products and services. ERPCo's customers include GE, FedEx, KPMG, Dell, Lubrizol, Emirates and Henkel etc. ERPCo started as a traditional Enterprise Resource Planning (ERP) vendor and had more than 800 installations of its ERP products globally through an ERP Suite covering an entire gamut of organizational business processes. In 2005, ERPCo's Senior Management mandated developing ERP applications on the cloud to be accessible for SMBs worldwide under the SaaS model. The firm envisioned to develop a product that would serve SMBs primarily but also suitable for large enterprises eventually. Accordingly, it launched individual modules of functionality beginning in 2005 and the full-fledged cloud-based ERP product was launched in 2008, which is hereafter referred to as SaaS-ERP. SAAS-ERP covers the entire spectrum of enterprise functions through a suite of products for Manufacturing, Financial Management, Supply Chain Management (SCM), Human Capital Management (HCM), Customer Relationship Management (CRM), Enterprise Asset Management (EAM), Project Management and Process Control etc. The portfolio was extended to include a Business Analytics suite of products and suite of products targeted towards specific industry verticals. SAAS-ERP is one of the first cloud-based ERP solutions and gained a user base of more than 300 customers with 10000+ active user licenses at the time of this study.

ERPCo's products were historically built on the internally developed service-oriented architecture (SOA) based technology platform (referred hereafter as SOA-Platform) that runs on a model-driven architecture to integrate software delivery with business process visibility through assembly of business components. SOA-Platform provides guidance on the development methodology wherein business components that make a business process are identified and developers can give specifications of the complete application as a model in a structured form. The code generators in the SOA-Platform interpret the model and generate the code based on the model specification. There is a clear translation from model specification to code generation, thereby minimizing

human/programming errors. ERPCo uses the SOA-Platform to develop internal products and has recently extended the SOA-Platform to create a new platform named SOA-BIPlatform that automates the development of products in the Business Intelligence (BI) domain. SOA-Platform and BISOA-Platform simplify the whole cycle of software development wherein new features can be churned out quickly by creating and assembling business components that make up the required functionality.

IV-4.2. Site Selection

I used four selection criteria for my research setting, all of which were satisfied by ERPCo. I needed a site where (1) the vendor provided extensive access to individuals at multiple levels who could describe management practices and how they deliver the services (2) the vendor has developed strong capabilities in delivering cloud-based IT products and services, thereby giving an opportunity to observe revelatory phenomenon. In my case, ERPCo has gained years of experience as well as a large customer base to demonstrate critical mass (3) the vendor delivering high-end applications under the cloud-based model as industry evidence claims that cloud computing can democratize access to make capital intensive applications like ERP accessible even to small businesses. In addition, I sought to examine a vendor with established global market presence for cloud-based services including in developing nations for the same reason of democratization of IT capability access (4) A vendor where old and new business models co-exist so that appropriate comparisons can be drawn to understand the technology and organizational redesign needed to suit the evolving cloud-based business model. In addition, I seek to examine a firm where large scale IT applications are delivered under the traditional business model while the firm had to reorient its product development, delivery and support functions to deliver near-similar functionality under the cloud-based business model. The research method did not require multiple sites except interviewing multiple stakeholders including business partners and customers. However, replicating my study to

contrast or compare it with vendors of other types of applications or other types of cloud computing services would provide further insights.

IV-4.3. Data Collection

Data collection was driven by a developed case protocol that included my research objective, areas of inquiry, data types and interview questions. ***Appendix B*** provides an overview of my interview guide. As a preparation to the project, extensive literature review was conducted to develop a deep understanding of the cloud computing phenomenon and comparing it with earlier IT phenomenon. I identified various factors that can drive adoption in cloud computing and understood the characteristics of vendors and customers in general IT adoption context to develop comparative understanding. The goal of this exercise was to identify relevant questions informed by literature to be examined in the field study phase of the study.

Data Collection was conducted in 2012 to understand the nuances of the SaaS business model, ERPCo's technical and business approach to enter the SaaS market, an understanding of the customer organizations and the benefits expectations of the customers. In this phase, I conducted one to three rounds of in-depth interviews with various stakeholders at ERPCo and one wave of interviews with ERPCo's partner and customer organizations. ***Appendix C*** provides an overview of the interviewee profiles and the duration of interviewing. Semi-structured interviews were conducted resulting in nearly 50 hours of interviewing and a total of more than 150 pages of transcribed data. Questions were open-ended and focused on five key areas: What was new to the organization about cloud-based systems development and delivery? How was it different from traditional systems development and delivery? What organizational functions were involved in product development and customer/partner engagement? How did these organizational functions help

ERPCo in general in product development and customer/partner engagement? How did these organizational functions reorient to serve cloud-based market?

I allowed enough latitude for interviewees to answer questions in the way it was appropriate to their context. Prior research has shown that this method of data collection is more flexible and can be adapted to fit different scenarios (Blumberg et al. 2008). I also reviewed internal documents from ERPCo related to product description, internal processes and customer case studies. In addition, I collected archival data from various sources related to press releases, product comparisons and market information related to architecture evolution, ERP evolution, ERPCo's products and ERPCo's competition.

The collected data were examined and analyzed guided by the logic of constant comparative analysis to identify preliminary concepts, to link the evolving set of concepts to higher level categories and then identify the linkages among the categories as appropriate (Charmaz 2000; Sarker and Sarker 2009). Implicitly, the constant comparative process involved data triangulation across respondents, different business functions and different levels (cf. Patton 1990). I conducted a careful reading of all the interview transcripts and other documentary evidence to develop a high level understanding of the potential categories and patterns. The transcripts were read again carefully to determine and code based on emergent categories according to an inductive process ((Melville and Whisnant 2012; Yin 2009). Further, text for each instance of a category was collated and placed into a table to consolidate the set of categories emergent from my analysis. At the end of this process, categories that were related were combined, and categories themselves were further refined. Documenting the findings and analyzing them provided insights into SAAS-ERP development and implementation and assisted in drawing comparisons with the activities in the traditional ERP domain. ***Appendix D*** provides details about the methodological approach adopted towards data collection and analysis as informed by past research.

IV-5. Findings

The history of ERPCo shows that the firm could successfully create initial traction in the cloud-based ERP market. ERPCo was able to enter a viable new product domain and fostered a new service model enabled by a new set of resources (cf. Floyd and Lane 2000). The findings section is organized according to the various modes by which a firm's extant resource base can be changed: creating new resources, extending through external resources and modifying existing resources (cf. Helfat et al. 2007). The explanation intertwines the changes in business functions which necessitated resource alterations. ***Appendix E*** provides a summary of the findings.

IV-5.1. Creating new resources

In the absence of existing resources to modify and reuse, creating new resources might alter the resource base of the firm and this capacity of the firm to purposefully create new resources is a dynamic capability (Helfat et al. 2007).The bundles of new resources created form a new competence and provide the firm the ability to accomplish new tasks (Grant 1991; Helfat and Peteraf 2003). However, firms need a higher order competence to develop the new competences constituted by a set of new resources. The ability of a firm to build new competences has been suggested as a second-order competence (cf. Danneels 2002) and is the competence at adding new competences i.e. a competence at explorative learning (Collis 1994; Danneels 2008; Levinthal and March 1993; March 1991). For example, while a firm has a customer competence i.e. knowledge about existing customers, developing a second-order customer competence provides the firm the competence to develop customer competence in new markets i.e. understanding about new customers in new markets and developing new knowledge about them.

My findings suggest that ERPCo created new resources in terms of (1) developing customer knowledge/market knowledge about a new set of customers

related to the cloud model (2) new IT resources towards hosting and infrastructure management and (3) a new marketing function to reach out to customers and partners. Collectively, these signify a new customer competence, technology competence and marketing competence respectively.

IV-5.1.1. Creating customer knowledge

One of the promises of cloud computing is the democratic access to IT capabilities and cloud computing enables vendor organizations to create dynamic capabilities in IT service delivery to serve the needs of even smaller organizations. But this requires developing knowledge about what those customer needs are. Developing customer knowledge gives the firm the ability to serve certain customers. Customer knowledge reflects an integrated mental model of customer's identity, needs, lifestyles and purchasing behaviors (Danneels 2003). Customer knowledge pertains to developing knowledge of customer needs and their preferences and purchasing procedures. It also includes developing appropriate communication channels for exchange of information between the firm and customers during development and commercialization of the product. Hence it is a resource that a firm can draw upon to position itself in target markets.

ERPCo's traditional ERP customers were large enterprises and understanding how ERP satisfied them was product-specific. This was inadequate to develop an understanding of the prospective customers in the cloud-based ERP market where customers can be both small and large firms. Hence ERPCo had to develop an understanding of (i) potential uses of the application in this market, (ii) modules and their logical sequencing that may address the customer business problems and (iii) typical profiles of the end users in customer organizations.

First, ERPCo had to develop an understanding of the potential uses of SAAS-ERP. As the SAAS-ERP had to be hosted as a single-instance as well as there is less scope for customization, ERPCo had to determine what generalizable functionality in the application could serve a community of customers. Understanding common business processes in target businesses and issues faced in those processes became important to determine what functionality should be included in the product to satisfy this customer base with a robust ERP product.

"We accumulated deep expertise in several domains with our traditional ERP. But the goal of the new product is to give an integrated ERP to firms which did not have one or could not afford one. Hosting a single instance implied we could not give everything but we did not want to give a light ERP. We wanted to give a full-fledged ERP in a feasible way which can even be subscribed by large enterprises eventually. Hence we decided to understand and tap on the typical workflows and common problems in any business." [Vice-President & Chief Architect, SAAS-ERP]

"Sales cycle or purchase cycle will have some workflow and we knew what it was in large companies from our history. We went after several SMBs to see what their sales cycle is, what the common steps in their sales cycle are and what the typical efficiency of a sales cycle is. We looked at issues they were facing – visibility of orders, inventory, cash flows and sales commitments etc. We filtered the variations and came up with an understanding of common business process activities." [Senior Manager, SAAS-ERP Product Development]

Second, ERPCo also had to decide the sequence of creating modules and including them in the product. It understood that customers first looked at the sales cycle and a related functionality to take care of associated revenue flows. Then they looked at procurement cycle as the next priority. Costing was typically the least preferred as only large firms needed it as a separate business function.

"We created a grouping by building market understanding and comparing with our traditional ERP experience. The goal was to capture a small market and then move on. We started with 'order to cash' process – only the sales cycle as we understood that any firm will have this process. Then we brought in 'procurement to pay' function as firms were looking for sales and procurement as a minimal combination needed to run business. Later we found that firms

needed modules for HR, accounting and service management etc. In some cases, for example, once we had service management module, we determined that warranty management module will be a sensible follow-up to service management. What we created sequentially were modules in their own right to run any business yet these fit to create an integrated system. We went by the market need but did not lose focus of an integrated ERP" [Senior Manager, SAAS-ERP Product Development]

"Discrete manufacturing and trading business were what we defined as the first market for 'order to cash' and 'procure to pay' functions. ERPCo is very familiar with these businesses from our ERP as ERP concept has its roots in manufacturing. Then we went into leather industry which is a variant of manufacturing. This way we slowly graduated to general operations." [Executive Vice-President, Marketing]

Third, ERPCo found that most of these customers were using some kind of standalone software till then and the existing systems were not supporting their organizational growth. In addition, most of these firms had no IT departments and were looking at using solutions in a cost effective way without hiring new resources. Several constraints were noted within these firms including ad-hoc processes and data collection procedures, lack of IT expertise and IT assets etc. which helped to define ERPCo's product and marketing strategy.

"Our traditional ERP is for higher-end markets and we had to design a product for SMB based on who is using it and how they are using it. They were mostly first time ERP adopters using some standalone software for functions like finance. We had to understand how people were using those solutions, what was driving to use them and how we can fit in with an end-to-end solution. We also had to see what data they wanted to analyze and how to present it intuitively. The user community had taken the lead to drive our product evolution. We determined that this market needed a system where basic information can be got without much fuss." [General Manager, SaaS-ERP Sales]

"These were firms with no or small IT departments and lacked skilled manpower to implement or use an ERP. They work based on loyal people and they do not have aligned departments to run business. They were looking for some system to streamline processes, integrate information and have control. They have an IT savvy management but management has no visibility into information. Everything is ad-hoc. They keep records manually or by using

excel sheets. They don't have authenticated data to adopt an ERP class solution. Also, one resource can don multiple roles and raise sales orders, invoices etc. They want high level of automation as there were not many employees in the organization. They wanted to automate bank reconciliation, export order balancing, production scheduling etc. to make them efficient. We would be off without understanding them. [Chief Operating Officer, ERPCo]

"Many customers we surveyed loved cost efficiency and total cost of ownership story. Management saw the potential to bring in order and control in the company. In fact, one executive said he wanted visibility into operations across multiple locations and alerted about IT expertise in his company. He wanted to establish processes and control without investing in capital expenses. Understanding these kinds of customers helped to size our expectations. We felt that the product should be designed needing our customers to be good in excel and a little basics of computer operations. We would train them on our screen navigations and workflows. We needed one person with technical knowledge who can do the settings or troubleshooting from a document we send him or over the phone. This should be all we can assume on our customer end." [Senior Manager, SAAS-ERP Implementation]

In sum, entry into cloud market required developing a different understanding of the customers from what ERPCo had accumulated over the years. ERPCo's knowledge of traditional ERP market was product-specific as those customers were large and the way ERP was implemented and used in those organizations differed from what it was in the target market for cloud ERP. Even though the product was still an ERP in essence, ERPCo needed different market-related knowledge to serve the prospective customers. Hence ERPCo had exercised a second-order customer competence to develop an in-depth understanding of its customers and what they would look for in a prospective solution. This helped to create products that emphasized on usability to match organizational needs and skill levels in the target market. From the customer perspective, my findings suggest that customers may not possess advanced capabilities in internal IT systems and processes i.e. they lack required IT capabilities and IT skills and run business through ad-hoc processes which means that they need solutions which thrive on simplicity and they rely on vendor support for continued usage.

IV-5.1.2. Creating a new marketing function

When creating a new business model for cloud, ERPCo exercised second-order marketing competence, that is, it built market related resources to enter new markets. ERPCo entered the cloud computing market in 2008 when cloud computing was still nascent and a market for cloud-based products was not mature. ERPCo had to leverage the new customer understanding it developed to create a sales function to sense, evaluate and define the prospects in the market. ERPCo determined that SMBs may be a lucrative target for its new products; given that cloud computing enabled hosting a single instance to several customers and allowed making the pursuit technically and economically feasible. Within this target market of SMBs, there was a widespread myth that ERP implementations needed high investment. SMB market was heavily relying till then on point solutions for functions like financial management.

"We had to create the market itself when no need was felt by the market or the customers themselves. We wanted to target SMB segment with SAAS-ERP and the market believed that ERP is capital-intensive. We converted the first mover advantage into highest market share with more than 300 customers and a 100% year-on-year growth by 2012 but the company had to work hard to create our position. We had to educate the market. Now we are trying to extend the acceptance from tail-end to high-end and even large companies are coming to us." [Executive Vice-President, Marketing]

ERPCo also faced several challenges while positioning its product. It had to develop an understanding of the market needs, create new benchmarks and specifically understand what people may look for in the product and how they may use the product. To accommodate these special needs i.e. to simultaneously develop an understanding of the market as well as creating apt products, the marketing team and the product development team worked together with back and forth feedback loops.

"Conventionally, we were a player in the ERP market and we could look at other ERP vendors like SAP or Oracle to see what they are delivering, their customer profiles and whether our product would suit the needs of similar

customers. With SAAS-ERP, we did not have a benchmark. That was one challenge. Second, our traditional ERP product was a huge product and we had to design a new product for SMB based on how people may use it. We were clear not to be inward looking and felt that we should sell what the market needs." [General Manager, SAAS-ERP Sales]

"We cannot give a rich product as a traditional ERP and cannot customize it to the extent of an ERP. We had to host varied customers within one instance. Hence we surveyed the market to tap on the general factors of business. We looked at what the typical processes like order-to-cash were, which will be a process in any business. Second, we had to understand who the typical users are and our guess was they will not be technically-savvy as these are small firms. We had to understand how they will use the system and how to make it simple. Third, the goal of cloud-ERP should be to enable it for Do-It-Yourself mode to keep the support costs low for us and for our customers. Given these dynamics, the product should continually evolve and selling such a product does not happen unless the sales and the product development teams are in sync. Hence right from the beginning, I was accompanied by the Head of Marketing whenever we visited companies to understand them. It is not like the sales teams sense the market and the product teams deliver in the back-end. We both should sense and the sales team should know what is coming per what the market needs [Vice-President & Chief Architect, SAAS-ERP]

"As we were accelerating on cloud, the product churn out was faster. Within a module, the features were being unveiled faster. Hence there had to be constant learning for the marketing teams on what our products can do on this day. The development team had a product plan and they tell us when something is released. Similarly, as we were the ones who were in touch with the market, we document everything in the CRM. There were certain cases where customers may have unique requirements but the goal is to sell what we have as we cannot accommodate changes on a customer basis. If something is insisted by several customers, we have to discuss with the product team if it is feasible, if this is coming in the future and if the product development team can add it to the enhancement list. As we engage with the user community who are our ultimate product designers, there is a lot of collaboration between our internal product development team and sales teams." [Senior Manager, Marketing]

Further, to penetrate quickly into the market, ERPCo had to design marketing plans per the distinguishing features of the target markets and ensure that its products reached the target market quickly. ERPCo created a multi-

pronged approach to advertise and sell the product. First, as the entry and exit criteria were much easier in cloud computing, ERPCo offered the product for trial by a few customers to make inroads into the market. This became crucial to build live references from satisfied customers which ERPCo could leverage for educating prospective customers. Second, ERPCo understood that unlike in traditional ERP where the sale was to the CIO and their IT departments, the sale in SAAS-ERP market was directly to the business and the business people. Further, the value proposition used for selling also changed. It moved away from IT-based selling to business performance improvement based selling. This was a big change to the nature of business engagement and how the sales people had to be trained to sell per this dynamic. Hence, at the operational level, ERPCo laid out a new sales and marketing plan for increasing brand visibility and for channel building.

"We sold to a few customers to try us for 1 year and see if it works. Most of them stuck with us. A few customers dropped but it was because even a cloud-based ERP was too much for them. It was helpful as we gained initial traction, refine the product from their experience and got word of mouth." [General Manager, SAAS-ERP Sales]

"We were selling our traditional ERP to large customers and this needed no advertising as such because the product had to compete and sell itself. Selling happens through corporate presentations and discussions at the Executive level. In cloud market, we had to advertise as if we are in retail industry as the customers were small firms and can be anywhere." [PR Analyst, Marketing]

ERPCo engaged in corporate marketing and field-based marketing to increase the visibility for SAAS-ERP. For corporate marketing, ERPCo created a separate sub-unit to contact prospective customers by telesales and sending email based corporate materials describing SAAS-ERP's features, advantages and success stories. Telesales were based on calling prospective customers using databases created by profiling the target market. ERPCo's sales teams had to create new databases comprising of the target market of SMBs. For example, to target the automobile component manufacturer market, ERPCo sales teams had to search the internet extensively to identify all the auto component

manufacturers in a regional market like India or Middle East and create a database with contact information, the key executive to contact etc. Additional channels of engagement through telesales included customers themselves calling in to enquire about ERPCo's products.

Field marketing had the components of digital marketing and event-based marketing. Through digital marketing, ERPCo attempted to enhance its presence on digital channels like the internet through techniques like search engine maximization. Through events-based marketing, ERPCo's strategy was to partner with other organizations to host third-party events and conferences. By being present in technology-related road shows and by leveraging opportunities to jointly host promotion events with non-competing firms like banks, ERPCo tried to reach out to SMB customers.

"We had digital signs in airports to catch attention of many executives passing through these airports hoping they may take note of our product. We had distributed pamphlets and tied banners in industry clusters. We had promoted joint events with banks wherein a bank may be disbursing business loans to the companies and we used this congregation to explain our product and the need for IT. We lost no opportunity to gain visibility." [PR Analyst, Marketing]

"The way we began advertising was unprecedented. ERPCo had never advertised so heavily and believed that the product should talk. In our traditional ERP market, it was more of corporate presentations, attending conferences to showcase our products and make contacts. Here it was like you advertise for any consumer good." [Head, Talent Management]

In addition, ERPCo hosted events in cities where the target market was organized as an industrial cluster. For example, if a city was home to a cluster of textile or automobile companies, ERPCo hosted events to bring together participating companies in the chamber of commerce to sell products to the industries in that cluster. As the industries in the cluster have similar requirements, it also opened a possibility for generalizing the solution to a group of customers per the requirements of an industry vertical.

"One target to scale rapidly is creating community clouds by bringing together a cluster of companies in an industry like textile or leather that thrives on common processes and understanding how a community of companies can deploy SAAS-ERP. As these are SMBs, they nearly have very common processes and it is feasible to bring them onto our product." [Chief Operating Officer, ERPCo]

In sum, unlike in traditional ERP, there was a shift from serving only large enterprises to serving any enterprise, particularly the SMEs enabled by the cloud model. There were changes pertaining to who were the primary stakeholders in the customer organizations and the nature of engagement becoming direct with the business users. This implied developing multiple channels to advertise and sell. Relatedly, ERPCo created a second-order marketing competence which was key to foster a marketing function specific to the target market. ERPCo had to develop mechanisms for sensing the requirements of a typical community of customers and develop new benchmarks in terms of customer profiles and their requirements. Sales teams and product development teams together evolved through improved market understanding. ERPCo created a multi-pronged strategy to ensure that digital and field-based marketing enhanced brand visibility and had leveraged opportunities to work with third parties in promoting the products. From the customer perspective, my findings suggest that customers initially subscribed easily when they were offered a trial of the product to test the suitability and viability to their unique contexts. This trial of the functionality has helped ERPCo to create initial traction and to bust the myth around ERP costs.

IV-5.1.3. Creating IT infrastructure resources

Technological competence consists of tangible resources such as skilled human resources and infrastructural support and intangible resources such as engineering know-how. Building a new technological competence involves detecting new technologies that have commercial potential, developing necessary skills and human resources in the identified prospective areas and creating

infrastructure like new product development facilities (Danneels 2002). Second-order technology competence is a higher order competence at exploring new technologies and building new technological competences to add to the firm's extant capabilities (Danneels 2010).

One of the distinguishing characteristics of cloud computing is the need for vendors to host their products as an instance accessible via the internet (Armbrust et al. 2009). This is unlike in traditional product models where the product sales are one-off and the customers themselves become responsible for providing the capacity for installation and hosting the solution. To provision services for subscribing customers, ERPCo had to build an IT infrastructure asset base for hosting and provisioning highly scalable infrastructure to support the capacity demands of cloud-based ERP. Relatedly, it had created a new Infrastructure Management Group (IMG) exclusively for the purpose of providing hosted services to the customers and equipped it with necessary IT assets and skilled people to support service delivery. This group was made responsible for keeping the infrastructure up and running to obtain the promised service levels and also for maintaining SAAS-ERP functionality in terms of patch management and feature upgrades.

"In our traditional ERP, there was no need to maintain infrastructure as the product was hosted in customer location. In SaaS, we had to host the product, update it and maintain it. There will be asset costs and bandwidth costs in addition. Hence we created a team that handles the system hosting and administration" [Vice-President, IMG]

One of the first tasks of this group was to determine the capacity requirements to meet the service levels promised to the customers. It meant that SAAS-ERP as a web-architected and highly scalable application should live up to the expectation and rapidly ramp up the number of users depending on the growth of the company. But this also implied several challenges to determine the capacity needed in advance. The product development team collaborated with IMG to evaluate and strategize different mechanisms for addressing the dynamic

capacity requirements of its hosted software, before zeroing in on what it called as a scale-out strategy. The scale-out strategy implied the ability to add multiple machines and create a cluster of servers to increase the infrastructure just in time so that the infrastructure and licensing costs were minimized. The architecture per this strategy was multi-layered with the application server, database server and web server being at different layers so that required numbers of each server can be added based on number of users accessing the application.

"The challenge with a cloud-based application is that the investment on infrastructure is mandatory but it is a kind of hedging as we do not know how the application will be received by the market. We cannot buy a lot of infrastructure and we cannot be underequipped. Hence capacity planning is a unique challenge in cloud. We first do a guesstimate and sizing based on the number of customers, users and the volume of transactions. The challenge comes when a 10-user company creates thousands of records per day but a 15-user company may be doing only 15 transactions per day. We are now doing the sizing per user and it can serve up to certain number of people as we have an estimation based on the volumes and usage patterns we have seen. What we are worried is the peaks like tax season, end of the quarter and the end of the month where customers generate lots of reports. We add more servers to the system and then take them out after the peak." [Vice-President, IMG]

Further, ERPCo had to design safety mechanisms towards user authentication, routing the user access requests to appropriate servers hosting the users' data and building in redundancies to reroute the request immediately to an alternate server when there was a failover in the primary servers. ERPCo also had to put in place mechanisms to route the user requests to servers with lesser loads to reduce latency in information.

"We needed to deploy new technologies which balance load on all servers. Hence there is a crisscross right from the internet to the database server and there are multiple ways to jump in with a secondary device so that the requests are entertained in the shortest possible time without failovers. We need to ensure that this whole chain is enabled all the time to prevent service disruptions and comply with SLAs." [Senior Manager, IMG]

In addition to the primary hosting facility, ERPCo had to build a disaster recovery (DR) center in another city and create disaster recovery procedures for backup purposes to provide continuous services to the customers in the event of a failure or catastrophe. The location of this center was fixed to be in a different seismic zone to mitigate the impact of natural calamities. This center hosted one server of each kind for backup purposes and ERPCo had to ensure that all the transactions of the customers and transaction logs get replicated in the DR center within a short lag. Even the application functionality inclusive of any patches applied was immediately replicated to provide access to application functionality in the event of service failure in the primary data center.

"We have to maintain DR capability which is again unique to our cloud ERP. The idea behind the DR site is to have the data available. The transactions happen in the DR site only if the primary site is down. We mirror the primary site in our DR site in 5 seconds to fix the DR lag only as 5 seconds. So there is a very minute potential of any customer losing his transaction. All he may notice is that his current transaction may be terminated. For us, after correcting the situation, the primary site database has to be resynched with fresh data." [Vice-President, IMG]

The IMG became responsible for updating the application and servers with any fixes, features and patches. Further, IMG ensured that service level agreements are honored during the feature upgrade by posting the downtimes and rerouting the requests to any other servers available to contain service disruption. IMG also had privileges to set up databases, data backup, index management and data archiving.

"Whenever we move any feature into the system, we do the load testing and performance testing and tune the application before adding to the system. While the update can be instantly used by all customers, the challenge is that it should not disrupt others who have not asked for it. Similar challenge is with updating the reports. We may update the reports for one customer with his company logo and he only should see this update without breaking others. In traditional ERP, all of this raises only for a specific customer during customization or when the next version is released. Here it is every day work." [General Manager, SaaS-ERP]

"We have specific procedures to address when a customer unsubscribes. One superficial concern you read in all industry reports is the customer concerns about data and what will happen to it if they unsubscribe. Deep down, it is much more intensive work for us. Customers only think of how they get data or what will happen to it. But for us, we proceed to several steps of archiving to make data available several months after the customer has left. It means a lot of procedures and a lot of storage needs. These steps are not there in our traditional ERP as we sell the product and then it is customers' duty on how they want to collect data, make it available, archive it and flush it." [Vice-President, IMG]

In sum, cloud computing needs IT capabilities for hosting the solution and vendors need to factor in capacity management to provide reliable service to customers. Further, vendors need to address challenges related to disaster recovery, secure access and data archiving; which were not present in traditional ERP. ERPCo had exercised second-order technology competence by creating a new IT infrastructure management capability by setting a team towards infrastructure management in its primary and secondary data centers. This group was made responsible for provisioning the IT assets needed to support the service levels, disaster recovery procedures and data management.

IV-5.2. Extending the resource base – Accessing partner capabilities

Another way to reform the resource base is to extend the resources by accessing resources external to the firm. According to Helfat et al. (2007), the capacity of the firm to purposefully extend the resource base is a dynamic capability. Alliances and acquisitions are two ways that a firm can access external resources to extend the internal resource base (Das and Teng 2000; Harrison et al. 2001). In fact, rather than building new resources on its own to grow in the cloud market, ERPCo relied on creating an ecosystem of partners to develop the reach and scale needed to make the business model viable. This included several business partners who were needed for selling and implementing the product in local markets and a set of technology partners who were needed for hosting the products in local geographies or for enabling the bandwidth needed for delivering

the product over the internet. For ERPCo, the most important of these partnerships were with business partners who became crucial for the firm to gain footprint in the markets by selling, implementing and supporting the products and services on ERPCo's behalf.

"Our traditional ERP customers were large firms, manageable in number and growth rate was predictable. Hence our sales teams could sell directly, our own implementation teams could implement and we scaled. But in cloud market, these were small customers and project revenues are not that big. This means we should grow rapidly to make the business model viable. It all depends on footprint and scale. We cannot do it on our own as it needs a lot of resources. The question is who will take our product and add value to the customer. They should buy into the cloud philosophy and should be our front-end. We identified 30-40 IT firms who will be our technology partners for selling and implementing our products in local markets. They should seamlessly fit into our organization. It should also be profitable for both. This is how we planned to scale." [Vice-Chairman and Managing Director, ERPCo].

"The question is about proximity to the customer as we cannot be everywhere. We knew we can put together a solid product and master the implementation part. We did this for our traditional ERP and can do it again. Hence product is not a problem but the ecosystem is. We needed partners to support customers through implementation, handholding and training. These partners also allay any concerns by being right there. We had to plan what processes these partners should follow, how they should be trained and the pricing structures for different markets." [Chief Operating Officer, ERPCo].

Resources pooled across firms through an alliance, if they complement, can present opportunities for enhanced learning and development of new capabilities, thereby generating new value (Harrison et al. 2001). However, accessing external resources through alliances will be mutually beneficial only if both the firms see value from the alliance (Danneels 2002). While partners helped ERPCo to expand quickly in the target markets, these partners also benefited by associating with ERPCo. ERPCo's brand became fungible and enhanced partners' credibility and image. Further, the best practices and

standard methodologies that ERPCo accumulated over the years became an educative resource for partners in strengthening their own expertise.

"We target mid-tier partners with 25-50 employees and having an IT setup. We train them in technology, implementation, processes, how to address changes, what to customize and what not to customize. We handhold them till they understand us completely. Thereafter, we support them through our product teams and implementation teams on an issue basis." [General Manager, SAAS-ERP Sales]

"We were in IT consulting business but mostly selling standalone software and hardware in the local market. We were looking for an opportunity to enhance our revenue and our image. Today we can claim that we are a business partner of ERPCo which is a well-known business group and ERP company. Product selling is also easy as it is comes with ERPCo name. We are now an end-to-end solution provider." [Client Services Manager, Business Partner Organization# 1]

"We were mentored by ERPCo about the technologies and methodologies. We implement the product per their methodologies. This process discipline is what we imbibed from ERPCo. We have well-defined processes in place on how to engage customers, implement products, manage changes and all of this by taking ERPCo into confidence." [Project Manager, Business Partner Organization#2]

Further, ERPCo entered into partnerships with internet hosting and telecom service providers who could host their products in local geographies and sell ERPCo products as a value added service. In one case, ERPCo partnered with a major global IaaS provider to host the solution for Australian market in the provider's Singapore data center. Similarly, ERPCo partnered with several telecom providers in Asia who could sell ERPCo's products to their corporate customers.

"We recently entered the Australian market and we are partnering with a major Australian IT company to implement our products. Similarly, an electronics major in Japan who initially was our customer is now selling our products as an extended business. We serve our global customers through Amazon and Rackspace's data centers in America and Amazon's Singapore

branch. We can use local hosting services if a client specifies it, or if it is required by law [Chief Executive Officer, ERPCo]

"We are partnering with telecom companies to sell our cloud services. One example is an Indian telecom and their sales team is selling our ERP to their corporate customers. These companies are selling bandwidth till now in a pure sense. Fighting on bandwidth is not a differentiator. The value-add is to sell products that works over internet along with bandwidth. They have big sales force, they can provide good bandwidth and our ERP is a natural fit. They can claim that they can offer enterprise applications for their corporate customers. They can offer ERP, video conferencing etc., as a service. They have a big base and none of them have sold applications. We have 20 effective partners and we want to make this 50." [General Manager, SaaS Sales].

"We are delighted to have partnered with ERPCo, a like-minded organization which is a market leader for subscription-based cloud solutions, for marketing its ERP on Cloud. There is a growing market for holistic, integrated and robust enterprise software on a SaaS model. ERPCo's ERP on cloud is dedicated to meet the complex needs of an enterprise, by providing agile, global-class enterprise software solutions, and is aligned to an enterprise's IT needs and business goals. We see a latent demand among our customer base for Cloud ERP offering and believe ERPCo ERP on Cloud will help us address this need, effectively" [Managing Director, a global systems integration company]

In addition to the business and technology partners who were crucial to take the product closer to customers, ERPCo partnered with other ancillary service providers like payment gateway services which help customers pay quickly for subscriptions. These solutions were integrated into ERPCo's product interface to enable customers a simple and secure way of processing credit card, debit card and ACH transactions to pay for subscribed services. As an example, ERPCo partnered with a major payment gateway company in the US to allow the US customers pay quickly for ERPCo's services. This fully integrated solution allows clients to process payments within their SAAS-ERP interface, providing quicker realizations as well as lower processing costs as compared to traditional check processing methods.

In sum, unlike in traditional ERP, cloud-based model demanded accessing external partners to develop quick scale. External resources did help ERPCo to increase the market footprint by complementing internal organization. ERPCo could benefit from alliancing and could use its internal resources to create mutual value with partners (cf. Eisenhardt and Schoonhoven 1996). It could leverage its brand equity and internal technical and process assets to add strength to its partner ecosystem. ERPCo brand became fungible as it enabled its business partners to build credibility and for technology partners to sell ERPCo's products as a value-added service. Further, the association proved beneficial to business partners to strengthen their IT process discipline and learn best practices drawing upon ERPCo's related expertise.

IV-5.3. Modifying the resources

Modifying the resources is an avenue for a company to reorient itself by capitalizing on its extant resource base and find new alternate uses for its existing internal resources. The capacity in the organization to purposefully modify the internal resources to find alternate applications is a dynamic capability (Helfat et al. 2007; Miller 2003). A firm's capability lies beyond and at a higher order from the end product and exists in the ability to foster a generalizable capability which might find several alternate applications for its existing products (Teece 1982). Resources consist of a bundle of potential services and can be defined independently of their use (Penrose 1959: 25). However, resources vary in their degree of fungibility and can be beneficial to leverage for alternate uses depending on how fungible they are (Danneels 2010). As explained in the next sections, ERPCo could modify several tangible and intangible resources from its traditional ERP resource base and these resources could add value to the new products and services it put together for cloud-based delivery.

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IV-5.3.1. Modifying the IT process knowledge

One resource that ERPCo modified to serve the cloud context is its experience and knowledge from past IT process improvement initiatives. ERPCo leveraged some of the existing methodologies and subscribed to new methodologies required by the cloud model. As an IT company, ERPCo's software development processes for guiding traditional ERP development were assessed at SEI CMMi Dev 1.3 at Maturity Level 3. In addition, ERPCo's Business Process Outsourcing division was assessed for ISO 9001:2008 and ISO 27001:2005 information security standards. The Quality Management Group (QMG) at ERPCo was responsible for driving the organization on process management tasks. When developing cloud-based products, ERPCo could leverage some of the existing IT process methodologies and reuse them in the cloud-based ERP context. ERPCo defined the nuances of setting the baselines and metrics collection activities based on past IT process improvement knowledge.

"We are CMMi assessed and CMMi methodologies guide our product development. When SAAS-ERP went into development, we decided that all engineering activities will follow CMMi guidelines. It meant we leveraged our process knowledge which is per the best specification, no separate processes and everything can be done through QMG as we saw it as an extension of what we were doing. But SAAS-ERP is a new product and we did not have any process data. CMMi kind of specifications depend on historic data. In fact, data-driven is their strength. So we had to collect engineering data about how long it took to develop a feature etc. We had to start from scratch and set baselines but it was not challenging as we knew clearly what data needs to be collected as we did this earlier for other products. So all engineers knew what data to collect and we could build the data quickly. The cycle time was very short." [General Manager & Head, QMG]

Further, ERPCo had to subscribe to process improvement initiatives in new areas to govern cloud-based systems delivery. As ERPCo's customers stored their data in ERPCo's data centers, ERPCo had to demonstrate that effectively designed control activities towards information management were in place. Hence ERPCo strived to achieve International Standard on Assurance

Engagements (ISAE) 3000/3402 certification which is a reputed assessment to certify that the organization had effective controls in place to protect the applications and customer data. Along with adding credibility to ERPCo, these certifications were also important to the customers to comply with the norms of their own business when they were audited. As the customers were outsourcing their data to ERPCo and this data might involve financial information, the certifications helped customers to notify their auditors about data protection procedures.

For this assessment, ERPCo worked with a global Big-4 audit firm to identify 11 areas related to disaster recovery procedures, physical security and network security etc., which needed compliance. The primary objective of this compliance was to assure customers that ERPCo provided user experience per the terms of the customer contract with reliable access to the applications and with safe procedures to store and retrieve customer data stored in ERPCo's data centers. The task was very intensive as it needed consistent tracking with several groups within ERPCo if they were getting customer sign-offs at every stage. ERPCo could reuse its process knowledge and employee knowledge gained through continuous training and could quickly achieve this certification.

"We had to go for ISAE certification to assure our customers that their data is being subjected to highest levels of protection. We were rigorously audited for 6 months to check for effective implementation of required controls. The auditors looked at contractual commitment fulfillment – if our customers were receiving SAAS-ERP functionality, features, and availability of the system – per the service level agreement." [General Manager, SAAS-ERP Implementation]

"To comply with ISAE requirements, we get a sign-off from the customer on commitments and service delivery at several milestones to demonstrate that the commitments were fulfilled. Though traditional ERP also has milestones, the milestones are spaced out months apart and the sign-off there is to have proof of contract fulfillment. We were more responsible for effective implementation but need not worry about protection as their data is not with us. In cloud ERP, the sign-offs were at every stage within the 6-12 week implementation cycle to show 100% compliance which meant a lot of tracking and paper work. Further,

sign-offs were needed at every step like configuration of application, user creation, database creation, master data approval, master data upload etc., which are short sub-cycles. These cycles end very quickly. These would have been longer cycles in traditional ERP and would not require such frequent sign-offs and tracking." [General Manager & Head, QMG]

"We had certifications in the past but ISAE assessment is totally new for us as it is more about protecting data and IT assets from wrongdoings. CMMi is silent about backup, physical security etc. The customer and ISAE point of view needs them as critical areas. We had to learn a lot but we could quickly sort the issues in single iteration and were ready for assessment as we had the process orientation right from the beginning." [Vice-President, IMG]

To continuously adhere to process standards, the Quality Management Group (QMG) conducts monthly quality audits to ensure process compliance in all activities. The data collection process and ensuring that appropriate controls persist were taken up as a continuous process management initiative. Employees were given role-based process training and on-job training about their responsibilities for process compliance during software development and implementation. Further, ERPCo was also seeking opportunities to infuse the learning from assessments into SAAS-ERP business processes.

"What we did till now was about assuring SAAS-ERP customers. We are now trying to infuse ISAE principles into our product functionality. For example, we are seeing if we can take a business process related to finance in SAAS-ERP and if we can strengthen it per KPMG control guidelines so that the customer confidence will increase. I believe that SAAS-ERP is helping ERPCo with a holistic approach to quality management as ISAE can improve not just our processes but also our products." [Manager, QMG]

In sum, cloud-based business models specifically need process management methodologies about IT asset and customer data protection to build credibility with customers. ERPCo had to create new IT process management initiatives towards this end. The firm could put together new processes and metrics to guide IT process improvement when new process compliance requirements arose. Further, ERPCo could extend existing methodologies to guide software development for cloud-based products. The process knowledge

accumulated through CMMi adherence became fungible and helped ERPCo to quickly determine the data to be collected and the controls to be instituted towards IT process governance. Further, process orientation in the organization enabled faster employee training to adopt new methodologies. While ERPCo saw value in its internal IT governance processes to strengthen its products and services; the processes also added value to its customers by rendering confidence about their outsourced business processes administered by ERPCo.

IV-5.3.2. Modifying product implementation knowledge

Another resource ERPCo modified to the needs of the cloud market was the product implementation knowledge. Traditional ERP implementations often run into years and ERPCo over time had mastered the ERP implementation methodology. It built knowledge assets by capturing the implementation knowledge of each business process into templates. In the cloud model, ERPCo implemented the products in a typical implementation cycle ranging from 6 to 12 weeks with vanilla implementations at a single customer location needing the minimum. ERPCo had to modify its implementation knowledge and tailor it to suit the short implementation cycles. It created shorter versions of the templates about business processes it can configure and for collecting information from the customer about business requirements and data. These templates helped to fill in the elements of the business process in the customer organization and the data to be put together to enable in the implementation phase.

"In traditional ERP, we analyze every part of the organization from zero base, do consulting and take a huge time-based approach. We templatized all of our knowledge into business templates which we use for implementation. For cloud, we had to unlearn many things and come up with shortened versions of these templates. The business processes will not be that extensive and we had to create templates of 7-8 processes that we started giving as functionality. These processes were again generalized as we included in the application. Second, we have created templates to get data from customers about item codes, inventories, stock ledger balances – we give these templates in an user friendly form so that customer supplies the data and we upload it into master database.

In the first set of templates, we have business processes which the tool can offer and we match it against the customer's way of doing things. We make adjustments in customer business process to configure it to the application functionality. The second set of templates are about getting data from customer in an excel about master data like item codes, inventories, stock ledger balances – we give it in an user friendly form so that customer supplies this data and we upload it from the customer site. These are exclusive to cloud as traditional ERP has customer data stored in conventional databases which we use to create master data." [General Manager, SAAS-ERP Sales]

After the customer subscribes to SAAS-ERP, SAAS-ERP implementation teams begin working with the customer to understand their existing mode of operations. ERPCo team creates a Business Mapping Report based on this understanding to ascertain the gaps and the feasibility of the project.

"We have 1-2 meetings to understand customer operations, what their business processes are and if they have any process documentation. You can think of it as a combination of requirements analysis and business process reengineering (BPR) in traditional ERP. This is an entire project phase in traditional ERP and involves several stakeholders and project steering committees discussing over detailed process maps and doing gap analysis. Requirements analysis itself takes a few months with several templates to capture data, brainstorming meetings and questionnaires to collect additional information. Then comes a detailed BPR which again is a big task. In cloud context, these are short meetings with 3-4 key people and these meetings are more personalized to know what they have. Many of them do not even have any artifacts to share with us. We evaluate not to find flaws but to gain an impartial view of what a customer is doing, his pain points and see how we can enable him." [General Manager, SAAS-ERP implementation]

"SAAS-ERP will tell a new way or a different way of doing things. They have to do business process changes to a varying extent depending on where the customer organization is. We have done process changes but it is more about enablement. We automated manual processes or we put in processes when none existed. We come with templates and domain knowledge about the business processes customer is interested in. These 7-8 templates show processes we deduced from our ERP experience. We will try to understand the gaps between customers' current process and what the software can offer. But being an SMB, the complexities are not that high. The activity is about learning and unlearning

rather than doing an extensive BPR. There is a role for process reengineering but we find customers who do not have a process and may be using a manual system. We have to teach them how the process will be from now on." [Chief Consultant, SAAS-ERP implementation]

Once configuration needs of the application functionality were determined, it will be evaluated if a vanilla application fulfills the requirements. Else, the team will understand the scenarios to be enabled in the application and configures the parameters to provide the required features. Customization requirements are discussed and addressed per the feasibility in the applications. Minimal customization is done as feasible through the extension kits but is mostly confined to customizing reports and some screens where extra elements can be built in to visualize more information.

"In traditional ERP, implementation is a big project needing more money than procuring the product itself. Consultants are hired to implement the product, separate teams instituted within the company to handle the project, a big process for change requests, a large BPR exercise before implementation and a long training cycle. You can imagine how huge it is. Then support is another big project. Here you don't see all of it. It is 6 weeks or so to implement, a few people collaborating on both sides, a short training phase and then ERPCo takes over everything about support. We can do quickly finish as it is defining workflows and configuring them in the tool." [Senior Consultant, Implementation]

"If a vanilla application is fit, it is like you are signing up for Email. Here instead you are signing up for a full-fledged ERP. We will not even interact with the customers during implementation after understanding their business in a meeting or two. All you need is some 2-3 days of training which you don't need to use Email. It is that easy in that case. In the extreme case, one implementation for a large customer went for 18 months. But the customer was still happy as it would take years if he had gone for traditional ERP. In addition, he did not have an IT department and did not want to create one which a traditional ERP would have demanded. ERPCo support teams now act as his proxy IT team." [Chief Consultant, Implementation]

"In traditional ERP, the application can be customized the way you want. Customization in itself is a big project done by a systems integration company and done by changing the logic in the product. In cloud, customization is

minimal as we have to do everything within a single instance. We can customize a few reports and screens and will enable or disable a few configurations. The application logic will not be changed and we will not touch the base product. The product dictates feasibility levels for customization. If a customer needs a specific customization, unless we see that it has the potential to become a generic enhancement to our base product, we cannot fulfill." [Chief Knowledge Officer, ERPCo]

ERPCo standardizes the format of invoices and reports etc. ERPCo collects data for master data creation which brings uniform definition to data existing in different formats. In addition, ERPCo team creates a training database and models the new business flows in the training database to train the customer so that they understand what they have to do for a business process. In parallel, ERPCo gathers enrollment information to note the modules subscribed, the user licenses purchased and the roles to be assigned to the users to enable database creation based on the enrollment information. ERPCo team sets up user accounts on this system to ensure that a specific user gets to see only the information he is entitled to or will be access only the modules assigned to him. ERPCo ensures that a key person is assigned by the customer to own the project, work with ERPCo to explain requirements, understand the new system and concur with the implementation. He/she becomes the liaison in the post-implementation phase for learning new features enabled and provide training to his/her employees.

"Customization is limited. The access and authorization procedure setup is similar to what you see in any system. But the unique thing about SMB is that one person may be doing multiple roles. In traditional ERP, such an act may span people from multiple departments. Hence we need to do some customizations which help to view information related to a transaction from end-to-end. For example, one of our customers asked if he can get an option on the pending payments screen to see all the pending invoices related to that department. We had to create new feature in the screen so that he sees all pending invoices and only for his department." [Chief Consultant, Implementation]

"In ERP projects, there will be IT teams and then there will be end users. Here we generally do not have customer IT teams. We directly discuss with the end

users and pick an end user to be the liaison. ERPCo will troubleshoot any technical issues after implementation while one end user will be the internal functional expert. In some cases, even the senior executives play this role." [Senior Manager, SAAS-ERP implementation]

The handholding phase begins on the day the application goes LIVE. During this phase, users will be supported to conduct transactions, to generate reports and to enable new features if any new requirements come up working live on a business process etc. Per the efficiency of the cloud model, all customers get free access to any new features rolled out into the product and may opt in for them if required.

"The peculiar issues we come across in this phase are that customers will realize things which they are not even aware of. There may be scenarios where new screens may be opened up. He may realize the need for new modules wherein we will provide a week or 10-days plan to provide training and start on these new modules. There may be new features required and we raise a change request if it is doable and within the generic scope of the product functionality. For example, we have seen cases where a customer was not even aware that he was using a specific purchase order and was thinking that he was using a generic purchase order. He realized it during the handholding phase. In any case, the changes we do or we can do are small ones as our goal is not customization as in traditional ERP. " [Senior Manager, Implementation]

After the handholding phase, ERPCo takes charge of providing ongoing technical and functional support through the Continuous Customer Engagement (CCE) team. Customers receive continuous phone-based support about new features rolled in, changes in process configurations, clarifications and any issues in process execution etc. ERPCo experimented with rolling out new features into the application based on its proven expertise in the traditional ERP rollout but had to modify the process as the rollout was applicable to a common instance.

"We had proven procedures for feature rollout in our traditional ERP. But we had to modify it to suit the cloud model. Here each feature has to be developed, tested and updated to the system. The rollout is different as the features should be seen only by the applicable customers and should not disturb others. This means accommodating lots of variations. If 10 customers have to see the new

feature, they only will see them. We send a release note with each upgrade explaining how to use the new feature. They can call CCE for further support if they intend to use and face any issues. [General Manager, Implementation]

"The on-demand feature update here will help to add value to the customer beyond the initial implementation. For updates, all customers get it even if the feature was requested by one customer. This is a collective enterprise in that sense. In addition, all future enhancements in the modules subscribed by the customer will come to him free of cost. In traditional ERP, delivering new features runs through a whole change request cycle with commercial implications. Sometimes new features may come only in next version of the product for which he has to buy new licenses. We had to abandon several steps in implementation. Here all he needs to pay is the ongoing license fee. Even change requests run by one page documents as those are small changes." [Vice-President & Chief Architect, SAAS-ERP]

In sum, cloud-based product implementations run in short implementation cycles with ongoing maintenance and support of the application provided by the vendor. There was minimal scope for customization and any feature upgrades were automatically provided without additional fee. Process reengineering was more about process definition and automating the process in accordance with the product functionality rather than being an extensive exercise as in traditional ERP. Implementations were coordinated by forming small teams at the customer-end towards requirements elicitation and liaison. ERPCo had to learn to work directly with the end users rather than coordinating with IT departments as an intermediary. ERPCo had to modify its product implementation knowledge to accommodate template-driven methodologies, to accomplish the customizations within the scope of the generic functionality and to provide continued support beyond implementation phase per the characteristics of cloud-based model. From the customer perspective, while they were initially plagued by lack of well-defined business processes and integrated information, ERPCo's expertise assisted to establish processes per best practices and create data per established formats.

IV-5.3.3. Modifying product design knowledge

Another resource ERPCo had to modify for cloud-based products is the product design knowledge. ERPCo's traditional ERP products were designed with large organizations in mind where business processes are very complex and span multiple departments. The products were installed on-premise and were customizable to the unique requirements of the customers. When ERPCo decided to create an ERP product for the SMB market, it had to keep in mind the characteristics of the target market and constraints of cloud-based implementation. Firstly, ERPCo understood that in its target SMB market, it is often that firms do not have internal IT departments, process management is ad-hoc and one person may act in multiple organizational roles to accomplish several tasks alone. This meant that design of a product should integrate several functions and the product workflows had to be simplified to suit such usage.

"The commonality is that one guy in the organization multi-tasks to raise a sales order, raise an invoice etc., and this is unlike our experience in traditional ERP market where separate departments handle each of these tasks. These employees are not high-skilled with computers. Hence we had to package the application in a simple and intuitive manner without compromising the functionality." [Chief Operating Officer, ERPCo]

"The idea was to untangle what we had in traditional ERP. We had to remove validations, remove steps in business processes, make functionality leaner and reflect business processes prevalent in SMBs. How do you make sure that the purchaser has quick access to sales information – we envisioned a two-way link from Purchase Order (PO) to Sales Order and vice-versa. In large organizations PO is a separate function with many screens and has to be worked on by several people in different departments. Traditional ERPs are designed around this flow. In SAAS-ERP, information should be joined so that the user can collate it easily. Here, whenever I present a purchase, there may be accounts payable needed. Hence we architect the application bringing in two transactions together like enabling invoice authorization on PO or the PO itself acting as a Goods Receipt Note." [Chief Knowledge Officer, ERPCo]

"We definitely got influenced by some concepts from ERP experience. But it was only in terms of high level workflows. The change needed for an SMB product is

the usability. There should be one screen, reduced clerical work and made simple to understand or use. The nature of business is different, business lines are different and focus of customers is different when compared to traditional ERP." [Senior Vice-President, SAAS-ERP]

Further, ERPCo was aware that the product had to be hosted as a single instance which meant it needed generalization of the functionality. Hence ERPCo purposefully did not get into verticalization of the product specific to any industry. The goal was to keep the product generalized but to bring in verticalization in the implementation process. The design approach hinged on identifying commonalities in business activities and generalizing the product to accommodate the common workflows in processes.

"The approach of traditional ERP has been to give a personalized solution which solves your specific problem. In cloud, it is not about a customer but a community. We don't single out a customer and solve his problem. It is to crystallize a community's problems and give if not a satisfying solution, a satisficing solution. You generalize the solution with a set of customers in mind. You can customize only to a minimal extent and 90-95% functionality is common to all customers." [General Manager, SAAS-ERP Sales]

"The idea is not to have too much of variation from the usability perspective. The principle is that for retail business there is no need for too many variations. Trading of chemicals or electronics will be different. But they have common areas like buying, selling or marking and we are addressing the common activities. For example, one television channel is using our product for payroll but not for selling advertisements or slots. They are using us for payroll. We could penetrate non-core functions like HR or payroll while their main business may be something else. There will always be certain gaps specific to the business but we are not addressing them. The reason may be commercial or if it affects the overall architecture of the product. The goal is to make the product handle common functions without becoming too verticalized. May be it as 75% fit but the benefit will outweigh specialized solutions and maintaining them in the long run for the customers." [Senior Manager, Product Development]

"There are a lot of similarities between leather and textile industries. In both industries, the variations are huge. Every season there will be new models in various sizes. But there is no difference in the raw materials used or the process of creating the finished goods. It is only the variations. So we came out with a

functionality wherein you define the bill of materials at the product level while you produce the variants at the finished goods level. The same can be extended to textiles where you have variations of size and color." [General Manager, CRM Products]

To satisfy the business process workflow requirements of different customers within the generalized solution, ERPCo adopted a technical approach called 'extreme parameterization'. According to this approach, for example, there may be different customers who need different types of Purchase Orders (PO). One customer may need a simple PO P1. Another customer may need a PO P2 that allows him to specify the budget on the purchase order so that purchases can be made against the budget set. A third customer may need a blanket PO P3 which allows him to have multiple delivery dates based on a predetermined pricing. To host as a single instance meant that multiple usages should be accommodated within the same application. The complexity in such cases was not about product complexity but about maintaining different versions of the same function to deliver them per each customer requirements. Hence ERPCo treated the product as a system in perpetual beta. Further, it was technically complex as ERPCo had to maintain the application in a state it was five years ago and still superimpose ongoing updates so that a customer who opted for PO P1 five years ago can be delivered P1 and a customer who opted for Purchase Order P2 today should be delivered P2. This was unlike in traditional ERP where earlier versions were decommissioned by vendors with no option to the customer but to upgrade.

"We had to mind that in cloud, there is no old or new version. The version is what the customer is seeing and what he opted to see. Many customers refuse to upgrade. Somebody subscribing today should be able to choose anything. Somebody who started years ago should be seeing the version he chose then. You need to make sure that at every stage, everything you are building should be optional. Customers should be able to move to a newer version without going through intermediate versions. In traditional ERP, SAP decommissions SAP R/2 once SAP R/3 is launched. Further, if introduced a new process flow which may be a mandatory process, even if you do not want it, you still have to use it. The only other way is to pay and customize." [Senior Vice-President, SAAS-ERP]

"One customer may want an intermediate step in the process flow which was not there in the product while other customers should continue to avail the original process flow. Suppose if other customers were going to step 2 from step 1, this customer had to go to step 1.1 before going to step 2. We can design this step and enable it for him through extreme parameterization. But the problem comes with retrieving data for creating reports. The challenge is that once the process goes to step 2, it should have reference to both 1 and 1.1 to create an integrated report. We tried to create a variant of the report and all you see is this variant report if you follow the modified process flow and the original report if you followed the original process flow. This is the complexity we see when working with multiple customers. We have to maintain all states of the application and still maintain it in one instance. In traditional ERP, if a customer asks for a change, it will be on his own instance and is doable to full extent. [Vice-President & Chief Architect, SAAS-ERP]

To provide multiple functionalities in the same instance, ERPCo faced several architectural challenges which it had to factor into product design. Some of them were pertinent to conducting transactions over the internet and enable faster transmission of required data on a customer basis. This way crucial to ensure reliable delivery of services promised per the service level agreements. Others were relevant to provide customized screens within the same front-end per the settings a customer has chosen. ERPCo had to create functionality based on generalization principles wherein, for example, the screen remains the same but appropriate fields like tax categories or currencies have to be populated per the country chosen.

"When we say multi-tenant on the cloud, we should consider internet as a factor. Everyone uses the same front-end but the data has a unique signature for each customer. While it is the same purchase order screen, a customer may fill it with only one field to buy one item while another may add 200 fields to buy 200 items. This longer purchase order has to travel over the internet to get data from our servers and it can be slow. This is one trade-off we count from the transaction perspective." [Senior Manager, Implementation]

"We generate reports with PDF to prevent tampering and also use a technology called linearization so that a 1000-page report will load page by page rather than all at once to enhance systems performance. If a customer has to download a 1000 page report across the internet and clicks for it multiple times, it will put

unnecessary load on the system. Hence we give options to schedule such big downloads as jobs in the queue and also render the report page by page to put less strain on the system." [General Manager, CRM Products]

The product design also had to take into account minimal customization requirements that may be allowed in the application. It had to consider that the customizations should be doable by an educated user or an implementation partner but should not be allowed to disturb the core product which is always the same for all the customers. Hence ERPCo had to design extensible kits which allowed building customization on top of the application, allowed customization of some reports and provided analytical features that thrive on information from the application. ERPCo delivered a tool named Extension Development Kit (EDK) which allowed customers or implementation partners to build new functionality on the same run-time architecture of SAAS-ERP but without being a part of the base product. The EDK inherits all the characteristics of the SAAS-ERP application in terms of SOA-based, web-architected and multi-layered solution. For example, if the customer wants to track the Truck Numbers on the purchase order and this is something that is not affecting the flow of the transaction but may be something that can be printed on the reports, EDK can be used to build an additional screen with the provision to enter the truck related information.

"In traditional ERP, we can customize as much as the customer wants. In cloud, how can you have personalized solutions…it is not a 100% one-size fits all. The application was a highly parameterized application to configure to give different implementations to various customers. But there may be some changes we can allow. Customization was mostly through extensible kits and reports customization. The application logic will not be changed. May be a few customers need reports like sales register with 25 columns instead of the default 50 columns. It is not specific customization but they want to see only a part of the report. We gave these kinds of customizations in screens through EDK and also customized the reports without touching the base product. But if a customer needs a specific customization, unless we see that it has the potential to become a generic enhancement to our base product, we cannot fulfill." [Chief Knowledge Officer, ERPCo]

"In many cases, customers come with customized report requests with their own logo or printing the logo only on the first page and ask for formats like excel, notepad and HTML for printing convenience as they may not have laser printers being SMBs. Hence we need to give in a format of their choice." [Senior Manager, SAAS-ERP Product Development]

In sum, products designed for cloud-based market imply that the scope is only to provide generalized functionality with minimum room for customization. Relatedly, ERPCo had to modify the product development knowledge it had accumulated in traditional ERP. It had to take into account the unique characteristics of the target business and the design had to accommodate facilitating minimal changes without touching the application logic and base product. Further, the architectural challenges in providing variations within the hosted instance and the transaction complexity of providing services over the internet had to be factored in when designing the product.

IV-5.3.4. Modifying Product Development Knowledge

When ERPCo started developing SAAS-ERP, it had to modify the product development knowledge and methodologies to suit the characteristics of cloud-based models. Historically, ERPCo's products were built by leveraging the modeling and code generation capabilities of the SOA-Platform. Further, ERPCo's product development followed agile development methodologies like Scrum and RSprint. These efficiencies in the product development process became advantageous to ERPCo as time to market is a decision factor in the packaged software market and the rate of software change is higher through product updates and patches (Bingi et al. 1999). ERPCo could quickly put together business components needed to create the functionality in the traditional ERP product and deliver it to market.

Time-to-market became even more important in pursuing cloud-based customers as ERPCo had to quickly launch the products to gain market share and improve market understanding. Also, that cloud computing allows delivering

feature upgrades and patches without waiting for release cycles meant that changes were needed in the development model. ERPCo understood that product development should be enabled to absorb market feedback and make faster changes to enrich the application functionality. Hence the initial emphasis on faster product development in cloud-based ERP was to launch the modules quickly which later became to improve them in short iterations.

"Even in traditional ERP, we were an agile organization building the functionality incrementally and including it in the product. But in cloud, the interpretation and adaptation of various large scale methodologies needed careful consideration. Here the difference is speed and delivery. We build the functionality in small increments and deliver it instantly. Even an hour's work can go into the system if it is a meaningful piece of functionality. Hence we needed to be more agile i.e. take a feature, develop it, test it and update it in minimum time it takes to make it saleable." [Senior Manager, Implementation]

"The difference in cloud is what you can call as implement first and modify as you go. As we started envisioning the product, we had to quickly put together the modules. Hence it was short cycles of development to assemble modules from business components and test it. Now, we modify the system in short iterations based on improved understanding of what customers are asking." [Senior Manager, SAAS-ERP Product Development]

"The challenge is not in terms of accepting the changes but the sequence of changes. Should I go to change B or A or E? You need all at some point in time. But to do C, B becomes mandatory. We do a step-by-step process, we will build C with B half implemented, make C work and then plug in B. The factor here is the time to market. The business model here forces to put lot of stress into the system even if it does not fall in the sequence. But you have to be very quick. For traditional ERP, you can tell the customer to wait to develop the feature and he waits as it is a unique customization done to his needs." [Vice-President & Chief Architect, SAAS-ERP]

In addition, ERPCo also found that testing the developed features needed an intensive approach from what it was following in traditional ERP. It noted that the features being developed for cloud-based products needed testing at multiple levels. First, the features should be visible only to customers who requested for them and it implied testing multiple configurations to see that only eligible

customers were enabled. Other customers should be uninterrupted in service. Integration testing had to accommodate all the variations in workflows to ensure this configuration dynamic. Second, as the features were pertinent to a cloud-based instance, it needed a thorough performance testing to ensure that the application performance continued to be high at several load levels. Third, as IMG maintained customers' data assets, there was an additional need for thorough penetration tests to ensure that there were no data breaches.

“The goal is to build, test and integrate. But testing here is complex compared to other projects. First we need to test the functionality itself. Then we have to test many variations to see nothing is broken if a customer has not opted for a feature we are delivering. He should be able to work with his existing configuration irrespective of the change. We build a suite of automated test cases and add to them but the scope of automated testing we do for on-premise products is not that extensive as we need to test the customization we did to one customer.” [Senior Manager, Implementation]

"We need to take into account the performance, network traffic and the database server usage all should be considered to ensure there is no breach of data as well as the performance is high. Hence our testing approach is more holistic to ensure availability and security." [Senior Manager, SAAS-ERP Product Development]

To address the needs for faster development cycles, ERPCo leveraged the technology base of the SOA-Platform which provided the flexibility to model the solution and create it from pluggable components and test it, all within the platform to deliver end-to-end functionality. Creating the functionality compliant with the methodologies for developing components on this platform also obviated fostering incompliant plug-ins that would trouble stringing together coherent functionality as well as allowing seamless future upgrades without breaking the other parts of the system. Further, developing product functionality using this platform also meant that the firm could do focused testing of only the components that changed whenever new functionality was developed. This was because the SOA-based product architecture comprised of metadata that told what components were strung together to create the functionality, how the

components were related to each other, how they were connected, which components changed when new features were built in and what other components the changes could impact. ERPCo could quickly test if the main and the ancillary components continued to work properly when something had changed.

"Our SOA-Platform is based on service-oriented architectures. When we have to develop a new business process, we already have some understanding of what it should do. This is a typical business process I might need. We think about this process and identify the business components that make up the process. In each component, we enumerate the list of business activities. The advantage with componentization is that there may be options I may need after 5 years but I can create a provision now so that I can create the component later. This is very advantageous for cloud products as we have to quickly implement things that work and then make a provision for modifying as we go." [Vice-President & Chief Architect, SAAS-ERP]

"SOA-Platform is based on model-driven methodology that leads to rapid implementation. When we need to develop and test a new feature for cloud, it is through this platform that we quickly experiment and see what is working and what needs to be changed. The ability to change on demand and the reuse of assets makes experimentation fast and cheap. Also, everything is automated and the chance of human error is low." [Senior Vice-President, SAAS-ERP]

In sum, cloud-based product development needed faster cycles of delivering the functionality as there is a need for time-to-market as well as potential to deliver the functionality faster. Further, the testing is complex as it has to take into account integration requirements for various configurations of product workflows and should validate the functionality for high performance. ERPCo could exercise the dynamic capability by modifying its product development knowledge to create faster and shorter iterations of development and testing. The technology base at ERPCo became a fungible resource in enabling the modeling and assemblage of business components and building the functionality in a timely manner.

IV-5.3.5. Modifying human resources

Another resource ERPCo modified to the cloud context was the human resources (HR). As ERPCo was launching new products specific to cloud domain, HR structure in the organization had to be appropriately revised. Suitable HR initiatives had to be put in place to support the transition, to encourage learning, to design new incentive structures and to ensure that the employee morale stayed high. Revising the HR structure needed changes affecting the engineering and sales resources.

As described earlier, on the sales front, ERPCo has created a separate sales division as the sales model was to resemble a retail model. Relatedly, the sales team had to put in different strategies in terms of corporate marketing and field sales to create awareness about the product and its use to prospective customers. ERPCo had to take into account that the market was still nascent and which implied that the sales revenues might not be that high compared to the stable returns it was seeing in its traditional ERP business. Hence the incentive structure for the sales team had to be revised accordingly.

"The target market for SAAS-ERP is small customers who may not even know that they have the need for information systems. Hence ERPCo had to invest a lot in marketing and marketing teams had to work as much for educating the customers as for selling our products. They also had to identify our partners and train them on the sales pitch." [Vice-President, Human Resources]

"The way of selling is different and the sales people may not see the same numbers till the market grows. The margins will also be low per sale. Hence the incentive schemes for sales had to be revised to be slightly different. The incentive policy was devised such that they are not completely linked with the total sales as it is a budding market." [Head, Talent Management]

Creating technical teams for cloud-based product development was another necessity. ERPCo put together the initial team of technical experts drawn from its traditional ERP development group to conceptualize the product. The team had grown to 300 members at the time of this study with software

developers joining it with time. The technical teams could leverage some of the legacy technical and process expertise from the traditional ERP model, thus shortening the learning curve. However, there was also some unlearning needed to ensure that the people tasked with developing cloud-based products had to forego some of their traditional ERP knowledge. They had to learn to develop products in quick iterations to support continuous product enhancements feasible through the cloud model.

"A group of seniors were brought together to create a think tank and the team was eventually staffed with developers as we started readying the modules for market launch. Every team created for SAAS-ERP was educated on the product vision but was given the freedom to experiment. The key is we could show that there is an avenue for people to innovate within the company." [Manager, Human Resources]

"In the hindsight, SAAS-ERP is no different from any of our products launched. These people are with ERPCo right from the beginning and they see SAAS-ERP as their product. That way they were trained on agile development methodologies, service-oriented architectures, come with deep domain expertise and bring process guidelines to their work. Hence education was easy as everyone could see what has to be built and per a disciplined process. Even the sales teams knew the strength of the frameworks we use to build products. As the sales teams talk about our technology and process strengths, their transition was also easier. All they had to learn was new ways of selling." [Head, Talent Management]

"The transition to SAAS-ERP came with a lot of unlearning. SAAS-ERP teams had to unlearn about a large application like ERP and learn about how to launch products quickly without large gestation periods. Products will be used by the customers as you develop and have to be tested online. The team had to learn how speed and responsiveness become critical as they receive instant response for bad upgrades. Hence they had to be in a position to create good products on the run and absorb feedback on the run. Employees had to learn how to minimize turnaround time and how to increase customer satisfaction. While our product development was historically driven by agile methodologies, here it was even more agile to take small chunks of work, develop, test and deliver sometimes within a day. " [Chief Consultant, Implementation]

Further, ERPCo had to provide opportunities to people to work on the products of their choice and ensure that the transition was smooth. In some cases, the HR team identified challenges about how employees perceived being deployed in one team or the other. In addition, there was a need to allay the concerns of the developers and implementers of traditional ERP to ensure that their interests were protected.

"There was a lot of hype within and beyond ERPCo about cloud. Hence a conflict may arise within ERPCo regarding the importance given to each product. Employees might feel that the new product may garner more attention. We had to be sensitive to these concerns. However, we will continue to sell our traditional ERP and we will not switch over completely. We spoke with people within the traditional ERP division to retain their pride and tell them that ERP is still the bread and butter but if cloud is the way the market is going, we are working to be there and we are doing something collective towards the overall organizational goals." [Manager, Human Resources]

"It is not that everybody in the traditional ERP team was concerned about the changes happening in the company. While some of them felt motivated to be assigned to SAAS-ERP teams to develop new products, this deployment had to be smoothened. People may feel that they are being shunted to a new group and some of them may not like to work on products that need constant deliveries. We had to identify them and see that their preferences were accommodated." [Vice-President, Human Resources]

ERPCo also instituted additional processes for creating transparent mechanisms for performance reviews and compensation structure. In addition, ERPCo designed processes to work with external partners for creating a transparent ecosystem around SAAS-ERP. ERPCo HR department created processes that guide the organization in selecting the implementation partners and facilitate their quick absorption into the ecosystem. The goal was to create repeatable processes that help partner induction without too much handholding.

"The involvement of HR in expanding our ecosystem is to support the marketing and implementation teams with devising criteria to select our partners and to seamlessly bring them into ERPCo ecosystem. The goal was to have ourselves

ready to equip our partners about our philosophy and increase our ecosystem" [Head, Talent Management]

In sum, cloud computing needed a new sales structure to educate the market and an incentive structure considerate of revenue flows. While legacy technical and process assets added value by becoming fungible, technical resources had to learn new ways of developing the products in short cycles and launching them quickly to gain market share. ERPCo had put together new incentive mechanisms to balance the morale in traditional ERP and cloud-based ERP divisions. Further, cloud-based business model demanded design of new processes to evaluate, select and support the business partners to enable the scale needed for the viability of the business model.

IV-5.3.6. Modifying Relationship Management and Contract Management Knowledge

Relationship management and contract administration are crucial areas in sourcing of IT services (Feeny and Willcocks 1998). One resource ERPCo had to modify to suit the cloud model was its relationship management and contract management knowledge. In traditional ERP, relationships were driven by long term association with customers as ERPCo collaborated with them over extended periods of time through implementation and continued support. It was a very structured process where ERPCo and customers concurred on the fulfillment of contractual obligations at each milestone and the contract administration was governed with the support of legal counsel. Customers also fulfilled the financial obligations per the terms of the contract and payments were done on a milestone basis. In cloud based projects, the projects were shorter in duration and revenues were on an ongoing basis with an initial setup fee and monthly subscription payments. Further, the entry and exit barriers were low and the promise was that customer setup was easy and customer payments were as quick as paying through a credit card. Hence ERPCo had to modify its relationship management knowledge and contract administration knowledge to tailor it to working with several customers as in a retail model.

First, ERPCo wanted to make the implementation and support process as automated as possible to scale in this market. Once the implementation was completed, customers thereafter were provided telephone-based support through the Customer Engagement Center (CCE) setup exclusively for this purpose. When implementations were handled by business partners, customers are given the option to get issues resolved by directly working with the partners or by calling into CCE. Further, customers paid their subscription payments through payment gateways integrated into the product's interface. Direct customer engagement was predominant only if there was a need for implementing additional modules.

"Fundamentally nothing can change after 6 weeks as initial implementation and handholding will determine all the requirements and ensure that configuration requirements are fulfilled. Thereafter, it is only issue-based support through our CCE. We revisit only if there need new modules. The goal is to automate everything as much as possible and make it hands-off. Customer will get all upgrades, they pay monthly fee and the relationship continues through service provisioning." [Senior Manager, Implementation]

"We contact the customers through sales teams but relationship management is not you see in pure sense. As long as customers are getting the service they needed, they get support through CCE. They contact us only if there are any major issues or new business. It is not an everyday handshake you see in traditional ERP." [General Manager, SAAS-ERP Sales]

ERPCo also saw the need to modify the contract administration process by making it simple for the customers to enter and exit the business relationship. ERPCo saw several advantages and disadvantages in contract administration which it had to take into account while creating new knowledge about the customers. First, addressing cloud market through retail model implied quick contract signing ability and the service provisioning needed more frequent sign-offs towards ISAE compliance requirements. Hence ERPCo had to create several short templates which were needed to provide quick interactions with the customers. These templates were created for initial customer signups, milestone signoff and change requests. ERPCo made the process simple without the need for legal counsel as these contracts did not entitle large financial obligations. The

templates do not vary with customer unless large customers subscribe to SAAS-ERP. In addition, ERPCo finance department realized that payment collection procedures might see more customer defaults and hence created a new team to handle payment collection process.

"We have a template and an online agreement for any customer to quickly subscribe to SAAS-ERP. No legal counsel is needed for discussion as the SAAS-ERP contracts were generally modeled like in retail. This was different from our traditional ERP contracts which involve lengthy negotiations and intense contract administration as those were big contracts and ran very long. In traditional ERP, change requests themselves are substantial and many times even surpass entire SAAS-ERP contracts. The template for SAAS-ERP is a one page Purchase Order which will provide information on the time of commitment, subscription fee, any discounts applicable etc. The customers may use their own template. These are short sheets not found in traditional ERP. [Vice-President, Finance]

"The payment collection process is a bit more complicated in SAAS-ERP. The number of invoices is more as we are dealing with many customers and hence the cost of collection is more. It will be further complicated if a customer defaults as collection expenses may outweigh the receivables in some cases. It was very structured in traditional ERP and driven by milestones. Our customers there are also big and pay promptly. In SAAS-ERP, every month we have to track the payment, see who defaulted and then go after them for payment. The dynamics are more as customers also revise their contracts frequently to add services or licenses which again can be done with one page." [Senior Manager, Finance (SAAS-ERP)]

In sum, relationship management with customers was structured yet not as intensive as in traditional ERP. Working with several customers needed automation of relationship management processes to bring in efficiency in the process and obviate the need for continuous managerial interaction to support them. Relationship management and contract management process had to be simplified to ensure quick onboarding, easier signoff on contractual obligations and provisioning of continued service. Relatedly, ERPCo had leveraged its knowledge in these areas to make it template driven but suitable to work with and track multiple customers per the scale aspired in this model. A new team had

to be created in the finance function for tracking payments and defaults to bring structure to the process and minimize losses from non-payments.

IV-6. Discussion

The purpose of this study was to advance our collective understanding about the changes being effected by cloud computing architectures and their implications to vendors by supporting it with an empirical case. The emergence of cloud computing as an enabler of new modes of service delivery provided ERPCo an opportunity to create new products that have the potential to serve a new customer base. In the context of this firm, this study examined how and what changes in the technical and organizational business functions were needed to serve cloud-based product markets. My analysis finds that ERPCo created technology-related and market-related resources (cf. Danneels 2002; Mitchell 1992) to match its new products to the target market. My findings emphasize that the inherent characteristics in the cloud computing model can enable democratic access to technologies and hence firms need to develop new customer knowledge and marketing competence to design and deliver the products per the markets this democratization can open. Further, I find the need to understand the commonalities in target businesses to design solutions within the constraints of hosting per the cloud computing model. As cloud computing allows for instant delivery of functionality, developing and delivering the features in short cycles differentiates this model from the traditional product models. Generalized functionality in the product implies short implementation cycles that focus on enabling and automating the customer business processes and configuring it per the product rather than involving in extensive customization per the unique requirements of the customers. Cloud computing also entails simplified and automated relationship management and faces some unique challenges in relationship management as the customer base is huge and works like in a retail model.

Further, while the primary objective was to understand vendors' reorganization, my analysis provided deeper investigation into the capabilities (or lack) of potential customers in the cloud-based market. ERPCo's target customers lacked sophisticated internal IT internal IT infrastructure, IT skills, business process management capability and would potentially subscribe to solutions that hinge on usability and vendor support. Relatedly, ERPCo's implementations could define business processes in customer organization and configure them per the application functionality. Hence I could observe that customers got access to end-to-end system functionality without the need for additional internal resources and this manifested in democratic access to IT promised by cloud computing.

Within this context of understanding the dynamics of change, this study examined how ERPCo used various modes of resource alteration to exercise dynamic capability: creating, modifying and extending resources to capitalize on cloud computing to enter into other product categories. ERPCo was able to tailor its existing resources to offer competitively viable new products and build additional resources to revise its service model. ERPCo created new resources related to IT infrastructure capabilities, customer competence and marketing competence. Further, ERPCo extended its internal organization through an ecosystem of partners to gain required support in product sales and implementation. ERPCo leveraged its existing technical, process and implementation knowledge and modified it to reduce time-to-market and to implement product functionality in shorter timeframes.

ERPCo's resource change can provide a more nuanced understanding of the process of leveraging technologies for product-service innovation. New product researchers of the past have advocated that marketing and technological capabilities must be present for effective new product development. New product development fosters reuse of extant competences by delinking competences from current products and relinking them to new products (Danneels 2002). Delinking of those competences from the current product removes the impetus from

current customers and allows evaluating alternate applications targeted towards new customer bases (Marino 1996). Full exploitation of one competence requires other competences to be present or built. For instance, to leverage its technology by applying it to additional markets, in addition to having a technology that can have alternate applications, it is necessary that a firm must build market-related competences to connect the technology to the new markets (Danneels 2007). These market-related competences include a customer competence i.e. developing new knowledge about prospective customers and a marketing competence i.e. creating marketing channels to communicate and connect with them based on the knowledge developed about them. Hence leveraging the existing technology competence does not occur by merely leveraging the experience of serving extant customers but only by purposefully creating new competence to serve the new markets (Danneels 2010).

In the case of ERPCo, technology leveraging was facilitated by the presence of second-order customer and marketing competences. ERPCo could first create cloud-based products through the fungibility in its technology platform i.e. SOA-Platform through assembly of pre-built components. However, ERPCo could leverage its technology to apply to new markets only by exercising second-order customer and marketing competences to create new customer knowledge and to connect with these new customers through a new sales function. As the technology was de-linked from ERPCo's core market of traditional ERP, it became disengaged from the incentives from its extant traditional ERP customers and ERPCo could exercise second-order marketing competence to connect it with a new customer base from the cloud-based market. Further, ERPCo had *'reconfigured'* the technology and its related functionality appropriate to the new context before relinking it to new customers and serving the requirements of this new customer base – this reconfiguration becoming a vital intermediate step – a 'missing link' between delinking and relinking not highlighted in past product innovation research. Reconfiguration is the change of technical resources within an organization and linking together the existing components of an established system in a new way (Capron et al. 1998; Karim

and Mitchell 2000). In the context of this study, reconfiguration can be thought of as that while primary components would be largely the same, the components specifically chosen to define a cloud-based business process functionality and their interactions would change, sometimes introducing new interactions among the components (Henderson and Clark 1990).

Figure IV-2 below demonstrates the steps in leveraging ERPCo's technology competence and finding alternate applications for it. As can be seen, while evaluating alternate applications for its traditional ERP was a right step at ERPCo, creating cloud-based products was made possible through reconfiguring the technology competence. This reconfiguration in turn was swiftly made feasible through minimal effort due to the SOA-based expertise in ERPCo. As ERPCo gained new knowledge about the potential customer base, it could quickly assemble the components to create business process functionality that entailed market potential in the cloud-based market. Upon reconfiguration of the technology competence, ERPCo exercised second-order customer and market competences to link it to the new customer base. Further, as the product was gaining traction and as feedback started to arrive from the market, ERPCo could continuously reconfigure and improve the product features and functionality and relink it to the market per a continuous back-and-forth activity.

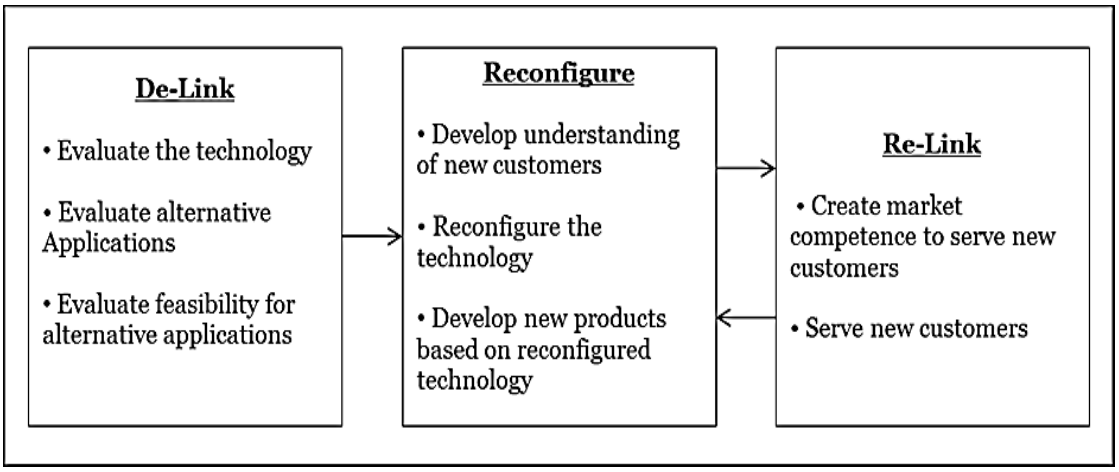

Figure IV-2: Leveraging Technology – Delink, Reconfigure and Relink

Further, going beyond product innovation i.e. technology-customer linkage (cf. Danneels 2007), ERPCo had exercised dynamic capability in areas pertaining to IT capability management, people management, relationship management and delivery management that became crucial in innovating and delivering the products as a service. It modified the human resource management knowledge and customer relationship management knowledge to suit the needs of the cloud model. It brought in appropriate changes in the implementation knowledge to suit the new context and serve the customer needs through short implementation cycles. IT process management knowledge was appropriately modified and extended to govern both the technical and service delivery aspects in the cloud model. It exercised second-order technical competence in creating new IT infrastructure resources to support hosting of products and protecting of customer interests through its Infrastructure Management Group. Creating, modifying and extending these resources and competences became necessary for ERPCo to effectively manage the link between technology competence and customer competence. Put differently, as depicted in Figure IV-3, these resources and competences became a virtual wrap governing the technology-customer linkage.

More specifically, each of these resources/competences was delinked from the traditional ERP context and was reconfigured before relinking to the cloud-based ERP context. ERPCo reconfigured its IT capabilities by adding infrastructure management before relinking them to the new customer needs. Similarly, human resources were delinked from the traditional ERP context, were reoriented towards cloud-based product development and sales and were relinked to develop products and sell them effectively to the cloud-based customer markets. Further, the IT process knowledge was delinked from the traditional ERP context, reconfigured to add new IT processes and aptly revise extant processes before relinking to the cloud-based IT development context. Finally, the implementation knowledge was also delinked from the long cycles orientation in traditional ERP, reconfigured to enable quick implementation cycles and was relinked to implement the products faster in the cloud-based

market. In sum, ERPCo's competence leveraging and competence building showed that in addition to handling the technology-customer linkage as in product innovation, it is vital to develop resources and competences that govern administering this linkage towards product-service innovation.

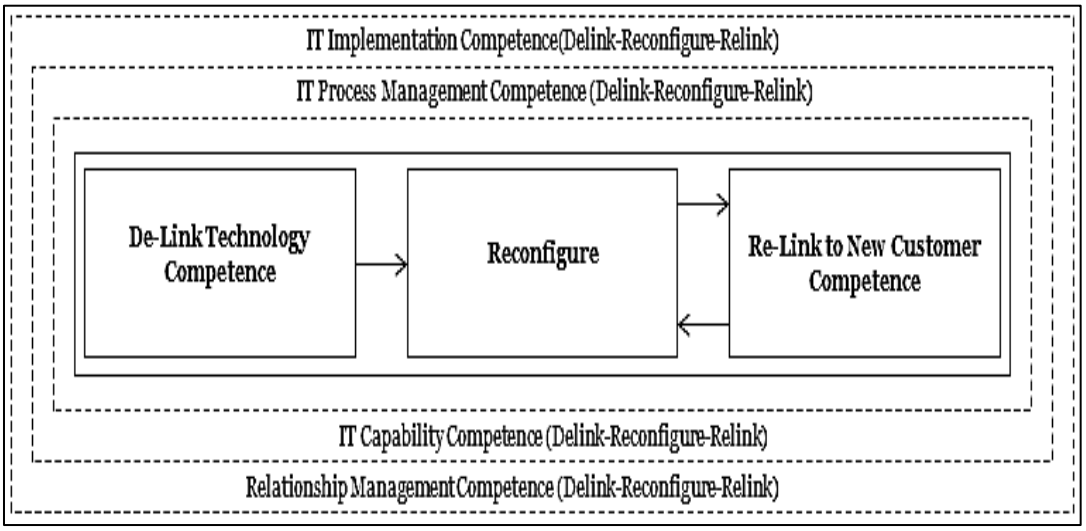

Figure IV-3: Governing the Technology-Customer Linkage

Two questions need to be asked about ERPCo's organizational design: What made ERPCo successfully manage resource alteration during transition? Were the benefits just about organizing for external markets or were the benefits internal too? My findings suggest that ERPCo could revise the resource base as it fostered fungibility wherever possible and second-order competences wherever needed. This was facilitated as ERPCo seeded its organizational elements with generative properties and the generative properties in existing competences of traditional ERP could seed new competence building for cloud-based ERP (Garud et al. 2006). For example, ERPCo historically invested resources in IT process methodologies for its software development activities. When ERPCo had to tap into the cloud-based market, it could leverage the IT process discipline to reuse or create IT processes for cloud-based product development and delivery. It could quickly create processes and metrics specifically needed for cloud-based model (e.g. ISAE 3000/3402). Hence past process orientation proved generative when the firm needed to change. Similarly, its historical approach to technologies and

IT processes enabled quick transition of human resources to work on cloud-based product development and implementation.

In addition, these abilities were beneficial to address several rigidities in organizational design. My case data provides support that ERPCo could address several internal rigidities related to technical inflexibility, process inflexibility, path dependency and competence traps. First, ERPCo's investment in technology platforms helped to address technical inflexibility. When organizations optimize their internal technologies to suit a particular context, the technical flexibility to suit new contexts and to dynamically evolve the technologies to match changing business requirements attenuates (Garud et al. 2006). Organizations may get mired in the successes, may develop inertia and hence the reluctance to invest in building flexibility into the proven technologies. Further, when firms view technology investments through the narrow lens of financial techniques like discounted cash flows and net present value, firms may not see the financial incentive for further investments in them as these techniques do not recognize the real options value of building flexibility into the extant technologies (Baldwin and Clark 2000). At ERPCo, however, when opportunity arose from cloud-based market, ERPCo's continued investment in the SOA-Platform over the time has fostered the technical flexibility and became fungible to build new products by quickly assembling the components needed to create a solution for the new market and reduced the time-to-market.

Second, rigidity in the processes can surface and processes can become inflexible when efficiency is the key benchmark in process design (Nelson and Winter 1982). For instance, rules and routines designed to enhance efficiency typically attempt to reduce deviations in the process workflows. With time, these rules and routines evolve to be well-entrenched and become inert and hard to change (Garud et al. 2006). Such firms rely on old frameworks and misunderstand the new opportunities and threats developing. Hence they create limitations to the organization's ability and agility to identify and respond to new opportunities and threats rising from the external environment (Henderson and

Clark 1990). However, ERPCo needed a standard, consistent way of doing things. So it began with the CMMi initiatives to build the basic processes to guide software development. Once the company reached a specific maturity level, metrics built into the framework triggered actions enabling the firm to climb up to a higher maturity level (Garud et al. 2006). This process journey seeded generative properties through enabling processes and metrics to guide and govern each step of their software development activity and ERPCo could transfer this process-driven culture into cloud-based product development.

Third, adding new competences to the firm's stock is important for continuing to thrive and also successfully addressing the changes in the external environment (McGrath 2001). Firms face path dependencies as they try to develop new competencies and the domains of competence developed in the future are influenced by historical choices (Teece et al. 1997). Firms follow a certain trajectory of competence development based on history and this path may define the current choices available to the firm and may also constrain the shaping of extant and new competences in the future. The extant resources commit the firm to a certain domain of activity (Dierickx and Cool 1989; Ghemawat 1991). In such a scenario, second-order competences are important because they may help the firms to mitigate path dependencies in new competence development and escape the traps and inertia from the current competences (Danneels 2007; Danneels 2010). ERPCo fostered second-order customer competence by creating new knowledge about the customers and a second-order marketing competence to transact with them. It provided the firm a competence at explorative learning by exploring new markets. Successful resource redeployment became contingent on the new customer competence it developed. Further, the ability to create new customer and marketing competences helped to avoid the customer competence trap of serving only the current customers and the marketing competence trap of lack of ability to access new customers. In sum, the generative properties in organization design and the ability to create higher order competences were what enabled ERPCo manage the changes in organization functions for the cloud-model. Understanding ERPCo

from a competence perspective explains the competences, the way to link them and the way to leverage them when product-service innovation has to become a dynamic capability. It also provides insights into how competency building can address organizational rigidities during reorientation.

IV-7. Contributions

The contributions of this study are multi-fold. For research, first, this is one of the first studies in an empirical setting to understand specifically the impact of cloud computing architectures on vendor organizations. It provides insights into the changes in product design, development, implementation and customer orientation that vendors need to take into account while defining their business model. My research setting provides a richer context to examine the changes between a traditional product model and cloud-based business model, thus providing comparative insights. I believe the set of technology and market related elements covered in this study provide a comprehensive checklist as the firm had been a traditional product vendor for more than two decades and had significant inroads into the cloud market. Second, through the lens of dynamic capability theory, this study examines the resource allocation and resource transformation needed in vendor organizations to create viable products and proportional services to succeed in this marketplace. By explaining the modes of alteration of resource base, this study provides a rich understanding of how exercising dynamic capability enables firm transformation. Third, this study builds on product innovation research to explicate the complementary resources needed in leveraging the technologies in a product-service innovation context. It highlights the role of fungibility, second-order competence and the importance of generative properties in organizational elements to leverage and create assets to address changes in the external environment.

For managers, first, this study provides a comprehensive list of key functions and resource needs that they should consider when competing in the cloud market. While I caution that it all depends on the vendor's organizational

maturity; creating fungible technical, process and people resources will be key to manage transformation. In ERPCo's case, it can be noted that the development process supported by a SOA-Platform and strong process orientation were key in creating new competences and leveraging existing competences. Second, opportunity recognition does not itself lead to the realization of those opportunities and technology leveraging depends on connecting it with customer competence. However, my study explains that the effectiveness of the technology-customer linkage is contingent on the complementary governance mechanisms in place. Firms should evaluate their processes related to relationship management, people management and delivery management and ensure that the incentive structures are revised as necessary to maximize value from technology-customer linkage.

IV-8. Limitations and Future Research Directions

This study has its limitations which can be potential areas for future research. First, the case study research method may lead to some context-specificity in the findings. However, the overall choice of the factors I covered in my analysis is not limited to one company. For example, the findings regarding faster implementation of cloud-based solutions had ample anecdotal evidence and my study validated it in an empirical setting. Future research may analyze multiple cases of success and failure which may provide rich insights into why some firms succeeded or failed despite resource revision. There might the role for factors like organizational inertia that impact the effectiveness of resource alteration. Second, my research setting provided scope to study the changes in a co-located situation and could supply rich information about changes comparative to traditional model of software development and delivery. However, understanding the process of resource alteration in a green-field company might provide similar or contrary results. I caution that observing all modes of resource alteration may not be possible in such a case. Third, my choice of ERPCo was a very comprehensive setting where several aspects of product design, development and implementations of large scale systems like ERP were

examined to compare how they change for the cloud-based context and what capabilities do firms need to create. However, there may be other product firms which may be hosting standalone software on the cloud which may not require such extensive reorientation of technical and business functions as in cloud-based ERP. Understanding the dynamics of organizational change in such a context needs further investigation. Further, changes in ERPCo's products, implementation strategy and supporting resources were oriented towards tapping SMB firms which traditionally did not have structured IT capabilities in-house. My framework can also be extended to understand the changes needed in vendor organizations that intend to serve customers with legacy IT assets and processes. Understanding the changes in such vendor organizations will be another avenue for future research.

IV-9. Conclusion

The extant research on cloud computing suggests that customers decide to procure IT services from vendors due to the inherent IT elasticity in the model, variable pricing structures, efficient usage of IT capabilities and ubiquitous access to these applications. While the customers' cloud-sourcing decisions and benefits of this phenomenon were studied in literature, the vendor's perspective received limited attention to my knowledge. It is not clear what capabilities do vendors need and how do they configure resources to deliver per the promise of the cloud computing model. In this study, I conduct a systematic examination of the implications of cloud computing architectures from the vendor's perspective and how the internal functions and resources should be configured to tap the cloud-based software market. My findings suggest that vendors should characterize their technical functions to develop and deliver products in short cycles and the internal technical, process and human assets become crucial to leverage while addressing this change. The possibility to make expensive applications accessible to a broader set of customers implies that vendors need to develop new understandings of the customers. Further, the analysis of capabilities in customer organizations suggests that cloud computing provides an enormous opportunity

to create value in customer organizations through appropriate resource building and resource leveraging in the vendor organizations.

IV-10. Appendices

IV-10.1. Appendix – A: Defining Characteristics of Cloud Computing

Cloud computing is emerging as a delivery model for software applications, platforms and infrastructure as a service (Armbrust et al. 2009). The computing resources accessed as a service in the cloud computing based models have four defining characteristics - (1) *Ubiquitous Connectivity and broad network access* – capabilities are available over the network and can be accessed through standard mechanisms that promote use by heterogeneous platforms like laptops, PDAs, mobile phones, tablets etc. (Armbrust et al. 2009) (2) *Centralization of resources by resource pooling* – vendors pool their computing resources to serve multiple customers using a multi-tenant architecture model, with different IT resources dynamically assigned and reassigned based on each customer's demand (Marston et al. 2011). Services can be accessed anytime anywhere. Customers may not know the exact location of provided resources but may be able to specify the location at a higher level of abstraction. For example, customers have the option to specify that their data should reside in geographic boundaries if there are compliance requirements. (3) *IT elasticity* – Cloud computing allows to add or remove resources at a fine-grained level and with a lead time of minutes rather than weeks allowing matching resources to workloads much more closely (McAfee 2011). For example, subscribers can add or remove connections to servers provided by vendors, one server at a time. The elasticity in the model eliminates the need for the customers to plan ahead for provisioning. (4) *Measured Service* - Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be

monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service. This implies that customers pay for the service as an operating expense without incurring any significant initial capital expenditure (Armbrust et al. 2009). These four factors collectively signify that there is an evolving model of service delivery wherein (a) IT applications which were earlier accessible only to large organizations can be made accessible to smaller organizations by deploying with the vendor and making them available without capital expenditures (b) customer organizations have the flexibility to use IT capacity and pay only for what they use and (c) vendors can generate economies by efficiently pooling resources and delivering them on demand.

IV-10.2. Appendix – B: Interview Guide

Table IV-1 below provides an overview of the areas of inquiry and the key questions in each area of inquiry.

Table IV-1: Interview Questionnaire

Area of Inquiry	Key Questions
Respondent Background	• Please tell me about your role and experience in the organization • Please tell me about your professional background
Market Characteristics	• Please tell me about the company's overall history and structure • What are the company's major markets? • What are the company's major modules of ERP? • What was the target market for SAAS-ERP? • How did you determine what should be included in the product? • What do you think is required to expand in these markets? • Can the customers already have an ERP and still subscribe to yours? What does this mean if they already have an ERP?
Customer Characteristics	• How do these firms differ from what you served in traditional ERP? • What are the typical customer profiles? What are the profiles of the end-users in these organizations? • How technical are the people in this organization to understand and use an ERP? • How did you get the technical liaison? • How will be the process activities in these organizations? • What is the appetite for ERP? Can these firms match up to the functionality of ERP or will they be overburdened? • You have some entry products if someone wants to test your ERP. What are they? Please explain. • How will they graduate if they want to move from entry products to

	SAAS-ERP?
Product Design	• How did you start the product design? • How did you decide on the modules? • How about the usability aspect of the product? • Was the traditional ERP product you have useful? • Did you borrow anything from the traditional ERP in terms of features or functionality? • How does single instance hosting affect design? • What did you do to ensure it is not a stripped down version of the product? • How do you accommodate changes in the product? • How do you handle customizations of the product? • I heard about the extension kits and portlets. What are they? How do they fit into product functionality • How do you ensure compliance across geographies as there are different accounting practices? • What is the future vision for the product? • Do you integrate analytics as you have products in that domain?
Product Development	• What did you take from the traditional product? • How is the development different in SAAS-ERP? • What is the implication of single instance hosting? • Are there any special testing requirements? • How do the employees follow methodologies? • Please explain in detail about the SOA-Platform. • How do you leverage SOA-Platform for building SAAS-ERP functionality? • What is the BISOA-Platform? How does it relate to SAAS-ERP? • How do you handle enhancements to the product? • How do you prioritize enhancements to the product?
Human Resources	• What were the changes in the HR function? • Did you see any challenges when SAAS-ERP team had to be created? • What is your role in partner selection? • Did you see any cases where someone does not want to be in SAAS-ERP or someone wanted to be in SAAS-ERP?
Relationship Management and Contract Management	• How did finance & costing change in SAAS-ERP? • What is the tax structure when you are selling SAAS-ERP? • ERPCo historically invested in R&D. What other costs did you incur for SAAS-ERP? What are your ongoing costs? • What do you see as the difference in relationship management? • How do you deal with so many customers in the new model? • How do you coordinate with your partners? • What is the payment collection process in SAAS-ERP? Are there any changes? • What is the difference in contract management? • When you have to work with so many customers, how do you administer the contracts? Please explain the complexity in contracts management?
Process Management	• What did change with SAAS-ERP? • What additional process do you need? • What is SAS70 (found during interviewing that SAS70 was named as ISAE)

	• How did you get assessed for ISAE? What do you need to put in place to get assessed successfully? • Have you withdrawn any processes? • Are there additional requirements as now you have to handle development, infrastructure, implementation and maintenance? • What is the role of process management for infrastructure? • I know you are CMMi assessed. How is CMMi useful? • Are there any changes to CMMi with respect to SAAS-ERP? • How do you get audited for SAAS-ERP?
Infrastructure Management	• What did you have to learn in this domain? • When a customer signs-up, how do you set up his environment? • How do you ensure that SLAs are obtained? • Please explain the security aspects of service provisioning. • How do you ensure authentication? • How do you prevent unauthorized access? • What are your disaster recovery procedures? • What are your policies about data management? How will your customers get data if they unsubscribe? • Please explain what you do about ISAE in your group?
Implementation	• What is the change you see in implementation? • How do you initiate the implementation process? • Traditional ERP has long cycles like BPR. How does it appear in SAAS-ERP? • How do you handle customization requests? • What will you do if many customers are asking for the same feature? • What is the support you provide to implementation partners? • How will you handle maintenance after the customization? • What are the challenges in implementation? • Please explain the training phase. • What is the role of organizational factors like senior management commitment, user education and stakeholder involvement etc., which were often cited as critical success factors in traditional ERP? • How do you configure to talk with any other systems the customer has?
Marketing	• How does the ERPCo brand help? • Please explain about the partner ecosystem. • What other service providers did you need to take SAAS-ERP close to the customers? • Please explain about community clusters. • What marketing strategies do you follow for mass marketing? • How do you advertise the product? • How will the process of lead generation and lead conversion happen? • What challenges do you face in sales? • Please explain the customer exit procedures.
Summary	• How do you evaluate performance in each major market? • Please explain how you plan to address concerns about local laws? • What is the future product vision? Do you plan to include other technologies into product that help integration easier? • What are the future strategic plans of the company?

IV-10.3. Appendix – C: Interviewee Profiles and Duration of interviews

Table IV-2 below provides an overview of the sources of data and the profiles of the interviewees from ERPCo and partner organizations.

Table IV-2: Profiles of the Interviewees

Interviews within ERPCo		
1	Vice-Chairman and Managing Director	1 hour
2	Chief Operating Officer	1 hour
3	Chief Knowledge Officer	2 hours
4	Senior Vice-President, SAAS-ERP	1.5 hours
5	Vice-President & Chief Architect, SAAS-ERP	5 hours
6	General Manager, SAAS-ERP Product Development	5 hours
7	General Manager, ERPCo CRM Products	1.5 hours
8	Manager, SAAS-ERP Product Development	2 hours
9	Executive Vice-President, Marketing	40 minutes
10	General Manager, SAAS-ERP Sales	1.5 hours
11	Senior Manager, SAAS-ERP Sales	1.5 hours
12	Manager, SAAS-ERP Sales	1 hour
13	Public Relations Analyst, SAAS-ERP	2.5 hours
14	Vice-President, Human Resources	1 hour
15	Head, Talent Management	1 hour
16	Manager, Human Resources	1 hour
17	Vice-President, Finance	2 hours
18	Senior Manager, Finance	30 minutes
19	Chief Consultant, Implementation	6 hours
20	Senior Consultant, Implementation	3 hours
21	General Manager, Implementation	3 hours
22	Senior Manager, Implementation	2 hours
23	Vice-President, Analytics	1 hour
Interviews with ERPCo's Partners & Customers		
24	Client Services Manager, Business Partner Organization# 1	1 hour

25	Project Manager, Business Partner Organization#2	30 minutes
26	Chief Executive, Customer Organization# 1	1.5 hours
27	Finance Manager, Customer Organization# 2	1 hour
28	Implementation Manager, Customer Organization# 2	1 hour
29	Non-interview data	ERPCo internal documents, ERPCo public documents, Press Articles, White papers and other public materials about competition.

Note: The above times were for total interviewing with a stakeholder conducted in 1-3 phases.

IV-10.4. Appendix – D: Methodological Approach for Data Collection & Analysis

Table IV-3 below provides an overview of the methodological stance for the study.

Table IV-3: Research Methodology Approach

Aspect of the study	Methodological considerations	Description	Additional Explanation
Organization choice and entry	Defining the selection criteria to select a suitable organization for examining the phenomenon of interest	An organization has to be chosen as a representative organization where the phenomenon of interest is observable and can be studied thoroughly to understand the phenomenon as well as derive insights and implications (Patton 1990; Flick 1998)	ERPCo was chosen because of (1) Extensive access to individuals at multiple levels (2) ERPCo developed capabilities in delivering cloud-based IT products and services (3) The organization delivering high-end applications like ERP under the cloud-based model demonstrating democratic access to high-end IT capabilities (4) Where old and new business models co-exist so that appropriate comparisons can be drawn to understand the technology and

			organizational redesign needed to suit the evolving cloud-based business model.
	Entering the field with Credibility	Legitimacy and credibility created for the researchers due to 'known sponsor approach' (Patton 1990; Sarker and Sarker 2009).	• The Chief Operating Officer sent an official email to other senior executives • As a follow-up, the Chief Consultant of Implementation who is a senior executive in the organization introduced the research project and the researcher to relevant stakeholders and set up meetings and interviews.
		The researcher is not only the "observer" but also the "observed," i.e., organizational members tend to scrutinize researchers' actions, particularly in the initial stages (Patton 1990; Sarker and Sarker 2009).	A conscious attempt was made by me to develop and maintain an independent identity to ensure that I was not seen as an agent of management. I maintained credibility by being well prepared for the interviews and by preserving anonymity of the organization, technologies, business rules and knowledge gained during the research (Myers and Newman 2007).
Data collection	Choice of interviewees	Suitable respondents were suggested by the ERPCo senior management team and the Chief Consultant who himself is a senior executive helped set up the interviews.	I worked with ERPCo's Chief Consultant to arrange interviews with individuals at multiple roles, drawn from different business functions and different levels. This was to balance the width and depth of the perspectives from individuals across the organization.
		Using 'Snowballing techniques' as applicable (Patton 1990)	Respondents who can provide in-depth information were identified by other respondents (Sarker and Sarker 2009)
		Being sensitive to principles of: • "Flexibility" • "Non-direction" • "Specificity," and • "Range" (Flick 1998)	(1) Interviews were conducted per the availability of the interviewee. The meetings were rescheduled or shortened based on interviewee priorities (2) Interviews followed an open ended format with specificity included as required (Blumberg et al. 2008) (3) Specific questions were asked towards the middle of the interview (Flick

			1998). (4) Interview flow was regulated depending on the respondent's interest of elaborating on a specific topic. If the respondent's suggested that the question can be posed to another respondent, it was done so.
	Researcher involvement in the study	Data collection process involved longer engagements and persistent interactions (Flick 1998).	I was specifically involved in first having a set of conversations prior to field visit to understand the phenomenon and develop formative questionnaires and topics for field visit investigation. Field visit involved multiple interviews with various stakeholders over a three week period. It also included observing the work of the individuals; participate in meetings for first-hand observation and significant informal interactions with the participants.
	Maintaining empathetic Neutrality	"Nonjudgmental form of listening" (Walsham 1995; Zuboff 1988); empathizing with interviewees but simultaneously maintaining distance (Patton 1990)	The approach to interviewing was to be empathetic to the interviewees but being as objective as possible to record only the information relevant to the topic of the study.
	Collating and Consolidating the collected data	A case study database was created to store the raw material and the processed information (Dube and Pare 2003)	This database was used to store the interview recordings, interview transcripts, field notes, documents collected during data collection and any data collected from secondary sources about the market, the firm and its competition. Further, this database was used to store the coded data, the results of constant comparison, tabulations of categories identified and the documented findings from my research.
Data analysis and representation	Analyzing the data	• Reading the transcripts and identifying the patterns for coding. (Melville and Whisnant	• I conducted a careful reading of the interview transcripts, interview notes and other documents to gain a high level understanding of the

		2011) • Tabulating per the patterns identified (Dey 1993; Yin 2009; Melville and Whisnant 2011)	potential categories. • Coded the findings per the emergent categories according to an inductive process. • Text for each instance of a category was collated and tabulated by organizing per the category. The categories were combined, reorganized and refined during the process to consolidate the data and organize it systematically.
	Unearthing and refining concepts through constant comparison	Data were constantly analyzed to unearth and refine the concepts through constant comparison. The purpose of comparison is to examine if the data supports the emerging categories (Holton 2007: 277).	Used theoretical concepts to code the data and compare the categories by refining them iteratively. Induction process was predominant aid in the initial coding of data and formulation of different dimensions of resource alteration and matching them with changes in organization functions.
	Triangulation	Data were constantly compared to examine the responses across respondents, business units and levels (Charmaz 2000; Dube and Pare 2003; Flick 1998; Patton 1990).	The dimensions included were suggested by multiple respondents and were useful for collation, consolidation and comparison purposes.
		Lack of agreements in triangulation was used as an opportunity to interview again and explore the differing perspectives (Flick 1998).	Any disagreements or gaps identified were collated with other respondents in a back and forth interviewing process to examine the differences deeper. This helped to achieve a richer contingent understanding of the topics of discrepancy.
	Being suspicious about Evidence	Sensitivity to possible biases in interviews (Klein and Myers 1999; Sarker and Sarker 2009).	The interviews were conducted being empathetic that individuals in different positions and situations may bring different biases. The focus was only on objective information related to the phenomenon of interest. For example, when a customer had concerns about the terms of service and how ERPCo was structuring the pricing mechanisms, this information

			was treated with caution as it was private and not relevant to the study.
	Member checking	Validating/checking researchers' interpretations with interviewees (Flick 1998).	The interviewees were provided a copy of the interview guide and other research materials before the interview. For example, I presented a checklist highlighting the different dimensions of changes in business functions to all the interviewees with a provision to attach criticality to the elements in the questionnaire. I then assessed with them the validity of the dimensions through attaching criticality of the dimensions to the topic of interest.
	Being sensitive to ethical Concerns	Balancing anonymity and disclosure (Flick 1998).	Anonymity was ensured not to disclose the organization name, names of partners and customers, the specifics of the technologies and methodologies and any specific information about ERPCo and its products.
		Ensuring that the transcripts and other data were kept secure (Myers and Newman 2007).	The case database was accessible only to the researcher.
		Treating respondents, their knowledge, and their time with respect (Myers and Newman 2007).	The interview time slots were arranged according to the availability of the interviewees. In a few instances, the interviews had to be rescheduled due to contingencies at the customer site which were respected.

IV-10.5. Appendix – E: Summary of the Findings

Table IV-4 below provides an overview of the research findings and highlights the differenes between traditional ERP and SaaS based ERP as pertinent to areas of study.

Table IV-4: Summary of the Findings

	Traditional ERP	**SAAS-ERP**
IS Development Environment		
Design	• End-to-end functionality of the organizational business processes in large enterprises	• Common business activities in small and medium enterprises (SME)
	• Designed with the assumption that an activity is performed by multiple individuals across departments	• Designed with the assumption that a single individual may accomplish several tasks and roles
	• The base product allows customizations	• Limited overall customization possible with no changes possible to the base product.
	• ERP products designed with industry specific functionality	• Industry-specific verticalization not conceptualized into the product
	• Usability is emphasized but the users are traditionally tech-savvy	• The user base is not tech-savvy. Usability is the key to make the solution easy to learn and use
	• Product evolution is based on versions with earlier version decommissioned after new product versions are released	• Need to maintain different versions through a technique called 'extreme parameterization'
Development	• Development driven by agile methodologies but the functionality covers end-to-end business processes in large enterprises • Agile development practices to deliver functionality iteratively but the frequency of product upgrades is low	• Short cycles of product development to instantly deliver the functionality on the cloud-based installation • Componentized design allowed to put together business processes in SMB domain, test and deliver them to the system

	• Testing driven by testing developed features and testing the product installation upon customizations unique to each customer	• Product testing involves testing the features, their configuration for relevancy and irrelevancy to a pool of customers • Performance and load testing to ensure scalability of the system on-demand
Implementation	Extensive Business Process Reengineering (BPR) activities precede ERP implementation and together with requirements analysis form a separate project phase	No traditional BPR. Processes configured to the product.
	Long cycles of implementation ranging from 1-5 years. Ongoing maintenance upon completing the implementation handled by in-house IT or third-party teams which incurs additional expenditure under a separate project.	Short cycles of implementation ranging from 6-12 weeks. Ongoing maintenance handled by the vendor and is included in the monthly fee for services. 2-3 day training is provided for the key business users to use the system.
	Unique customization and long customization cycles - customization of product feasible up to 65% of the functionality	Minimal customization possible. Customization made possible reports, EDK and PDK
	Capital intensive to purchase, implement and maintain ERP	No upfront capital investment, one time small initial fee for implementation and ongoing monthly fee for services
	A large ancillary market of systems integrators and consultants to handle implementation after the product was procured from the vendor.	Vendor or a vendor's designated implementation partner handles implementation and ongoing maintenance within the set fee.
	Separate departments and key personnel in each department of the customer firm to work with vendor implementation teams and be in charge of each module implemented	Small organizations wherein 5-6 people become the key users, liaisons with the vendor and play multiple roles
Organizational Environment		
Marketing	• Sale is to the organization and marketing efforts are targeted at senior executives in organizations.	• Sale is to business and hence there is a need to target as many businesses as possible. Mass marketing methods employed for outreach.
	• Benchmark the target market against other ERP vendors	• Create new knowledge about target market

Contract Administration	• Document-intensive contract process guided by legal counsel	• One page template and an online agreement with no legal counsel required. Ongoing payment collection on a monthly basis with more chances for default
Process Improvement and Infrastructure Management	• Quality Management for development and implementation activities guided by standard methodologies like Capability Maturity Model Integrated (CMMi)	• Quality Management for development and implementation activities guided by standard methodologies like Capability Maturity Model Integration (CMMI) • Needs new process improvement initiatives towards IT asset and data protection
	• Does not need any infrastructure as the ERP system is hosted on customer's IT assets inside the customer organization	• Vendor's infrastructure is used to host the application. Also, vendors have to get certified for data protection & security standards like ISAE
Human Resources	• Sales teams focused on selling to enterprises • Product development teams involved in large-scale product development • Implementation teams were involved in extensive implementation cycles	• Sales teams had to orient per the changing nature of business engagement and client stakeholder profile • Revised incentive structures to suit the nascent business model • Product development and implementation need to be tailored to develop and deliver in short cycles
External Environment		
Customer Profiles & Target Market	• Target market of Large Enterprises	• Target market of SMB
	• Using disparate IT systems but have need for an integrated IT solution	• Using no IT or a standalone system for a function like financial accounting.
	• Sale is to the Chief Information Officer and the IT Department plays a key role in evaluating and procuring the system	• Sale is to the organization with key decision made by the Founder/CEO

	• IT Department coordinates ERP implementation and maintenance tasks	• No or Small IT Departments exist in the organization. The goal is to use a vendor and replace IT departments. Implementation and maintenance handled by vendor

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Chapter V. Summary and Conclusion

The goal of this dissertation was to contribute to IS research by systematically examining the emerging business model of cloud computing and the implications of its defining characteristics to customer and vendor organizations. Identifying a gap in past research, I attempted to empirically examine the value creation from the customer and vendor perspectives.

In the 'Chapter I – Introduction', I have provided a thorough explanation of defining and distinguishing characteristics of cloud computing models. I proposed that in line with past research, it is needed to examine the value creation from the organizational and individual role effectiveness standpoints to understand the success of this model in creating value. Further, I suggested that these architectures have implications for the vendors and hence understanding how the vendors reorient their business models to serve in the cloud computing market is important.

In Chapter II, I examined the impact of cloud computing technologies from the individual role effectiveness perspective with an emphasis on the Chief Information Officer role. With frequent emphasis in IS scholarship for the CIOs to be strategic, I argued that the inherent IT efficiency benefits of cloud computing mitigate the CIO time spent on operational task demands and instead allow him/her to focus more on strategic activities related to innovation and new product development. I also suggested that the organizational complementarities in business process and systems capabilities and learning from the past outsourcing experience of the firm augment this effect. Based on the data from 227 firms, my empirical findings showed that cloud computing adoption enables

CIOs to focus on strategic opportunities. I found that organizational complementarities in business process and systems capabilities augment this effect. A qualitative field study that included interviews with senior IT executives confirmed my empirical findings and I provided managerial insights based on my results.

In Chapter III, I examined the impact of cloud computing technologies from the organizational effectiveness perspective. My emphasis here was to systematically examine if these technologies create higher order benefits related to IT-enabled business innovation, contrary to the cost efficiency advantages often cited in practitioner literature. I build on business innovation literature and propose that among the different classes of cloud computing technologies, SaaS models can deliver higher order benefits to adopting organizations. I suggested that the IT elasticity inherent in the SaaS model will be instrumental to provide necessary IT support to business process flexibility as the agility in the business processes influences the innovation outcomes. Further, I investigated the impact of organizational complementarities in process management capability, IT architecture flexibility and past sourcing experience of the firm in enhancing the impact. Based on the data from 288 firms, my empirical findings showed that SaaS adoption can in fact be associated with IT-enabled business innovation in the firm. I also found that organizational complementarities in business process and IT architecture capabilities and past experience with outsourcing augment this effect. A qualitative field study that included interviews with senior IT executives confirmed my empirical findings. Synthesizing the results from quantitative and qualitative studies, I provided managerial insights about value creation at the organizational level.

In Chapter IV, I examined the implications of cloud computing architectures for the vendor organizations. Working through the revelatory case method, I examined the changes in the organizational business functions of a vendor organization set in the unique context of delivering ERP software through SaaS. I examined the resource reconfiguration in this firm in terms of what and

how resources were created, modified and extended when the firm had to reorient itself to serve the cloud-based software market. The findings of the study emphasized the need for creating new market understanding and the role of partnerships in developing the scale in the cloud-based market. Further, I found that firms need to modify and leverage their internal technical, process and people resources in effecting changes in product development, marketing and relationship management.

Taken together, the findings of Chapters II and III are important to bring to the fore the true benefits the cloud computing technologies can deliver and my findings highlight the transformational value of this technology model for individuals and organizations. The findings of Chapter IV are important to highlight different dimensions of change needed in the vendor organizations to prepare and compete in the evolving cloud computing markets. In sum, my dissertation is a systematic attempt to shed light on the strategic business benefits of cloud computing and the enablers of value creation from the customer and vendor perspectives.