CLOUD IMPLEMENTATION IN ORGANIZATIONS: CRITICAL SUCCESS FACTORS, CHALLENGES, AND IMPACTS ON THE IT FUNCTION

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by

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ABSTRACT

Organizations have been forced to rethink business models and restructure facilities through IT innovation as they have faced the challenges arising from globalization, mergers and acquisitions, big data, and the ever-changing demands of customers. Cloud computing has emerged as a new computing paradigm that has fundamentally shaped the business model in terms of how IT services are developed and delivered. A lot of conversations about cloud technologies can be observed in blogs, workshops, magazines, and industry reports, but there seems to be a paucity of either research or formal theorizing with respect to cloud computing implementation in organizations.

This dissertation develops a new theoretical framework with which to conceptualize the bidirectional relationships between IT departments and cloud computing implementation. The research seeks to achieve two key objectives. The first is to examine the factors that influence the success of cloud computing implementation in organizations. For this objective, a qualitative study using interview data and grounded theory was conducted. A taxonomy of both the Critical Success Factors (CSFs) and the challenges facing cloud implementation is developed, drawing on theories from organization and management studies. The study on CSFs and challenges indicates that a successful cloud computing implementation not only calls for a good understanding of cloud technologies, but requires a lot effort in, for example, mobilizing internal and external resources; dedicated architectural design; overcoming organization-specific challenges; and addressing political and cultural issues arising inside the IT department. The second objective is to investigate the impacts of implementing cloud computing on the IT function. To achieve this objective, a case study of two community cloud models was conducted. The study has identified a range of areas where the IT function can be impacted as a result of cloud implementation. These areas include the role and functionality; IT leadership; skills and jobs; IT staffing; formal structure; and workplace culture. Propositions with specific observations are provided to show how the IT function can be shaped in each affected area.

This dissertation contributes to the literature by extending extant CSF theory into the novel context of cloud computing implementation. It also develops new mid-range theories on IT-enabled organizational change by exclusively focusing on the overlooked effects that an IT
innovation can bring about within the IT departments. In addition, this research offers a number of actionable strategies for practitioners regarding how to make cloud implementation successful, and it highlights the importance of anticipating the potential business impacts of cloud computing on IT departments.
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ideas and constructive feedbacks. She motivated me to get the best mileage out of the data. She always has an amiable smile on her face. It was a pleasure to work with her.

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Chapter 1. INTRODUCTION

Globalization, mergers and acquisitions, tremendous amounts of electronic data, and ever-changing customer demands have created a proliferation of intensive information-processing issues. These challenges require organizations to rethink their business models and structures, and these changes need to be facilitated by innovations in IT. In order to gain a competitive edge, organizations are forced to move forward to be more flexible, efficient, and innovative.

The emergence of cloud computing provides a promising solution for the challenges that confront modern enterprises. It is characterized by utility computing and web-based services, and while the technology is not new, the business model that it uses substantially impacts how IT resources and capabilities can be used to support business operations. Cloud computing is widely popular with small business startups because it allows new services to be created quickly without a large upfront investment, and it enables big firms to concentrate on their core business without worrying about scaling, failure, and the maintenance of computing capabilities. It has become a key strategy for IT vendors, information service providers, telecom service providers, and governments (e.g. Apps.gov in U.S. and “The Kasumigaseki Cloud” in Japan).

1.1 Cloud Computing Definitions

The origin of cloud computing can be traced back as early as the 1960s when John McCarthy proposed the idea of computation being delivered as a public utility\(^1\). This idea faded in the 1970s because the technologies were not yet ready. In 2006, Google’s CEO, Eric Schmidt, publicly uttered the term "cloud computing" and his use of the term triggered a wide discussion within the information technology industry. The term “cloud,” which is a metaphor for both the Internet as a whole and applications that are hosted within it, offers businesses the opportunity for scalable and virtualized control over their organization’s information system infrastructure\(^2\).

Cloud computing has been defined in a variety of ways, each stressing different aspects of the concept. The definition of cloud computing developed by Buyya et al. (2008) highlights the


\(^2\)MPS 2009 survey on “The Future of Cloud Computing”
relationship between service providers and cloud service users. They defined cloud computing as a parallel and distributed system consisting of virtualized computers that are dynamically provisioned as unified computing resources based on service-level agreements negotiated between a vendor and its customers. Staten (2008) adopted a relatively narrow definition in which cloud computing is viewed as a pool of scalable and abstracted computing infrastructure for hosting end-user applications capable of being billed on the basis of consumption. From the business model perspective, Armbrust et al. (2009) refers to cloud computing as the applications delivered as services over the internet rather than the hardware and systems software in the data centers.

In this study, I employ the comprehensive definition of cloud computing as used by the National Institute of Standards and Technology (NIST). NIST defines cloud computing as “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” By this definition, cloud computing is not only an evolution of computing technology, but also a new business model for delivering IT-based solutions (Iyer and Henderson 2010). Cloud computing evolves from several precursors such as grid computing (Channabasavaiah et al. 2003; Srinivasan and Treadwell 2005), web services (Berbner et al. 2005), and utility computing (Rappa 2004). As a new business model, cloud computing has changed businesses in several ways—eliminating upfront IT investment costs and the need to maintain in house data centers—but the most significant advantage of cloud computing is cost reduction.

Cloud computing is characterized by a number of capabilities and attributes. Table 1 summarizes some key characteristics from the academic literature and industrial reports of research institutes. These characteristics distinguish cloud computing from other information technologies and show cloud computing to be far more than a simple buzzword.

<table>
<thead>
<tr>
<th>Table 1. Key Characteristics of Cloud Computing</th>
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<tbody>
<tr>
<td>Characteristic</td>
</tr>
<tr>
<td>On-demand service</td>
</tr>
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</table>
Ubiquitous access | Services can be accessible over the internet. | Armbrust et al. (2009), Mell and Grance (2011)

High elasticity and scalability | Computing capabilities can be elastically provisioned, and dynamically scaled up or down with demand. | Mell and Grance (2011), Qian et al. (2009)

Pay-per-use | Users are charged for actual use of service instead of by subscription. | Armbrust et al. (2009), Staten (2008)

Location independence | Users can access data and services without knowing its physical location. | Iyer and Henderson (2010)

No upfront commitment | Organizations can start small and increase resources as needed | Armbrust et al. (2010)

The NIST delineates three cloud computing service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Similarly, Iyer and Herderson (2010) classified cloud computing vendors based on different levels of abstraction. Vendors at the infrastructure level, such as Amazon, provide basic computing resources such as dedicated servers, memory, and storage. Vendors at the platform level, such as Microsoft and IBM, provide a development environment which allows users to create new applications. Vendors at the software level, such as Google and Salesforce.com, offer on-demand software rental. It is worth mentioning that SaaS is different from the ASP (application service provider) model in that SaaS is able to achieve economies of scale by providing one-size-fits-all solutions³.

Cloud computing represents a new fashion in the IT industry. A growing number of companies have labeled themselves as cloud service providers. Among the first of these was the Amazon Elastic Compute Cloud (Amazon EC2). As an early entrant, Amazon is currently the largest provider and market share winner in this market. Table 2 lists some of the major cloud service providers with divided into the three NIST service models. Cloud computing applications have been developed for the need of many areas such as scientific research, healthcare, R&D projects for testing new services, applications and design models, low-priority business applications, and web-based collaboration services (Hand 2007; Staten 2008).

³http://www.cio.com/article/109704/Software_as_a_Service_SaaS_Definition_and_Solutions
Table 2. Cloud Computing Services

<table>
<thead>
<tr>
<th>Service</th>
<th>Vendors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IaaS</td>
<td>Amazon</td>
<td>Elastic Compute Cloud (EC2) virtualized cloud infrastructure; Simple Storage Service (S3) cloud storage;</td>
</tr>
<tr>
<td></td>
<td>VMware</td>
<td>Vblocks: helps business customers build out clouds based on Vblock packages.</td>
</tr>
<tr>
<td></td>
<td>Rackspace</td>
<td>Rackspace Cloud: Cloud Sites, Cloud Servers, Cloud Files.</td>
</tr>
<tr>
<td></td>
<td>Joyent</td>
<td>Joyent Accelerators (virtual servers)</td>
</tr>
<tr>
<td></td>
<td>3Tera</td>
<td>AppLogic: provides infrastructure solution</td>
</tr>
<tr>
<td></td>
<td>Google</td>
<td>A platform for developing and hosting web applications in Google-managed data centers; supports Python and Java.</td>
</tr>
<tr>
<td></td>
<td>VMware</td>
<td>vCloud: manages applications within private clouds or has them federated on-demand to partner-hosted public clouds.</td>
</tr>
<tr>
<td></td>
<td>Salesforce.com</td>
<td>Force.com Platform (Custom Cloud 2, Development Platform)</td>
</tr>
<tr>
<td></td>
<td>Microsoft</td>
<td>Azure: a Windows-as-a-service platform consisting of the operating system and developer services</td>
</tr>
<tr>
<td></td>
<td>Joyent</td>
<td>OpenSolaris</td>
</tr>
<tr>
<td></td>
<td>IBM</td>
<td>Blue Cloud computing platform: enhances software development and delivery capabilities, particularly in large companies</td>
</tr>
<tr>
<td></td>
<td>NetSuite</td>
<td>SuitCloud: offers on-demand products, development tools, and services</td>
</tr>
<tr>
<td></td>
<td>3Tera</td>
<td>Cloudware: offers applications and storage.</td>
</tr>
<tr>
<td></td>
<td>Google</td>
<td>SaaS: Web-based communication, collaboration, &amp; security applications including Gmail, Google Calendar, Google Talk, and Google Docs.</td>
</tr>
<tr>
<td></td>
<td>Salesforce.com</td>
<td>CRM (Sales Cloud 2, Service Cloud 2)</td>
</tr>
<tr>
<td></td>
<td>NetSuite</td>
<td>SuitCloud: offers on-demand products, development tools, and services</td>
</tr>
</tbody>
</table>

Notes: IaaS—Infrastructure as a Service; PaaS—Platform as a Service; SaaS—Software as a Service.

From the perspective of service boundaries, cloud computing can be categorized as public clouds, community clouds, private clouds, or hybrid clouds (Table 3). It has taken some time for traditional IT professionals to both comprehend the benefits of, and establish trust in the concept of cloud computing. Thus, the main users of public cloud computing are small businesses and startups that don’t have a legacy system to manage or integrate (Staten 2008). It has also proven fruitful to the innovative companies that have taken the initiative to use it. The underlying
rationale is that they want to concentrate on core businesses by obtaining IT capacities from public clouds. One successful example is *The New York Times*, which uses Amazon EC2 and Amazon S3 for its online archives⁴. However, most big information and communication technology companies build their own private clouds. For instance, IBM, HP, Dell, and CMCC (China Mobile Communication Corporate) have all built private clouds. Google’s App Engine and Amazon’s Elastic Compute Cloud are hybrid clouds because they provide services for both public and private use.

| Table 3. The Service Boundaries of Cloud Computing |
|---------------------------------|---------------------------------|---------------------------------|
| **Type**                        | **Description**                 | **Reference**                   |
| Public Cloud                    | The cloud infrastructure is available to the general public and is owned by a cloud service vendor. | The NIST Definition of Cloud Computing (Mell and Grance 2011) |
| Community Cloud                 | The cloud infrastructure is shared by several organizations within a specific community that shares a common mission or set of concerns. |                                  |
| Private Cloud                   | The cloud infrastructure is provided solely for a single organization and is maintained by internal data centers or third parties |                                  |
| Hybrid Cloud                    | The cloud infrastructure is a combination of two or more cloud models. |                                  |

1.2 The Vision and Reality of Using Cloud Services

Cloud computing has been on the strategic agenda of a growing number of companies because it provides solutions for the specific challenges confronting organizational IT departments. These challenges include the difficulty of capacity planning, the dilemma of balancing time to market against asset utilization, and the business requirement to build IT Infrastructure without detailed business plans and without budget approval (Staten 2008). These issues relate (to some extent) to maintaining in-house data centers or on-premise software applications. As a new IT outsourcing model, cloud computing offers an alternative with two major benefits.

First, using cloud services has significant economic advantages. Cloud computing has the capacity to significantly reduce costs by eliminating both the need for up-front capital investment, and by reducing the necessity to maintain proprietary infrastructure (Jaeger et al. 2008). The pay-as-you-go model converts capital expenses to operating expenses and allows capital to be redirected toward investment in core business (Armbrust et al. 2009). Another reason for its economic advantage is that cloud service providers have extraordinary negotiating power when it comes to hardware pricing, software licensing, and support contracts. For example, Amazon costs $70-$150 per month fully burdened for a server versus an average of $400 per month for an in-house server (Staten 2008). The second benefit is elasticity. Cloud computing can accommodate new services within hours rather than weeks, and can handle workloads closely by dynamically scaling up or down. Armbrust et al. (2009) cited Target and Amazon as examples to show elasticity benefits for both start-ups and well-established large companies: while other retailers have severe performance problems during Black Fridays, Target and Amazon’s sites were only slower by 50%. This example also suggests another benefit of cloud computing: risk transference, especially the risk of over- or under-provisioning.

Along with the benefits of cloud computing discussed above, there are concerns and uncertainties that hold back current organizations from taking it on board. Jaeger et al. (2008) outlined some of the potential policy issues presented by cloud computing including privacy, security, reliability, access, and regulation. Reliability raises significant problems when service disruptions occur, or data integrity and accuracy is compromised. Security, privacy, and anonymity are the most pressing concerns for cloud users considering the possibility of the unauthorized release of sensitive information, or having content monitored by third parties. Access and usage restrictions may be problems for cloud providers because they have to worry about intellectual property violation and other illegal use by some users. Rochwerger et al. (2009) analyzed factors that mobilize cloud computing as a general-purpose public computing utility, including: ever-advancing hardware and software technology; the continued penetration of internet access; diminishing security and trust concerns on the part of users; and the ubiquity of visualization. In opposition to these drivers, organizations may also face obstacles in the adoption of cloud computing. These obstacles can essentially be categorized into either technical or organizational obstacles (see Table 4). It is argued that some of the technical obstacles may only be valid for a certain time period (e.g. the early stage of cloud computing) but are by no
means insurmountable in the future. For instance, the lack of interoperability (Rochwerger et al. 2009) between cloud providers will be solved as cloud computing evolves over time, and standards and protocols for improving interoperability will be developed.

| Table 4. Obstacles to the Growth of Cloud Computing |
|---------------------------------|---------------------------------|---------------------------------|
| Obstacles | Description | References |
| Technical Obstacles | Availability of service | Users expect cloud services to be delivered with high availability and reliability | Armbrust et al. (2010); Armbrust et al. (2009), Chow et al. (2009), Dikaiakos et al. (2009), Ranjan et al. (2012), Rochwerger et al. (2009) |
| | Data lock-in | Users have difficulty extracting data from one vendor to another due to a lack of interoperability | |
| | Data confidentiality and auditability | Sensitive data may be exposed to more security risks and certain auditability requirements need to be met | |
| | Data transfer bottlenecks | Data transfer over the internet could be costly | |
| | Performance unpredictability | Users want quality of service guarantees regardless of workload or use of resources within the cloud | |
| Organizational Obstacles | Differences over the pace of adoption between business and IT executives | While business wants to move forward to a full cloud adoption, IT tends to proceed more slowly because of concerns about security, management, and efficiency | HP Business White Paper (2011), Garrison et al. (2012) |
| | Different stages of maturity along an adoption continuum | Companies that have adopted virtualization are more ready to adopt cloud computing | |
| | Uncoordinated adoption | Organizations approach the cloud in a fragmented way without an overall adoption strategy | |
| | Inadequate business and technical acumen | The benefits of cloud computing may not be fully realized when cloud computing falls short of expectations because of an inadequate understanding of scope, span and implementation. | |
Industrial surveys were conducted in order to capture the mainstream perceptions and attitudes about the adoption of cloud computing within companies. The Symantec 2010 State of the Data Center Survey reveals that 69 percent of small firms, 85 percent of mid-sized firms, and 79 percent of large firms are involved in cloud computing. BT’s Enterprise Intelligence survey (2009) reports that over half of the CIOs remain unclear about how cloud services can save money even though cloud services are designed to reduce capital expenditure requirements. The survey conducted by MPS partners in 2009 examines the factors that may influence the use of cloud computing, including more capacity for less money; less upfront investment and lower total cost of ownership; and integration with service-oriented architecture principles. In summary, these surveys suggest that cloud computing today is a nascent but promising paradigm. The major reason why organizations have not jumped onto the adoption bandwagon is that they remain uncertain about its ability to create more efficient IT operations, achieve better use of infrastructure, and save resources.

1.3 Structure of the Dissertation

The dissertation is organized as follows: Chapter two describes the research motivation, questions and scope. Chapter three reviews relevant findings of CSFs of enterprise-wide IT initiatives and IT-enabled organizational change from previous studies. A new research framework will then be proposed that conceptualizes the bi-directional relationship between IT departments and cloud computing implementation. Chapter four delineates the research methodology; and the overall paradigm and research method—including data collection and analysis—of two studies will be discussed. Chapter five presents an essay of investigating factors that influence the success of cloud implementation within organizations. Chapter six presents another essay that will examine the impact of cloud implementation on the IT function. In Chapter seven, key findings will be summarized, followed by a discussion of the theoretical and practical implications of the research, concluding with a few thoughts on both the limitations and possibilities for future research.
Chapter 2. RESEARCH OBJECTIVE

2.1 Motivation

A variety of issues related to cloud computing have been widely discussed in online forums, trade magazines, industry reports, and professional trade journals. To date, little research or formal theorizing can be found with respect to these topics in the literature, largely because cloud computing is a relatively new phenomenon and it takes years to reveal its organizational implications. While it is arguably an irreversible trend, the practice of cloud implementation is less likely to flourish without corresponding theoretical foundations and rigorous research. Although one recent work by Garrison et al. (2012) identified three broad factors (trust, technical capability, and managerial capability) and tested their correlations with the cloud deployment success, the results have limited implications in terms of providing fine-tuned, actionable strategies that organizations can use to make the cloud implementation successful. In addition, their approach of conducting hypothesis testing using questionnaire data may not be a good methodological fit because the topic as a nascent research area is lack of meaningful constructs and undefined measures (Edmondson and McManus 2007). This research contends that new patterns and constructs should be identified first by analyzing qualitative data before conducting hypothesis testing.

This research is mainly motivated by three factors. First, much of the literature in cloud computing has concentrated on technical issues such as deployment requirements, visualization, performance, and interfaces. Within the scope of organizational studies, research related to cloud computing is rare. This study will address the technical and non-technical issues of cloud implementation through the lens of organizational theories. Second, cloud computing is not simply an IT innovation, it also presents a paradigm shift in business model. Theories on IT innovation and findings from traditional IS studies may not be capable of offering sufficient and accurate explanations of some of the new emerging issues. Cloud computing implementation as a nascent research area has great potential for theory generation and extension. Third, the inquiry of the topic has significantly practical implications. The implementation of cloud computing is often a strategic initiative that involves substantial capital and human resource investment and gives rise to irreversible organizational changes. A better understanding of cloud computing
implementation as well as its organizational implications is not only a matter of making a cloud initiative success, but also a matter of leading organizations in the achievement of strategic goals.

2.2 Research Questions

This research aims to shed light on the area of cloud computing implementation from the perspective of organizational studies. It seeks to achieve two major objectives. The first is to examine the factors that determine the success of cloud implementation in organizations. Under this objective, three specific questions are addressed: 1) How is the success of cloud implementation determined? 2) What are the critical success factors for cloud implementation? 3) What are the key challenges to cloud implementation? The second objective is to investigate the “reconstruction effect” of cloud implementation on organizational IT. Under this objective, two questions are asked: 1) How does cloud implementation affect the external role of IT within an organization? 2) How does cloud implementation affect the internal composition of IT function? For clarity, the research objectives and questions for each study are listed in Table 5.

<table>
<thead>
<tr>
<th>Study One</th>
<th>Study Two</th>
</tr>
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<tbody>
<tr>
<td>To examine the factors determining the success of a cloud initiative</td>
<td>To investigate the “reconstruction effect” of cloud implementation on organizational IT</td>
</tr>
<tr>
<td>What factors influence the success of cloud implementation in organizations?</td>
<td>What impacts does cloud implementation have on the IT function of an organization?</td>
</tr>
<tr>
<td>1. How is success determined?</td>
<td>1. How does it affect the external role of IT within an organization?</td>
</tr>
<tr>
<td>2. What are the critical success factors?</td>
<td>2. How does it affect the internal composition of IT function?</td>
</tr>
<tr>
<td>3. What are the key challenges?</td>
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</table>

The essential contribution of this dissertation is to provide a suggestive theory of the phenomenon in question that will provide the basis for further inquiry. It contributes to the
literature by: 1) extending and revising extant theory on IS deployment and IT innovation by developing a taxonomy of critical success factors in the novel context of an organization leveraging cloud services to achieve its business goals; 2) building new theories on IT-enabled organizational change by exclusively concentrating on the influence of cloud initiatives on organizational IT itself.

2.3 Scope

Cloud computing has been widely used by individuals, firms, and government agencies. In terms of the computing models, cloud services can be grouped into SaaS, PaaS, and IaaS as described above. Within an organization, cloud usage is found at different levels—individual, group, department, and organization. Furthermore, within the different boundaries of cloud services (private, community, public, and hybrid), there are a number of possible combinations with respect to the breadth and depth of cloud penetration.

The two objectives described above are achieved through two distinct studies, each of which has a slightly different scope and context. The study of CSFs collected data through interviews. Interview participants were recruited from organizations with existing organization-wide SaaS implementation leveraging resources from standalone cloud vendors. PaaS implementation was ruled out because this type of cloud model is typically used for the creation and development of applications by IT/IS developers instead of organization-wide common users. IaaS implementation was also excluded because merely purchasing server capacity, storage, and network connectivity requires little effort to either implement or deploy; it can be easily imitated by other companies, and by itself offers little competitive advantage (Garrison et al. 2012). By specifying standalone cloud vendors, the study only considers public and community cloud models. This decision was reached based on the assumption that private or hybrid clouds involve more organization-specific factors that might compromise the ability to generalize the findings. Within these parameters, CSFs are analyzed at the inter-organizational, organizational, departmental, and individual levels.

The study of the impacts of cloud computing on organizational IT derives its data through two case studies. The case selection is a reflection of theoretical choices and pragmatic opportunities.
Two community cloud models—one from healthcare industry and the other from federal government—were chosen as the research sites. Both cases involve comprehensive cloud implementations at all of the NIST service levels: SaaS, PaaS and IaaS. The benefit of selecting cases from the same cloud deployment model is to create a common benchmark upon which the two cases can be compared. The two selected cases also shared similar vendor-user structures in which both employed a centralized service provider organization along with a number of affiliated user organizations; and, both sites shared similar concerns. Theses similarities allowed for the observation of common patterns both within and across each case. As organization IT is the focal unit of the study, analyses were conducted at the departmental and individual levels.

It is worth noting that the project originally focused on cloud-based, service-oriented architecture (SOA) instead of cloud computing. Cloud-based SOA refers to an application architecture within which all functionalities are defined as independent services with cloud-based APIs that can be used to leverage external computing resources through ubiquitous Internet access. This adjustment of the terminology and scope was based upon conversations with several IT professionals who have a great deal of expertise in the areas of cloud computing and SOA. First, although cloud computing and SOA are closely related concepts in such a way that they share a large degree of overlaps in rationale, principles, challenges and advantages, they are in fact different things. In regard to the first research objective, there are some factors that influence the success of cloud computing, and there are factors yet only specific to SOA. For the second study, moving to SOA requires changes in several components of IT function—processes, competencies, and tools. Bringing cloud computing for aspects of SOA will further complicate the analysis. It will be very difficult to isolate the impacts of cloud computing and SOA on organizational IT. Without an understanding of those impacts individually, conclusions drawing on from the data will become less meaningful. The second reason of dropping the term “cloud-based SOA” is a practical concern of data collection. Getting access to organizations is extremely difficult without help. Some small organizations (e.g. rural hospitals) do not have a full-developed SOA, but they can leverage cloud services. The term “cloud-based SOA” would certainly rule these organizations out.
Chapter 3. THEORETICAL BACKGROUND

3.1 The Critical Success Factors (CSFs) of Enterprise-wide IT Initiatives

The implementation of cloud computing on an enterprise-wide scale is a strategic initiative involving substantial capital and human resource investment, and which gives rise to fundamental organizational changes. It is believed that an enterprise-wide cloud strategy in comparison with department-level initiative is more likely to save money, improve operational efficiency and enable business agility. A review of CSFs of well-studied enterprise-wide IT initiatives may offer useful insights in identifying factors that determine the success of cloud implementation as another instance of an enterprise-wide initiative.

The concept of Critical Success Factors was introduced by Rockart (1979) to describe a number of areas in which desirable results will ensure successful competitive performance for an organization, or areas where things must go right for a business to flourish. Over the past decade, a considerable amount of research has been conducted in CSFs for various IT initiatives such as ERP implementation (Holland and Light 1999b; Somers and Nelson 2001; Sumner 2000; Willcocks and Smith 1995); enterprise application integration (Bieberstein et al. 2005; Grover et al. 1994; Lam 2005; Wixom and Watson 2001); and IT implementation in general (Al-Mashari and Zairi 1999; Marble 2000; Reel 1999).

3.1.1 Critical Success Factors for ERP Implementation

The Critical success Factors of Enterprise Resource Planning (ERP) implementation have been intensively studied through the approaches of meta-analysis, survey, and case studies, and researchers have developed a list of CSFs for ERP implementation. Despite the slightly different ranking, the most prominent CSFs are supportive top management; a clear understanding of strategic objectives; project management; project team competence; user training and education; interdepartmental or multi-site cooperation; and performance evaluation (Nah et al. 2001; Ngai et al. 2008; Poon and Wagner 2001a; Somers and Nelson 2001; Umble et al. 2003).

In developing theoretical models, researchers have placed CSFs into different categories. Nah et al. (2001) divided eleven CSFs into five phases over Markus and Tanis’ ERP life cycle model (Markus and Tanis 2000). Besides identifying and categorizing CSFs, researchers have also found that CSFs may change across the lifecycle of ERP implementation (Plant and Willcocks 2007; Somers and Nelson 2001). For example, top management support, clear goals and objectives together with strong interdepartmental communication are seen to be critical early in the lifecycle, but the emphasis will shift to a convergence of top management support, project team competence, and interdepartmental cooperation in the final stages (Plant and Willcocks 2007).

In contrast with a life-cycle approach, Holland and Light (1999b) divide the CSFs of ERP between strategic and tactical factors. The strategic factors include legacy systems, the business version, ERP strategy, top management support, project schedule, and plans. The tactical factors are client consultation; personnel; software configuration; client acceptance; monitoring and feedback; communication; and trouble shooting.

Another area of research closely related to CSFs is how to assess IS success. Instead of investigating success factors, DeLone and McLean (1992) developed a comprehensive taxonomy of IS success with six dimensions: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. Based on the change in the role and management of information systems, DeLone and McLean (2003) updated their “D&M IS Success Model.” The new model includes information quality, system quality, service quality, use of information, user satisfaction, and net benefits. Recursive causal effects are specified in the model. Similarly, Marble (2000) broadly explored the context of IS implementation success and reviewed areas including IS effectiveness, user information satisfaction, user involvement, management commitment, value basis, mutual understanding, design quality, project management, situational stability, and resource adequacy. These dimensions outline a framework from which CSFs can be identified.

Some researchers stress certain aspects of ERP implementation instead of developing a gamut of CSFs. Li (1997) emphasized the human factors critical to information system success by pointing out the existence of significant differences with respect to perception of IS success factors.
between IS personnel and user personnel. Hong and Kim (2002) suggested that ERP implementation success depends significantly on the organizational fit of the ERP and certain contingencies such as the levels of ERP and process adoption, and organizational resistance. Robey et al. (2002) focus on the dialectical learning issues that arise when implementing ERP systems, and argue that there are two types of knowledge barriers for firms to overcome: those associated with the configuration of the ERP package, and those associated with the assimilation of new work processes. In contrast to studies looking at CSFs in isolation, the dynamics of ERP implementation has been unveiled in several studies (Akkermans and van Helden 2002; Delone and McLean 2003). The key finding is that CSFs are highly correlated in a reinforcing manner.

3.1.2 Critical Success Factors for EAI and BPR

Enterprise Application Integration (EAI) and Business Process Reengineering (BPR) provide another rich context for the study of CSFs in IT initiatives. System integration is different from ERP implementation in terms of the scope and nature of the implementation. Despite a few similarities (e.g. top management, project management, and training), the CSFs of ERP may not apply to EAI without restrictions.

Lam (2005) pointed out that the selection of the right EAI tool, and an emphasis on technology planning and enterprise architecture are distinguishing features of EAI projects that are different from ERP or other information system projects. Lam also suggested that business integration precedes technology integration, that EAI requires specific personnel skills and expertise, and that the importance of adapters, especially the customer adapters, should not be overlooked.

Another feature—perhaps unique to business process integration—is the different perspectives taken by business managers and IT managers. The success of IT alignment requires different, yet convergent perspectives between IT and business managers (Burn and Szeto 2000). In emphasizing the social dimension that influences alignment between business and information technology objectives, Reich and Benbasat (2000) argued that shared domain knowledge between IT personnel and business executives; communication between IT staff and business executives; and connections between IT and business planning processes are crucial CSFs for business process integration.
For this work, the CSFs of Enterprise Application Integration found in the existing literature have been categorized according to the five dimensions developed by Al-Mashari and Zairi (1999). The classification scheme is outlined in Table 6 below.

Table 6. CSFs of Enterprise Application Integration

<table>
<thead>
<tr>
<th>Category</th>
<th>Factors</th>
<th>References</th>
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<tr>
<td>Change management and culture</td>
<td>Cultural adjustment, resistance, revising reward and motivation system, empowerment, effective communication, human involvement, training and education, receptiveness to change</td>
<td>(Ahmad et al. 2007; Carr 1993; Cooper and Markus 1995; Davenport 1993; Hammer and Stanton 1995; Huq et al. 2006; Sayer and Harvey 1997; Zairi and Sinclair 1995)</td>
</tr>
<tr>
<td>Management competence</td>
<td>Committed leadership, championship and sponsorship, risk management</td>
<td>(Attaran 2004; Bashein et al. 1994; Clemons 1995; Cooper and Markus 1995; Grover and Malhotra 1997; Harrison and Pratt 1993; Sutcliffe 1999)</td>
</tr>
<tr>
<td>Organizational structure</td>
<td>Job integration approach, BPR teams, job definition, responsibility relocation</td>
<td>(Brynjolfsson et al. 1997; Grant 2002; Grant 1996; Hasselbring 2000; Orman 1998)</td>
</tr>
<tr>
<td>Planning and project management</td>
<td>Adequate resources, appropriate use of methodology, external orientation and learning, effective use of consultants, effective process redesign</td>
<td>(Akkermans and van Helden 2002; Grover et al. 1995; Harrison and Pratt 1993; Raymond and Blili 2000; Sarker and Lee 2002; Thong et al. 2000; Wilcock and Smith 1995; Zairi and Sinclair 1995)</td>
</tr>
<tr>
<td>IT infrastructure</td>
<td>Alignment of IT infrastructure and strategy, IT investment and sourcing decisions, measurement of IT effectiveness, IS integration, legacy system, IT competency.</td>
<td>(Brancheau et al. 1996; Broadbent and Weill 1997; Earl 1996; Gunasekaran and Nath 1997; Kettinger et al. 1997; Reich and Benbasat 2000; Van Oosterhout et al. 2006; Zairi and Sinclair 1995)</td>
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3.1.3 Critical Success Factors for other Enterprise-Wide IT Initiatives

Besides the ERP and EAI initiatives described above, other kinds of IT initiatives—such as knowledge management systems, data warehouses, and IT outsourcing—have also been studied. Markus et al. (2002) developed a new IS design theory for emerging knowledge process support systems which shows that features of familiar system types can be effectively integrated and that IS development practices need to be customized to meet special requirements. Wixom and
Watson (2001) proposed a research model that delineates the relationship between factors that affect data warehouse success. In the model, implementation factors such as management support and user participation, are assumed to influence implementation success at three levels: technical, project, and organizational. Implementation success in turn affects system success as measured by data quality and system quality. Lee and Kim (1999) examined the determinants of IT outsourcing partnership quality, and outsourcing success based on power-political and social exchange theories.

3.2 The Impacts of IT Initiatives on Organizations

A preliminary survey of the literature shows that the impact of IT initiatives on IT departments has not been well studied. I believe that a review of the impacts of IT initiatives on organizations overall is a useful first step toward developing insight on this topic.

3.2.1 IT-enabled Organizational Change

A number of researchers have adopted a process-oriented approach to understanding how organizational changes emerge, evolve, and terminate over time (Kettinger and Grover 1995; Tallon et al. 2000; Van de Ven and Huber 1990). Three themes can be identified in the literature on IT-enabled organizational change: roles of IT in organizational change; paradigms of organizational change, and impacts of IT on organizations.

Researchers are inclined to converge on the argument that IT is not simply a tool for automating existing processes; more importantly, it is an enabler of organizational changes that can lead to strategic advantages (Dedrick et al. 2003). IT plays a moderating role in the relationship between organizational characteristics (e.g. structure, size, culture, learning, and international relationships) and organizational outcomes (Dewett and Jones 2001). While IT can enable change, it can also be a potential inhibitor—especially when the IT in use is inflexible (Bashein et al. 1994; Brancheau et al. 1996; Davenport 1993). The level of IT infrastructure capability is found to have an impact on the speed and nature of business process change (Broadbent et al. 1999). In addition, some studies on ERP outcomes suggest mixed patterns of results (Robey et al. 2002).
Different schemas have been used in theorizing the event sequences and unfolding mechanisms of process change. For instance, the ERP implementations can either be considered as discrete events or a sequence of stages (Robey et al. 2002). Van de Ven and Poole (1995) distinguished four fundamental types within process theories: life-cycle, teleological, dialectical, and evolutionary theories. By a less fine-grained approach, Stoddard and Jarvenpaa (1995) articulated differences between evolutionary change and revolutionary change as well as their respective tactics. They alerted researchers and practitioners to the different contexts in which process change takes place by pointing out that business process re-engineering doesn’t necessarily need a revolutionary approach in order to effect change. Besides the evolutionary view (which suggests that each successive level of integration increases the strategic potential of IT), Teo and King (1997) also discussed a contingency view, contending that there is no single way to achieve the fit between organizational factors and planning process types in the integration between business planning and information system planning. These theories provided a foundation for the research on IT-enabled organizational change that followed.

The majority of research in IT-enabled organizational change has focused on examining the organizational impacts of IT at either the business performance or strategic level. The improvement of business performance accounted for by IT innovation includes the quality and timeliness of intelligence and decision making; production; communication and the integration of information; strategic planning; and, business flexibility (Dennis et al. 1997; Huber 1990; Sabherwal and Chan 2001). At the strategic level, IT is viewed as a critical force for shaping organizations with respect to the transformation of competitiveness, firm structures, and firm boundaries (Kambil and Short 1994). In synthesizing ten generic principles of business process change, Kettinger and Grover (1995) proposed a high-level theoretical framework that delineates a strategic version of the interrelated roles of organizational changes. In the proposed framework, business process change is an initiative led by top management. The cultural readiness of a given organization, as well as its willingness to share knowledge, learning capacity, and balance in network relationships supports the implementation of prescribed process management practices and change management practices.

Change initiatives can be categorized as either quality management or process reengineering (Davenport and Beers 1995). IT-involved organizational changes largely fall into the second
category. Among others, EAI and BPR are two widely studied reengineering practices. EAI is a broad concept which covers business processes, business models, and organizational transformation (Sharif et al. 2004). Sharif et al. (2004) suggest that an evaluation of the impact of EAI should go beyond the technology and adopt a stakeholder-based view which addresses both the attributes of the underlying technology and other aspects of EAI, including the capacity for the organization to learn and adopt the integrated information management practices and analysis of decision-making flow. In a different study, Kambil and Short (1994) found that electronic integration dramatically altered the business networks of small businesses by leveraging the capability of various other organizations, and previously separate business networks through contracts. These views imply a focus shift from inter-organizational components to intra-organizational components.

Business Process Reengineering (BPR) is another rich source of research on IT-enabled organizational change. It involves attempts to transform the organizational subsystems of management (style, values, and measures); people (skills, roles, and culture); information technology (data, knowledge, decisions, and modeling); and organizational structures (formal and informal structure, power distribution, and team and coordination mechanisms) (Kettinger and Grover 1995; Kettinger et al. 1997). Some typical impacts of BPR include reduced costs, more efficient processes, rapid development of revenue-based services, closer relationships with suppliers, and new business opportunities (Broadbent et al. 1999). BPR also results in cultural and behavioral transformation. Many examples of failed or stalled BPR implementation can be attributed to inadequate attention to individual behavior and collective changes (Bieberstein et al. 2005). Some of the influences of BPR in this regard include fostering teamwork; matching skills and roles to services; new work styles; and new assessment metrics (Bieberstein et al. 2005). One way to minimize these issues in an IT transformation situation is to allow employees the necessary time to accept change and practice it (Lawson and Price 2003).

At the strategic level, the alignment between process, strategy, information systems, and change management has been a topic for examination. Earl et al. (1995) looked at the interaction between planning processes and BPR and identified four distinct BPR strategies. Their findings suggest that engineering and system strategies can lead to more definitive and enduring BPR
projects; on the other hand, bureaucratic and ecological strategies generate more widespread process change and BRP awareness within the organization.

The argument that will be presented here is that findings relating to the change enabled by IT initiatives at the organizational level may provide a useful framework with which to understand potential changes at the department level. Specifically, by drawing on the model proposed by Kettinger et al. (1995; 1997) to understand the context of cloud computing implementation, one could expect that IT departments may undergo changes in governance style, worker skills, tools and resources, and department structure.

3.2.2 The Impact of IT initiatives on IT Departments

Most of the literature on IT-enabled organizational change focuses exclusively on unidirectional relationships relating to the way an IT department carries out or impacts an IT initiative. For example, the expertise of the IT staff and the quality of the technology are often used as explanatory factors for firm performance (Barthélemy and Geyer 2005; Byrd and Davidson 2003; Cragg et al. 2002; Melville et al. 2004; Ross and Weill 2002). Another area that has been overlooked in the literature is the possibility that IT departments can be to some extent reconstructed by IT initiatives. In other words, although this is not yet reflected in the literature, the IT function in fact play more than one role in the process of organizational transformations involving IT.

The dual role of technology in organizations was examined by Orlikowski (1992), who argued that technology may not always simply be an independent, external factor that influences people and organizations, but that it may also function as a dependent product subject to strategic choices, human action, and design. But, aside from this broad discussion, little research effort has been dedicated to examining changes in the role and responsibilities of IT departments during the implementation of IT initiatives (Weiss and Anderson Jr 2003). Admittedly, some studies have alluded to the impact of IT initiatives on certain aspects of IT units; for example, as IT is leveraged to successfully transform business processes and services with added value, the role of the IT department has evolved from a simple service provider to a strategic partner (Van Grembergen et al. 2003; Venkatraman 1999). IT leaders are now expected to take more responsibility for developing and maintaining the strategic alignment between IT and business
function, and for the management of change (Boynton et al. 1992; Varon 2002; Weiss and Anderson Jr 2003). Meanwhile, the role of IT staff members has transformed to encompass communication, business problem solving, and understanding the political and cultural issues of their end users (Weiss and Anderson Jr 2003). The constantly evolving innovation in technology has brought several challenges to IT departments and IT professionals, including the need to achieve economies of scale within IT departments when mergers are completed (De Haes and Van Grembergen 2005), and of maintaining technological competence (Gallivan 2004; Schambach and Blanton 2002). The strategies employed by IT managers to deal with these rapid changes are education and training, internal procedures, vendor support, and consultant support (Benamati and Lederer 2001).

These findings are certainly useful in directing future research, but they are as yet incomplete and isolated, offering only a piecemeal account of the phenomenon. Much greater research efforts need to be expended in order to develop a systematic, fine-tuned understanding of this topic. The present study contributes to accumulation of this knowledge by offering an in-depth analysis of how IT department can be influenced by cloud computing as a new form of IT initiative. As I discussed in section 1.1, cloud computing is seen to be a new driver for organizational reengineering. Although most of the current discussion about cloud computing focuses on the technology, cloud computing will most likely have its greatest impact on the organization’s competitive strategy (Iyer and Henderson 2010). Furthermore, a cloud strategy may substantially change an IT group in many ways; for instance, cloud implementation involves both leveraging external resources and outsourcing some functions originally maintained in-house. An enterprise-wide cloud implementation requires IT departments to be more involved with the strategic planning of business process reengineering. And, cloud implementation may affect the job descriptions, IT professional expertise, turnover, CIO leadership, and functionality of IT department personnel.

3.3 An Integrative Research Framework

Much of the IS literature focuses on investigating the role of the IT department in IT innovation implementation. The expertise of IT staff and the quality of the technology are often used as explanatory factors for business operation performance (Barthélemy and Geyer 2005; Byrd and
Davidson 2003; Cragg et al. 2002; Melville et al. 2004; Ross and Weill 2002). In these studies, an IT department that has been tasked to implement the IT initiative must mobilize resources, facilitate processes, and pay continual attention to the factors that will deliver IT success. This stream of research essentially depicts a thinking process from the IT department to the IT initiatives, with an emphasis on the role of the IT department in implementing the IT initiative.

Similarly, there is another research stream that looks at the way IT initiatives bring about both expected and unexpected outcomes for organizations. Some of these IT-enabled organizational changes include effects on business performance, competitive advantage, organizational structure, culture, and management style (Kettinger et al. 1997; Sabherwal and Chan 2001; Sharif et al. 2004). Technology can enable change, but it also interacts with factors that resist change (Robey and Boudreau 1999). Furthermore, even identical information technologies, implemented in similar settings can yield quite different outcomes in organizational change (Robey and Boudreau 1999).

It is worth noting here that IT-enabled organizational change is, by and large, documented at the organizational level, without specific reference to IT departments in particular. As new forms of IT initiatives emerge, and considering the fact that businesses are more and more reliant on innovative IT to gain competitive advantage—or to simply maintain financial viability—the landscape is gradually changing in the realm of organizational IT. In the example of cloud computing, it has been observed from the practitioners’ perspective that IT departments are undergoing non-trivial changes resulting from the adoption of cloud computing in organizations. Yet, as discussed in Section 3.2.2, the issue has barely been studied in academia. In other words, the relationship between IT initiatives and organizational change has been well studied, but research examining IT initiatives in relation to organizational change within IT departments remains a missing link in the literature. One of the main objectives of the present study is to shed light on this missing link by investigating the impacts of cloud computing initiatives on IT departments.

In summary, researchers and practitioners are eager to understand factors that influence the successful implementation of an enterprise-wide IT initiative. They are also interested in understanding the possible impacts on IT departments that will result from the implementation of
an IT initiative. While these two research directions—from IT departments to IT initiatives and from IT initiatives to IT departments—could be studied independently, this study will argue that a combination of the two perspectives would potentially uncover some interesting dynamics between IT departments and IT initiatives, with the natural question being: What is the relationship between the IT department and the IT initiative?

Common wisdom dictates that the IT department both spearheads and carries out the IT initiative, and is intimately responsible for its success (Hirschheim et al. 2003; Rose and Scheepers 2001; Wastell et al. 2000). But are IT departments always advocates for new IT? It is postulated here that perhaps they are not. In facing the new pervasiveness of cloud computing, IT professionals—especially those who are accustomed to working in the on-premise computing environment—remain skeptical and hesitant (McAfee 2011). In other words, IT departments can in fact inhibit the adoption of new forms of IT. A further thought may disclose the underlying reason for this resistance and skepticism: cloud computing is perceived by some IT professionals to bring about some changes they do not like. Humans are creatures of habit (Samuelson and Zeckhauser 1988), and cloud computing to some extent emerges as a destructive force on the status quo in relation to the way computing resources are provided and the way organizational IT operates (McAfee 2011).

![Diagram](image)

**Figure 1.** The Interplay between IT Departments and IT Initiatives

This discussion indicates that the relationship between an IT department and an IT initiative is far from straightforward. On one hand, IT departments can either promote or inhibit the IT initiative. On the other hand, IT initiatives justify the existence of the IT department, even while they sometimes have a simultaneously destructive—or transformative—effect on that same department. The intrinsic dynamics of these two entities is depicted in an integrative framework in Figure 1. It is worth noting that the IT department is the formal organizational unit responsible
for information technology services, and the IT function may be consisted of several IT departments in very large organizations (Gottschalk 2004). In this dissertation, I use IT department and IT function interchangeably.

A central assumption of this model is that the complex relationships between the IT department and the IT initiative would be better understood when examined as a dynamic system. Studies of any one particular relationship between these two entities should also take into account of other connections, because the other connections provide the context of the specific relationship under study. Investigating the factors that determine the success or failure of cloud initiatives is essentially an inquiry into the effectiveness of IT departments on IT initiatives. Investigating how cloud initiatives can change and shape IT departments is essentially an inquiry into the constructive and destructive effects of IT initiatives on IT departments. These two topics should be studied together because a clear understanding of the second topic is the prerequisite to deal with the negative impacts of cloud initiatives on IT departments, which in turn can be assumed to be a key factor affecting the success of cloud initiatives in the first topic.

This research encompassed two distinct, but inter-related projects. The first project, Study I: “CSFs for Cloud Implementation” uses grounded theory to illuminate the Critical Success Factors necessary for an IT department to implement a successful cloud initiative. The second project, Study II: “How IT implementation impacts IT Departments” uses two case studies to investigate the impacts that IT implementation can have on an existing IT department. The two projects were investigated independently, but the analysis revealed that the results from each project become more meaningful when they are interpreted within the integrative framework.
Chapter 4. RESEARCH METHOD

4.1 A Post-Positivist Paradigm

A paradigm can be viewed as a set of basic beliefs based on ontological, epistemological, and methodological assumptions (Guba and Lincoln 1994). In the field of Information Systems research, positivist research has been established as a dominant research paradigm while interpretivism is a new strand that is gradually gaining momentum (Chen and Hirschheim 2004; Walsham 1995a). The differences between positivism and interpretivism can be identified at three levels. Ontologically, positivism believes that there is an actual reality of a phenomenon which can be apprehended and tested empirically (Guba and Lincoln 1994; Van de Ven and Huber 1990), whereas interpretivism assumes multiple possible realities of the same phenomenon and that these realities are established through verification of the researcher’s interpretation with the subject (Barley 1990; Pentland 1999). Epistemologically, positivism suggests that researcher and subject should be independent and that research activities should be conducted without influencing the subjects (Guba and Lincoln 1994). By contrast, interpretivism posits that researcher and subject are interactively linked, and that the constructed reality is influenced during the interaction by the researcher’s preconceptions or biases (Guba and Lincoln 1994; Heracleous and Barrett 2001; Walsham 1995a). The objective of theory building in the interpretive diagram is to create descriptions, insights and explanations (Gioia and Pitre 1990). Methodologically, positivist studies are concerned with hypothetic-deductive testability with well-measured objective evidence (Chen and Hirschheim 2004). Interpretivism uses hermeneutical and dialectical techniques to understand the meaning embedded in social interactions (Guba and Lincoln 1994); this requires the researcher to play a more active role in participating in the social construction of data discovery and data interpretation (Locke 1996; Orlikowski and Baroudi 1991).

Although positivism and interpretivism have distinct metaphysics, assumptions, roles of researchers, and research practices, these two paradigms can be synthesized (Cavaye 1996; DeLuca et al. 2008). For example, Lee (1991) integrated positivist and interpretivist approaches by proposing three levels for understanding social reality—understanding the human actors in their natural social context, the researcher’s interpretation of the first level understanding, and
then abstraction and generalization of the researcher’s second level conceptualization. Similarly, Trauth and Jessup (2000) adopted both positivist and interpretive analyses in a study of computer-mediated group discussions. They took a positivist approach to content-coding for the effectiveness of Group Support System sessions, and then shifted to an interpretivist approach to include contextual considerations.

The present research combines positivism and interpretivism in a post-positivist approach (DeLuca et al. 2008). According to Lincoln and Guba (1985), post-positivism assumes that reality does exist but that the researcher can only create successively closer approximations to this reality. In other words, reality can only be apprehended probabilistically (Gephart 2004). Post-positivism is rooted in positivism, but with a broader acceptance of falsifiable (as opposed to verifiable) and common-sense hypotheses (as opposed to null hypotheses) (DeLuca et al. 2008). While objectivity remains the ideal, post-positivism studies are usually involved with collecting situational information to help understand the meaning and reasons behind people’s actions (Guba and Lincoln 1994). Post-positivist inquiries can rely on well-developed qualitative methods to discover facts and to compare them with preexisting hypotheses (Gephart 2004). Among others, some typically-used research methods are grounded theory (Glaser and Strauss 1967), action research (Baskerville and Wood-Harper 1996; DeLuca et al. 2008), and deconstruction (Rosenau 1992).

This study is an inquiry into cloud computing as an emerging phenomenon of interest. From a post-positivist perspective, the factors that determine the success of cloud implementations, and the impact of cloud initiatives on organizational IT exist objectively; the ultimate goal of this research is to mirror the reality of the observed phenomena as closely as possible by making sense of data in natural settings. Data collection and data analysis follow prescribed procedures to ensure that the findings from the data fit with preliminary propositions or theory models.

Because to date little research or formal theorizing can be found for either of the topics, it is reasonable to say that cloud computing is a nascent area in the field of IT/IS studies. In order to reach a methodological fit, a qualitative approach has been chosen which is typically recommended for nascent area or research (Edmondson and McManus 2007). Unlike mature fields, which normally use quantitative data for formal theory evaluation, nascent research is characterized by less meaningful constructs and undefined measures (Edmondson and McManus
Because of this, open-ended, rich and detailed data are more suitable to generating hypotheses and theory (Edmondson and McManus 2007). The present study uses grounded theory and case studies to achieve its two research objectives.

4.2 Study I: Factors for Successful Cloud Implementation—Grounded Theory

Grounded theory describes an organic process of theory generation based on how well data fit into conceptual categories identified by an observer; how well these categories explain or predict ongoing interpretations; and how relevant these categories are to the core issues being observed (Glaser and Strauss 1967). Instead of developing a set of hypotheses beforehand, the grounded theory approach is characterized by a process-oriented, analytic procedure that allows hypotheses to emerge from the data through continuous iteration between data collection, coding, and theory generation (Locke 1996). Grounded theory has been widely used as a means of conceptualizing patterns in descriptive data, denoted by categories and their properties (Glaser 2002). Even though grounded theory originated within the interpretivist paradigm (Van Maanen 1998), it is not unusual to find it employed in post-positivist research (DeLuca et al. 2008; Gephart 2004; Guba and Lincoln 1994). It should be highlighted that grounded theory by no means implies that researchers do their research blindly. In fact, Strauss et al. (1990) suggest that prior theory, nontechnical literature, and personal experience be allowed to assist the researcher in gaining insight into the data. Grounded theory perfectly matches the goal of Study I, to identify and categorize the Critical Success Factors of cloud implementation.

4.2.1 Data Collection

The first study used interviews rather than a survey questionnaire to collect data. The questionnaire is not an appropriate technique in this nascent area of research, even though it might be more appropriate for intermediate or mature theory research because it usually relies, at least partially, on established constructs and measures (Edmondson and McManus 2007). Compared to the rigidity of the survey questionnaire, interviews are relatively loosely structured and allow the interviewees to talk about whatever they feel is relevant to the research topic (Alvesson 2003). Interviews also allow the interviewer to digress and probe in response to the issues and topics raised by the subject (Alvesson 2003; Blee and Taylor 2002). Using the
interviews, the study results reach the level of generalization by providing perspectives across time, person, and context while not losing the specific details of the narrative stories that are related (McGrath 1981).

A “key informants” method was used to choose interview participants. The essence of this method is that certain, targeted respondents assume a “key informant” role and are capable to provide aggregated reports on organizational entities rather than personal attitudes (Segars and Grover 1998; Venkatraman 1989). The selection of key informants for recruitment were limited to senior IT managers, senior enterprise architects, and C-level executives who have been involved in planning and implementing organization-wide cloud initiatives. Entry-level or junior employees were assumed not to be qualified to answer questions about the issue under investigation and were excluded from consideration for recruitment. The contact information for potential interviewees was obtained from one of three sources: 1) cloud computing groups on LinkedIn; 2) referrals from other respondents; and 3) connections from my academic advisor. A cover letter was sent to each interview candidate. To encourage response, potential participants were promised a report of the research findings. From January 2012 to April 2012, twelve interviews were conducted involving fourteen participants. The decision to end the data collection phase after twelve interviews was based on theoretical saturation (Eisenhardt 1989).

Each interview followed the same protocol. The objective of the research was briefly explained at the beginning of each interview. Interviewees were then given a confidentiality document to provide assurance that their identity would remain anonymous, and they were informed that they could request the recorder be turned off at any time. Out of courtesy, key questions were sent to the interviewees before the interview. Each interview started off with some short warm-up or rapport-building questions (Spradley 1979) about the individual and the organization, and then quickly moved on to more substantive questions. The questions were arranged in a rough order from easy to complex.

4.2.2 Data Analysis

Interview data were coded and analyzed using multiple content analysis procedures. Constant comparative analysis was used first (Glaser and Strauss 1967) to identify constructs that appeared in the data, to document their properties, and to catalogue recurrent themes by
observing similarities and differences. This was followed by complete axial coding, which involved identifying the context in which a particular theme is embedded and the conditions that led to it (Strauss et al. 1990). I iterated between data representation and theorizing (Edmondson and McManus 2007; Eisenhardt 1989a) to address the research questions and discuss potential contributions to extant theory.

The total number of interviews was not established a priori; rather, interviews were conducted until theoretical saturation was achieved (Dawson et al. 2010; Eisenhardt 1989a). To this end, transcription and preliminary data analysis were conducted after each interview was completed. This procedure served three purposes. First, a summary of the transcript and follow-up questions were sent back to the interviewee—a procedure known as member checking (Lincoln and Guba 1985)—to ensure that the researcher’s interpretation accurately captured the participants perspectives (Lincoln and Guba 1985). It is likely that different people in an organization would have different experience with, or knowledge of what an organization is doing in relation to the implementation of cloud computing. This isn’t to say that one person’s experience negates another’s. If there appeared to be perceptual agreement between informants (James 1982), their responses were integrated for a comprehensive picture of the organization. If, on the other hand, there was a substantial disagreement, further discussion was initiated during the interview.

Second, a review of the completed interviews provided the opportunity to revise and refine various questions, thereby improving the quality of the interviews that followed. Third, a preliminary analysis allowed for a determination of whether the data collection had achieved theoretical saturation by checking to see if any new concepts or patterns appeared (Bowen 2008).

4.3 Study II: “How the Cloud Impacts the IT Function”—Case Studies

Case studies were conducted to examine the ways that cloud implementation can affect organizational IT. The case study is a research method that concentrates on understanding an issue of interest within a single setting (Eisenhardt 1989a). It involves in-depth analysis of a specific phenomenon, particularly when it is impossible to accurately observe the phenomenon under study outside of its context (Stake 1995; Yin 2003). The underlying paradigm of case study research varies depending on the philosophical assumptions of the researchers (Myers 1997). A case study can be positivist, post-positivist (Yin 2002), or interpretive (Walsham
1995a). Researchers can use case studies with quantitative and/or qualitative evidence to achieve goals such as phenomenon description (Kidder 1981), hypothesis testing (Pinfield 1986), and theory generation (Gersick 1991). Case Studies allow researchers to take advantage of multiple data sources, which is very useful in investigating a technology’s implications for organizations because the behaviors and interpretations that create the organization’s social patterns become more meaningful within its context.

4.3.1 Data Collection

In the second study, case study analysis was conducted on two community clouds in two different sectors. One research site was a health IT consortium involving 17 rural/small hospitals in the same geographic region in United States. Within the consortium, one facility served as a centralized data center offering various health care-related IT services and resources to the participating hospitals. The other site was a federal government agency. In this community cloud, a federal service provider offered diverse, yet integrated business solutions for one federal department and several federal agencies.

The case selection is a reflection of theoretic choices and pragmatic opportunities. The studies were limited to community clouds in order to minimize variations that might be derived from different boundaries of cloud services. The benefit of selecting cases from the same cloud deployment model is that it makes possible the creation of a common benchmark upon which the two cases can be compared. Second, the two selected cases shared common characteristics in several respects. They share the same structure in that both are comprised of one centralized service provider organization with a number of affiliated user organizations. Within each community cloud, the user organizations share similar backgrounds in terms of budgetary concerns, mission, and security and policy considerations. The similarities between the user organizations allowed common patterns to be observed within each case.

In order to illuminate the impacts of cloud implementation on IT departments, interview narratives, field notes and documents were used to accumulate data. The charm of narrative data lies not only in its richness, but also in the fact that organizational members use the same type of data to plan, interpret and evaluate their own activities (Pentland 1999). The narrative approach
focuses on contextual detail and conveys a great degree of subtlety that cannot be achieved in large samples (Golden-Biddle and Locke 1993; Langley 1999). A purposive sampling technique (Kalleberg et al. 1990) was adopted to select key informants from each organization. Subjects were recruited from various positions that were assumed to have the best knowledge of the issue under study.

In the healthcare community cloud, the roles of the interviewees included CEO, CFO, and CIO; director of healthcare and IT/IS; IT manager, clinical analyst and IT support personnel. Six facilities were visited and interviews in each facility were conducted in a group. All interviews followed the same protocol. At the beginning of each interview, the objective of the research was briefly explained. The interviewees were given a confidentiality document to provide assurance that their identities would remain anonymous, and they were informed that they could request to turn off the recorder at any time. As a courtesy, the research questions (rather than specific interview questions) were sent to the interviewees ahead of time. Because this study was exploratory in nature, the conversations were not strictly tied to the prepared interview questions with the result that once in a while truly interesting topics came up that went beyond the original scope of the research. After each interview, a field note was composed to capture the key points, processes, and impressions about the conversation.

In the federal community cloud, the positions of interview participants included CTO, chief architect, knowledge architect, and technology team lead. Data collection proceeded in a two-phase process. In February 2012, the first phone meeting was initiated to establish a mutual understanding of the research goals, and to allow the researcher to gain an understanding of cloud computing initiatives within federal agencies. In May 2012, a research team conducted an on-site visit and had presentations, discussions, and interviews with representatives of the federal agencies. All participants were interviewed as a group. The interviews provided two types of data: (1) the interviewee’s general opinion about the impacts of cloud computing on IT departments, and (2) specific examples of impacts that have occurred within their own organizations. Other data resources included presentations, discussion notes, and relevant documents.
4.3.2 Data Analysis

Data analysis from the case studies uses a three-phase strategy drawing from building case study research proposed by Eisenhardt (1989a). In step one, in-case data were analyzed. This process treats each case as a standalone unit and allows the observer to elucidate the unique patterns within each case before rushing on to cross-case generalizations. A generic procedure proposed by Barley (1990) was used to detect patterns in which patterns are identified by virtue of a computer-aided text analysis tool. In step two, cross-case patterns were explored. Beginning with the patterns that emerged from in-case data, similarities and differences between the two cases were compared. In step three, propositions were developed along with specific observations and explanations. The preliminary conclusions generated from the within- and cross-case analysis were polished and shaped iteratively to the extent that the statements fit well with the evidence from both cases.

The overall research methodology is summarized in Table 7.

<table>
<thead>
<tr>
<th>Table 7. Research Methodology</th>
<th>Study I</th>
<th>Study II</th>
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<tbody>
<tr>
<td><strong>Research Objective</strong></td>
<td>To investigate the factors that determine the success of cloud computing implementation in organizations</td>
<td>To examine the impacts of cloud computing implementation on the IT function</td>
</tr>
<tr>
<td><strong>Research Paradigm</strong></td>
<td></td>
<td>Post-Positivism</td>
</tr>
<tr>
<td><strong>Research Method</strong></td>
<td>Grounded theory</td>
<td>Case studies</td>
</tr>
<tr>
<td><strong>Data Collection</strong></td>
<td>Interview data</td>
<td>Interview narratives, field notes, documents</td>
</tr>
<tr>
<td><strong>Data Analysis</strong></td>
<td>Constant comparative analysis</td>
<td>Three-step case analysis approach based on Eisenhardt (1989a)</td>
</tr>
</tbody>
</table>
5.1 Introduction

Globalization, mergers and acquisitions, big data, and rapidly changing business opportunities have created new challenges for IT platforms and information systems in organizations (Markus 2000; Overby et al. 2006; Stanoevska-Slabeva et al. 2009). These challenges include dynamically scaling information systems to respond to customer demands (Sahay and Walsham 2006); integrating disparate software applications across organizational boundaries (Bernstein and Haas 2008); cutting costs to maintain data centers in economic downturns (Armbrust et al. 2009); and responding in a timely manner to changes in the business environment (Lee et al. 2003). To deal with these challenges and remain competitive, organizations are forced to adopt a variety of IT innovations and even to reengineer their business models (Teece 2010).

The emergence of cloud computing has provided an opportunity for organizations to leverage external computing capacity to address these challenges in an innovative way. Cloud computing is “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” Cloud computing was identified in the 2011 CIO Agenda survey by Gartner as the top technology priority by CIOs all over the world. Cloud computing uses a “pay as you go” model and thus allows organizations to scale up and down dynamically (Armbrust et al. 2009). It offers quick readiness for IT resources and incomparable flexibility and business agility for organizations. Cloud computing creates significant cost advantages by eliminating the need for up-front capital investment and reducing the necessity to maintain proprietary infrastructure (Jaeger et al. 2008). With a service oriented architecture (SOA), cloud computing brings forward some transformative benefits, such as service discovery via federated clouds and rapid service deployment (Wei and Blake 2010).

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6 http://www.nist.gov/itl/cloud/
7 http://www.gartner.com/it/page.jsp?id=1526414
While cloud computing is generally regarded as a promising solution for many technological and business issues, it also poses non-trivial challenges for organizations when it comes to cloud computing implementation. These challenges can be both technical and managerial, such as standardizing and prototyping economic models for cloud services; bringing cloud computing to internal architecture planning; managing and monitoring services in the cloud environment; and dependency on service providers for end-to-end secure solutions (Wei and Blake 2010). A clear understanding of the factors influencing the success of cloud computing implementation is not simply a matter of saving money, it is also a matter of leading organizations toward achieving strategic goals and gaining competitive advantage.

Over the past decade, a considerable amount of research has been conducted on Critical Success Factors (CSFs) (Poon and Wagner 2001b; Rockart 1979) in a variety of IT initiatives (Al-Mashari and Zairi 1999; Holland and Light 1999a; Sumner 1999; Wixom and Watson 2001). However, cloud computing has some new features that are not seen in traditional IT initiatives. These features, as described below, justify a reexamination of CSFs. First, cloud implementation extends the scope of the IT initiative beyond the boundary of the organization because it leverages external hardware and software resources provided by third-party vendors (Markus and Benjamin 1997). Unlike many traditional IS/IT projects, the utilization of cloud services is no longer an intra-organizational matter. Second, cloud computing is more of an innovative business model than a new technology. For many organizations, cloud implementation is a strategic initiative that involves fundamental changes in business processes and service provisioning (Bieberstein et al. 2005; Kryvinska et al. 2009); and, it offers an innovative way of doing business in terms of its capacity to speed up business processes and to rapidly transfer market requirements into new services. Third, large-scale cloud implementation is not simply a one-time, plug-in process; rather, it is a dynamic and adaptive in that new services and software components can be continuously added or changed (Armbrust et al. 2009). While cloud computing has become popular in various industries, these same organizations suffer from a lack of guidance and an understanding of best practices for cloud implementation. Traditional, or common wisdom may be instructive in these endeavors, but there is no guarantee that it can foresee and address all potential issues.
This paper sets out to investigate the factors that influence the success or failure of cloud computing implementation in organizations. This overall objective is achieved by asking three key questions: 1) How is the success of cloud implementation determined? 2) What are the critical success factors of cloud implementation? 3) What are the key challenges facing cloud implementation? The focal unit of analysis is organizations that have organization-wide Software as a Service (SaaS) implementation that leverages resources from standalone cloud vendors. Platform as a Service (PaaS) implementation was ruled out because this type of cloud model is generally used for the creation and development of applications by IT/IS developers rather than for organization-wide common users. Infrastructure as a Service (IaaS) implementation was also excluded because merely purchasing servers, storage, and network connectivity requires little effort to implement or deploy. It can be easily imitated by other companies, and by itself offers little competitive advantage (Garrison et al. 2012). By specifying standalone cloud vendors, the study considers only public or community cloud models. This decision was based on the assumption that private or hybrid clouds would involve more organization-specific factors that might potentially compromise the generalization of the findings. Furthermore, investigation of the factors influencing decision-making processes about cloud strategies is beyond the scope of this research. Within these parameters, CSFs were analyzed at the inter-organizational, organizational, departmental, and individual levels.

The paper is organized as follows. In section 5.2, the literature of the CSFs of enterprise-wide IT initiatives will be surveyed. Two theories are selected for identifying and explaining CSFs in cloud implementation. Section 5.3 covers the research methodology and describes data collection and analysis. Section 5.4 presents the research findings in relation to the three research questions: 1) measuring success; 2) CSFs; and, 3) key challenges. Section 5.5 concludes with a proposed model of factors affecting cloud implementation success and a discussion of the theoretical and practical contributions of the study.
5.2 Literature Review

5.2.1 The Critical Success Factors (CSFs) of Enterprise-wide IT Initiatives

The implementation of cloud computing on an enterprise-wide scale is a strategic initiative involving substantial capital and human resource investment, and which gives rise to fundamental organizational changes. It is believed that an enterprise-wide cloud strategy in comparison with department-level initiative is more likely to save money, improve operational efficiency and enable business agility. A review of CSFs of well-studied enterprise-wide IT initiatives may offer useful insights in identifying factors that determine the success of cloud implementation as another instance of an enterprise-wide initiative.

The concept of Critical Success Factors was introduced by Rockart (1979) to describe a number of areas in which desirable results will ensure successful competitive performance for an organization, or areas where things must go right for a business to flourish. Over the past decade, a considerable amount of research has been conducted in CSFs for various IT initiatives such as ERP implementation (Holland and Light 1999b; Somers and Nelson 2001; Sumner 2000; Willcocks and Smith 1995); enterprise application integration (Bieberstein et al. 2005; Grover et al. 1994; Lam 2005; Wixom and Watson 2001); and IT implementation in general (Al-Mashari and Zairi 1999; Marble 2000; Reel 1999).

Critical Success Factors for ERP Implementation

The Critical success Factors of Enterprise Resource Planning (ERP) implementation have been intensively studied through the approaches of meta-analysis, survey, and case studies, and researchers have developed a list of CSFs for ERP implementation. Despite the slightly different ranking, the most prominent CSFs are supportive top management; a clear understanding of strategic objectives; project management; project team competence; user training and education; interdepartmental or multi-site cooperation; and performance evaluation (Nah et al. 2001; Ngai et al. 2008; Poon and Wagner 2001a; Somers and Nelson 2001; Umble et al. 2003).

In developing theoretical models, researchers have placed CSFs into different categories. Nah et al. (2001) divided eleven CSFs into five phases over Markus and Tanis’ ERP life cycle model.
(Markus and Tanis 2000). Besides identifying and categorizing CSFs, researchers have also found that CSFs may change across the lifecycle of ERP implementation (Plant and Willcocks 2007; Somers and Nelson 2001). For example, top management support, clear goals and objectives together with strong interdepartmental communication are seen to be critical early in the lifecycle, but the emphasis will shift to a convergence of top management support, project team competence, and interdepartmental cooperation in the final stages (Plant and Willcocks 2007).

In contrast with a life-cycle approach, Holland and Light (1999b) divide the CSFs of ERP between strategic and tactical factors. The strategic factors include legacy systems, the business version, ERP strategy, top management support, project schedule, and plans. The tactical factors are client consultation; personnel; software configuration; client acceptance; monitoring and feedback; communication; and trouble shooting.

Another area of research closely related to CSFs is how to assess IS success. Instead of investigating success factors, DeLone and McLean (1992) developed a comprehensive taxonomy of IS success with six dimensions: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. Based on the change in the role and management of information systems, DeLone and McLean (2003) updated their “D&M IS Success Model.” The new model includes information quality, system quality, service quality, use of information, user satisfaction, and net benefits. Recursive causal effects are specified in the model. Similarly, Marble (2000) broadly explored the context of IS implementation success and reviewed areas including IS effectiveness, user information satisfaction, user involvement, management commitment, value basis, mutual understanding, design quality, project management, situational stability, and resource adequacy. These dimensions outline a framework from which CSFs can be identified.

Some researchers stress certain aspects of ERP implementation instead of developing a gamut of CSFs. Li (1997) emphasized the human factors critical to information system success by pointing out the existence of significant differences with respect to perception of IS success factors between IS personnel and user personnel. Hong and Kim (2002) suggested that ERP implementation success depends significantly on the organizational fit of the ERP and certain
contingencies such as the levels of ERP and process adoption, and organizational resistance. Robey et al. (2002) focus on the dialectical learning issues that arise when implementing ERP systems, and argue that there are two types of knowledge barriers for firms to overcome: those associated with the configuration of the ERP package, and those associated with the assimilation of new work processes. In contrast to studies looking at CSFs in isolation, the dynamics of ERP implementation has been unveiled in several studies (Akkermans and van Helden 2002; Delone and McLean 2003). The key finding is that CSFs are highly correlated in a reinforcing manner.

**Critical Success Factors for EAI and BPR**

Enterprise Application Integration (EAI) and Business Process Reengineering (BPR) provide another rich context for the study of CSFs in IT initiatives. System integration is different from ERP implementation in terms of the scope and nature of the implementation. Despite a few similarities (e.g. top management, project management, and training), the CSFs of ERP may not apply to EAI without restrictions.

Lam (2005) pointed out that the selection of the right EAI tool, and an emphasis on technology planning and enterprise architecture are distinguishing features of EAI projects that are different from ERP or other information system projects. Lam also suggested that business integration precedes technology integration, that EAI requires specific personnel skills and expertise, and that the importance of adapters, especially the customer adapters, should not be overlooked.

Another feature—perhaps unique to business process integration—is the different perspectives taken by business managers and IT managers. The success of IT alignment requires different, yet convergent perspectives between IT and business managers (Burn and Szeto 2000). In emphasizing the social dimension that influences alignment between business and information technology objectives, Reich and Benbasat (2000) argued that shared domain knowledge between IT personnel and business executives; communication between IT staff and business executives; and connections between IT and business planning processes are crucial CSFs for business process integration.
For this work, the CSFs of Enterprise Application Integration found in the existing literature have been categorized according to the five dimensions developed by Al-Mashari and Zairi (1999). The classification scheme is outlined in Table 8 below.

<table>
<thead>
<tr>
<th>Category</th>
<th>Factors</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change management and culture</td>
<td>Cultural adjustment, resistance, revising reward and motivation system, empowerment, effective communication, human involvement, training and education, receptiveness to change.</td>
<td>(Ahmad et al. 2007; Carr 1993; Cooper and Markus 1995; Davenport 1993; Hammer and Stanton 1995; Huq et al. 2006; Sayer and Harvey 1997; Zairi and Sinclair 1995)</td>
</tr>
<tr>
<td>Management competence</td>
<td>Committed leadership, championship and sponsorship, risk management</td>
<td>(Attaran 2004; Bashein et al. 1994; Clemons 1995; Cooper and Markus 1995; Grover and Malhotra 1997; Harrison and Pratt 1993; Sutcliffe 1999)</td>
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<tr>
<td>Organizational structure</td>
<td>Job integration approach, BPR teams, job definition, responsibility relocation</td>
<td>(Brynjolfsson et al. 1997; Grant 2002; Grant 1996; Hasselbring 2000; Orman 1998)</td>
</tr>
<tr>
<td>Planning and project management</td>
<td>Adequate resources, appropriate use of methodology, external orientation and learning, effective use of consultants, effective process redesign</td>
<td>(Akkermans and van Helden 2002; Grover et al. 1995; Harrison and Pratt 1993; Raymond and Billi 2000; Sarker and Lee 2002; Thong et al. 2000; Willcocks and Smith 1995; Zairi and Sinclair 1995)</td>
</tr>
<tr>
<td>IT infrastructure</td>
<td>Alignment of IT infrastructure and strategy, IT investment and sourcing decisions, measurement of IT effectiveness, IS integration, legacy system, IT competency.</td>
<td>(Brancheau et al. 1996; Broadbent and Weill 1997; Earl 1996; Gunasekaran and Nath 1997; Kettinger et al. 1997; Reich and Benbasat 2000; Van Oosterhout et al. 2006; Zairi and Sinclair 1995)</td>
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</table>

**Critical Success Factors for other Enterprise-Wide IT Initiatives**

Besides the ERP and EAI initiatives described above, other kinds of IT initiatives—such as knowledge management systems, data warehouses, and IT outsourcing—have also been studied. Markus et al. (2002) developed a new IS design theory for emerging knowledge process support systems which shows that features of familiar system types can be effectively integrated and that IS development practices need to be customized to meet special requirements. Wixom and
Watson (2001) proposed a research model that delineates the relationship between factors that affect data warehouse success. In the model, implementation factors such as management support and user participation, are assumed to influence implementation success at three levels: technical, project, and organizational. Implementation success in turn affects system success as measured by data quality and system quality. Lee and Kim (1999) examined the determinants of IT outsourcing partnership quality, and outsourcing success based on power-political and social exchange theories.

Among the previous studies, there was one recent research work by Garrison et al. (2012), who examined the key factors of cloud computing deployment, and found that trust, technical capability and managerial capability are three factors that positively affect the success of cloud computing deployment. This research suffered from two major shortcomings. First, their approach of conducting hypothesis testing using questionnaire data may not be a good methodological fit because the topic is a nascent research area characterized by lack of meaningful constructs and undefined measures (Edmondson and McManus 2007). It is untenable to take for granted that the factors or constructs identified from traditional IT initiatives could apply to the new context of cloud computing deployment. This study argues that the patterns and constructs should be identified by analyzing qualitative data first before conducting hypothesis testing. Second, their findings of the three broad success factors are lack of depth, and thus have very limited implications in terms of providing fine-tuned, actionable strategies that organizations can use to make the cloud deployment successful.

5.2.2 Theoretical Orientations

One of the key roles of theories in information system field is to provide a lens for viewing and explaining the phenomenon of interest (Gregor 2006). In this section, I attempt to find reference theories that might be useful in identifying critical success factors of cloud computing implementation. It has been widely acknowledged that IS research is not dominated by a single theory but rather multiple theoretical paradigms (Banville and Landry 1989; Dibbern et al. 2004; Truex et al. 2006). In addressing novel or even well studied issues, researchers tend to move theories from one research domain to another. The key of borrowing a theory is that keen attention need to be paid to the essential logic of the theory and to the fit between the theory and
the object of study (Truex et al. 2006). In the process of identifying reference theories that can be adoptable to implementation of cloud computing, I use two dimensions: level of analysis and theoretical argument. The purpose of using level of analysis is to categorize reference theories on the basis of the scope or entities that implementation of cloud computing can reach to. The theoretical argument provides a chance of deep reflection before the theory can be adopted. To meet the “fit” criterion, I explain the reasoning why the theory is well suited in this research. Table 9 summarizes two selected theories — agency theory at the inter-organizational level and resource-based theory at the intra-organizational level.

<table>
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<th>Table 9. Selected Reference Theories</th>
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<td><strong>Level of Analysis</strong></td>
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<tr>
<td>Inter-organizational level</td>
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<tr>
<td>Intra-organizational level</td>
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At the inter-organizational level, I take an outsourcing perspective and focus on the inter-organizational relationships between user organizations and cloud vendors. *Agency theory* assumes that there exists asymmetric information, uncertainty and partly different preferences of risk between principal and agent (Dibbern et al. 2004; Eisenhardt 1989b). Rooted in information economics, agency theory has developed into two streams: positive agency theory and principal-agent theory (Jensen 1983). Positive agency theory concerns situations where principals and agents have conflicting goals if the principal does not opt for a self-serving governance mechanism (Eisenhardt 1989b). Principal-agent theory is a formal theory which seeks to find out optimal contractual relationships by careful specification of assumptions, logic deduction and mathematical proof (Jensen and Meckling 1976). These two streams are rather complementary in
a way that positive agency theory helps explore contract alternatives and problems, and principal-agency theory helps identify the most efficient governance model under various levels of uncertainty, information asymmetry, and risk aversion (Eisenhardt 1989b). Agency theory has been frequently adopted in IT outsourcing studies (Bahli and Rivard 2003; Dibbern et al. 2004; Gefen et al. 2008; Gonzalez et al. 2006; Tiwana and Bush 2007). One primary application of agency theory is to examine under what incentives the agent can be motivated to behave for the principal's interest (Ménard 2008). The establishment of joint problem solving, fine-grained information sharing, trust, and shared culture norms and values are suggested to be important incentives in offshore outsourcing IS projects (Rai et al. 2009). The adoption of cloud computing poses risks and issues to organization users in, for example, privacy and confidentiality (Pearson 2009); security and recovery (Heiser and Nicolett 2008); monitoring and control (Chow et al. 2009); and regulatory compliance and audit (Vouk 2004). Agency theory can be a useful tool to address these issues by boosting joint efforts from both parties.

At the intra-organizational level, I view success factors for cloud implementation as internal resources and capabilities that organizations have to acquire. Resource-based theory contends that heterogeneous firm resources are the basis for competitive advantage (Barney 1991). In contrast to resource dependent theory, resource based theory emphasizes on internal resources of the firm, rather than external factors controlled by its environment (Gottschalk and Solli-Sæther 2005). A resource is defined as a fixed input enabling a firm to perform certain tasks (Rubin 1973). However, to become a sustained competitive advantage, a resource must be rare, valuable, difficult to intimate, and no substitution available (Barney 1991; Melville et al. 2004). Firm strategies are comprised of exploiting current resources and developing new resources (Grant 1991; Wernerfelt 1984). To that end, external acquisition of resources and capabilities may be of necessity (Grant 1991). Therefore, resource-based theory conveys a point that firm strategies are not implementable without constraints, but rather dependent on having necessary resource base (Cheon et al. 1995). In the example of cloud implementation, resource-based theory provides a framework for examining the availability and readiness of IS resources and capabilities for carrying out a cloud strategy. Guided by Barney's (1991) classification of firm resources, Melville et al. (2004) formulated IT resources and complementary organizational resources, upon which the IT business value is dependent. The IT resources are further divided into technological IT resources (infrastructure and business applications) and human IT resources.
(technical skills and managerial skills). The complementary organizational resources include
organizational structure, policies and rules, workplace practices, and culture.

5.3 Methodology

Because so little research or formal theorizing has been conducted with respect to the CSFs of
cloud computing, it is reasonable to say that cloud implementation is a nascent research area.
Nascent research, characterized by less meaningful constructs and undefined measures, usually
uses qualitative approaches (Edmondson and McManus 2007). This paper adopts grounded
theory as the research methodology because grounded theory is well known as a way to
conceptualize descriptive data into patterns, denoted by categories and their properties (Glaser
2002; Glaser and Strauss 1967). Grounded theory is “an inductive, theory discovery
methodology that allows the researcher to develop a theoretical account of the general features of
a topic while simultaneously grounding the account in empirical observations or data” (Martin
and Turner 1986, p.141). It describes an organic process of theory generation based on how well
data fit conceptual categories identified by an observer, by how well the categories explain or
predict ongoing interpretations, and by how relevant the categories are to the core issues being
observed (Glaser and Strauss 1967). Grounded theory fits the needs of this study as a way to
identify and categorize the factors that determine the success or failure of cloud initiatives.

5.3.1 Data Collection

This paper uses semi-structured interviews (Alvesson 2003; Blee and Taylor 2002) rather than
surveys as the data collection method. The questionnaire is not an appropriate technique in this
nascent area of research, even though it might be more appropriate for intermediate or mature
research because it usually relies, at least partially, on established constructs and measures
(Edmondson and McManus 2007). Compared to the rigidity of the survey questionnaire,
interviews are relatively loosely structured and allow the interviewees to talk about whatever
they feel is relevant to the research topic (Alvesson 2003). Interviews also allow the interviewer
to digress and probe in response to the issues and topics raised by the subject (Alvesson 2003;
Blee and Taylor 2002). Using the interviews, the study results reach the level of generalization
by providing perspectives across time, person, and context while not losing the specific details of the narrative stories that are related (McGrath 1981).

A “key informants” method (Pinsonneault and Kraemer 1993) was used to choose interview participants. The essence of this method is that targeted respondents assume a key informant role and are capable of providing aggregated reports on organizational entities (rather than personal attitudes) (Segars and Grover 1998; Venkatraman 1989). Since the goal of this paper is to build a mid-range theory (Carroll and Swatman 2000), the data “sources” (the interviewees) were selected with discretion. From January 2012 to April 2012, twelve interviews were conducted involving fourteen interviewees, including managers, architects and top executives. Participants from different positions were recruited in order to capture a wide range of perceived CSFs from different perspectives. Entry-level or junior employees who were judged less likely to provide “aggregated” information were not used as key informants for this study. The contact information for potential interviewees was obtained from one of three sources: 1) cloud computing groups on LinkedIn; 2) referrals from other respondents; and 3) connections from my academic advisor. The subject profiles are summarized in Table 10.

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Organization Size*</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Senior manager</td>
<td>large</td>
<td>Info. Tech. &amp; Services</td>
</tr>
<tr>
<td>2</td>
<td>Senior Manager</td>
<td>Large</td>
<td>Info. Tech. &amp; Services</td>
</tr>
<tr>
<td>3</td>
<td>Chief Technology Officer</td>
<td>Small</td>
<td>Marketing and Advertising</td>
</tr>
<tr>
<td>4</td>
<td>Chief Operation Officer</td>
<td>Small</td>
<td>Computer Software</td>
</tr>
<tr>
<td>5</td>
<td>Senior Manager</td>
<td>Medium</td>
<td>Info. Tech. &amp; Services</td>
</tr>
<tr>
<td>6</td>
<td>Software Architect</td>
<td>Large</td>
<td>Info. Tech. &amp; Services</td>
</tr>
<tr>
<td>7</td>
<td>Chief Architect</td>
<td>Large</td>
<td>Defense &amp; Space</td>
</tr>
<tr>
<td>8</td>
<td>Manager</td>
<td>Large</td>
<td>Telecommunication</td>
</tr>
<tr>
<td>9</td>
<td>Chief Technology Officer</td>
<td>Medium</td>
<td>Government Agency</td>
</tr>
<tr>
<td>10</td>
<td>Chief Architect</td>
<td>Medium</td>
<td>Electronic Manufacturing</td>
</tr>
</tbody>
</table>
To encourage response to the initial query, potential participants were promised a report of the research findings. Once the subjects agreed, each interview followed the same protocol. The objective of the research was briefly explained at the beginning of each interview. Interviewees were then given a confidentiality document to provide assurance that their identity would remain anonymous, and they were informed that they could request the recorder be turned off at any time. Out of courtesy, key questions were sent to the subjects before the interview so they could prepare initial responses ahead of time. Each interview began with some brief rapport-building questions (Spradley 1979) about the individual and their organization, and then quickly moved on to the more substantive questions. The questions were arranged in a rough order from easy to complex. The IRB (Institutional Review Board) submission is provided in Appendix A. The informed consent form and interview protocols are provided in Appendices B and C respectively.

5.3.2 Data Analysis

The interview length ranged from 35 to 120 minutes. All audio recordings were transcribed into a 149-page document, and the interview data were coded using multiple content analysis procedures (Glaser 2002). Open coding (Glaser and Strauss 1967) was used first to identify constructs appearing in the data, to document their properties, and to catalogue recurrent themes by observing similarities and differences. This process is called first-order analysis: first-order “in vivo” themes are identified that reflect the voice of the participants. Axial coding was then performed, which involved identifying the context in which a theme is embedded and the conditions that give rise to it (Strauss et al. 1990). In this second-order analysis, concepts and patterns identified by the researcher are abstracted categorical codes of the first-order themes. I iterated between data representation and theorizing (Edmondson and McManus 2007; Eisenhardt
1989a) to answer research questions and discuss the contribution to extant theory. The coding work was conducted with the assistance of qualitative data analysis software –nViVo. The first-order codes may have one or more occurrences (known as references) either within or across the interview transcripts. Table 11 provides a summary of the interview transcripts and coding.

<table>
<thead>
<tr>
<th>ID</th>
<th>No. of Interviewees</th>
<th>Length of Interview (minutes)</th>
<th>Length of Transcript (words)</th>
<th>Date Interviewed</th>
<th>Date Transcribed</th>
<th>Date Analyzed</th>
<th>Number of First-order Codes</th>
<th>Number of References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>46</td>
<td>3414</td>
<td>2/1/2012</td>
<td>2/4/2012</td>
<td>2/25/2012</td>
<td>32</td>
<td>43</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>40</td>
<td>2345</td>
<td>2/3/2012</td>
<td>2/10/2012</td>
<td>2/25/2012</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>49</td>
<td>4629</td>
<td>2/16/2012</td>
<td>2/19/2012</td>
<td>2/25/2012</td>
<td>35</td>
<td>46</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>62</td>
<td>3600</td>
<td>2/23/2012</td>
<td>3/13/2012</td>
<td>3/13/2012</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>75</td>
<td>6796</td>
<td>2/29/2012</td>
<td>3/10/2012</td>
<td>3/13/2012</td>
<td>42</td>
<td>49</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>51</td>
<td>3944</td>
<td>3/5/2012</td>
<td>3/7/2012</td>
<td>3/13/2012</td>
<td>21</td>
<td>33</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>37</td>
<td>2216</td>
<td>3/6/2012</td>
<td>3/29/2012</td>
<td>4/16/2012</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>55</td>
<td>4195</td>
<td>4/8/2012</td>
<td>4/24/2012</td>
<td>4/19/2012</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>62</td>
<td>4735</td>
<td>4/18/2012</td>
<td>5/27/2012</td>
<td>4/29/2012</td>
<td>17</td>
<td>23</td>
</tr>
</tbody>
</table>

The total number of interviews was not established ahead of time; rather, interviews were conducted until theoretical saturation was achieved9 (Dawson et al. 2010; Eisenhardt 1989a). To

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9 As the data analysis progressed, it became apparent that a rigid point of redundancy could not be reached, and this can be attributed to two factors. First, the stories related by the subjects were situated in different contexts: even if they all fall into the broad category of “cloud implementation” and share many commonalities in terms of achieving successful implementation, they vary in the particulars, including the types of cloud services, the scope of the project, the size of the organization, and the industries they belong to. These contingencies account for the uniqueness of each story. As long as interview data are collected based on different projects and contexts, new observations will continue to emerge, so it is arguably very difficult to reach a point of redundancy. Second, in order to retain as much richness as possible during the first order analysis, a portion of the text is treated as a new
facilitate this process, transcription and preliminary data analysis were conducted immediately following each interview. This procedure served three purposes. First, a summary of the transcript and follow-up questions were sent back to the interviewee—a procedure known as member checking (Lincoln and Guba 1985)—to ensure that the researcher’s interpretation accurately captured the subject’s perspectives (Lincoln and Guba 1985)\(^\text{10}\). Second, a review of the completed interviews provided the opportunity to revise and refine various questions, thereby improving the quality of the interviews that followed. Third, a preliminary analysis allowed for a determination of whether the data collection had achieved theoretical saturation by checking to see if any new concepts or patterns appeared (Bowen 2008). Figure 2 shows the iterative process of data collection, coding, and interpretation.

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{data_analysis_procedures}
\caption{Data Analysis Procedures based on Grounded Theory}
\end{figure}

node or concept whenever there is a subtle difference in its meaning. Merging nodes with similar meanings (at this level), would mean the loss of a certain level of granularity resulting in fewer total nodes, even though it might achieve the point of redundancy. It was therefore determined that theoretical saturation was achieved at the second-level of analysis without reaching a rigid point of redundancy.

\(^\text{10}\) One of the interviews involved multiple subjects from the same organization. It is likely that different people in an organization would have different experience with, or knowledge of what an organization is doing in relation to the implementation of cloud computing. This isn’t to say that one person’s experience negates another’s. If there appeared to be perceptual agreement between informants (James 1982), their responses were integrated for a comprehensive picture of the organization. If, on the other hand, there was a substantial disagreement, further discussion was initiated during the interview.
5.4 Results

The key objective of this study is to discover the factors that influence the success of cloud implementation in organizations. The interview questions covered three key areas corresponding to both the research objective and the level of analysis:—1) How should the organization manage its vendor relationship? 2) What preparations should an organization make before implementing cloud computing? 3) What factors need the most attention during implementation itself? The answers led to the development of a number of recommendations for organizations wishing to pursue a successful cloud initiative. Certain challenges and barriers were also revealed that an organization should address or at least be aware of before implementation. I have the fourth area: 4) what challenges need to be addressed?

Note that although data analysis in the grounded theory methodology is essentially conducted from the bottom up, the results in the following sections will be presented from the top down. A high-level categorization of factors influencing cloud implementation is provided in Table 12. Analysis of the interview data resulted in the development of three broad categories of factors. Each of the categories contains two or three layers of abstraction. For example, within the categories of success criteria and challenges, there will be second-order concepts and first-order themes; within the category of CSFs, there will be sub-categories, second-order concepts and first-order themes. The main categories and lower-level concepts will be discussed in detail in sections 5.4.1, 5.4.2 and 5.4.3.

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success Criteria</td>
<td>1) Business value</td>
</tr>
<tr>
<td></td>
<td>2) Technical performance</td>
</tr>
<tr>
<td></td>
<td>3) Project delivery</td>
</tr>
<tr>
<td>Critical Success Factors</td>
<td>1) Vendor management</td>
</tr>
<tr>
<td></td>
<td>2) Implementation Preparation</td>
</tr>
<tr>
<td></td>
<td>3) Project Execution</td>
</tr>
<tr>
<td>Challenges</td>
<td>1) Vendor management challenges</td>
</tr>
</tbody>
</table>
5.4.1 Defining “Success”

The first research question listed in the introduction above seeks to elucidate a definition of “success” in relation to the implementation of a cloud computing initiative. How can one determine whether a cloud initiative is successful? What criteria can be used to measure the success of cloud implementation? DeLone and McLean (2003) proposed a comprehensive taxonomy of IS success comprised of six dimensions: information quality, system quality, service quality, use of information, user satisfaction, and net benefits. Similarly, Marble (2000) explored the context of IS implementation success and reviewed areas including IS effectiveness, user information satisfaction, user involvement, management commitment, value basis, mutual understanding, design quality, project management, situational stability, and resource adequacy.

Drawing on elements from these studies, and more importantly from the data analysis, it is proposed that cloud implementation success can be assessed across three broad dimensions—business value, technical performance, and project delivery—though constructing a rigid definition of “success,” or developing an exhaustive metric framework is beyond the scope of this study. It is, however, essential to develop a basic common understanding when using the term “critical successful factors.” Table 13 summarizes the criteria for a successful cloud implementation in these three domains.

| Table 13. Criteria for a Successful Cloud Implementation |
|----------------------------------|------------------|
| **Dimensions**                  | **Criteria of Success**          |
| Business Value                  | 1) lower capital and operational cost |
|                                  | 2) market new services quickly     |
|                                  | 3) allow business to be more agile to market changes |
|                                  | 4) free the company from its non-core functions |
| Technical performance           | 1) meet specific technical requirements |
Today, the adoption of cloud computing is often initiated as a strategic move by an organization. Whether it will help the company gain business values and achieve strategic goals is naturally one of the most important criteria in assessing the success of implementation. Four first-order themes have been identified in the business value dimension (among others): 1) reduced capital and operational costs; 2) marketing new services quickly; 3) allowing business to be more agile in response to market changes; and 4) freeing the company from its non-core functions.

The success of a cloud initiative should also be assessed at the technical level. The first-order themes in this domain include: 1) meeting specific technical requirements; 2) reducing complexity; and, 3) usefulness acknowledged by users. The following three quotes exemplify each of these technical-level concepts.

“NM (a pseudonymous company) wanted to make sure that all of the recommendations that are going to come and fill on their page will be returned within 200 milliseconds. So that was one of the key success from NM’ s perspective.”

“So to be able to relegate off the complexities, manage infrastructure correctly, build skills to transcribe the video, and process that data, it was a big all around.”

“It solves so many problems for agencies. That actually turned out to be the big rain for the longest time. Agencies were saying that the SaaS product was almost more valuable than the officers.”

Similar to other IT/IS projects, the success of cloud implementation can also be assessed from the perspective of project management. Three first-order concepts are: 1) within budget; 2) within timeline; and 3) seamless integration/migration. A successful project should be delivered within budget and on time. Because many cloud projects involve both system integration and
migration, it is also an essential to ensure that the process is seamless and continuous. One interviewee emphasized:

“Some of the success metrics that were communicated included particular updates. They wanted to ensure that when updates required, bug-fix required, that will be seamless, and will be part of continuous integration process. I am sure that you've heard that term before essentially in cloud computing, that continuous integration is one of the key factors for any SaaS integration.”

5.4.2 Critical Success Factors

The data collected in the interviews point to a number of factors that were felt to be critical to the success of the cloud initiatives implemented in the various companies. The CSFs of cloud computing implementation are organized into three categories—vendor management, implementation preparation, and project execution.

5.4.2.1 Vendor Management

The fact that organizations implementing cloud solutions do not own and maintain at least a portion of their computing resources in-house calls for a strong, workable partnership with its outside vendors to deal with security, reliability and other issues. Computing resources from vendors are often provided based on service-level agreements arrived at through negotiation between the vendor and its clients (Buyya et al. 2008). The way that an organization manages the vendor relationship is a question to be answered at the inter-organizational level.

Analysis of the data reveals a number of CSFs with respect to vendor relationship management; these were grouped into three second-order concepts: 1) vendor and technology assessment; 2) formal and informal contracts; and 3) collaboration and trust.

Vendor and Technology Assessment

Many interview participants spoke of both the importance of securing good technology vendors and ways to do it. These results suggest that organizations that intend to use cloud services should make a thorough analysis of both available technologies and suitable vendors. When
assessing potential technologies, the client organization needs to make sure that the technology and service can be integrated into the existing technology infrastructure of the organization. In other words, the cloud technology should be compatible with the existing system and be well aligned with the technology roadmap for the next few years. Moreover, an organization should clearly articulate what kinds of technology they are looking to add, and what elements and services they do not need. The recommendation is that organizations should stick with their identified technology requirements and not to be cross-sold on unnecessary and unwanted add-on products.

Several elements need to be considered when it comes to vendor analysis. The first is that client organization should screen out unqualified vendors. Because cloud computing has become a very hot trend in the business world, many technology vendors that are not actually doing business in this area have labeled themselves cloud vendors in order to get more customers and higher stock prices (Parameswaran et al. 2011). It was also noted that more than one qualified technology vendor should be considered, and that the introduction of competition is one way to drive the cost down. The second element of great concern to a user organization is customer support. A good vendor will be able to provide both good support and flexibility. In any case, if an organization is looking for long term cloud services with the ability to achieve a larger scale, they will need to choose a vendor that has the capacity to supply the services at that level, and that will less likely to be out of business in the future. In other words, sustainable support is an important factor to be taken into account during vendor selection.

**Formal and Informal Contracts**

A review of agency theory reveals that some issues between users and vendors could be addressed from the perspective of formal or informal contracts (Jensen and Meckling 1976). Contracts can exist in the form of service-level agreements, which define the responsibilities, performance, warranties, compliance, and other aspects of the way that customers receive the service. The data show that it is important for a user organization to have specific and rigid service-level agreement with cloud vendors. For example, the user organization should enumerate in the contract their expectations and requirements for the performance of services. Should the vendor fail to meet these requirements, financial penalties will be deducted from the
payment. Likewise, proportional bonuses will be provided if the vendor exceeds the listed requirements, and incentives should flow in both directions.

Because data are stored on the vendor side, one of the critical issues is the establishment of appropriate security protocols to ensure that the vendor does not have unauthorized access to proprietary data. In many instances, cloud implementation not only involves use of cloud (software or hardware) products, it also requires technical support from the vendors—especially when the initiative is relatively large and complex. The data reveal that having a contracted, professional service team to work onsite is key for a user organization to successfully facilitate the implementation process and even ongoing system operation. It is reasonable to assume that not every single detail can be covered by a formal contract because unexpected things happen for unexpected reasons. Coping with the unexpected situations calls for a certain amount of flexibility that goes beyond a rigid contract. A user organization and its vendors should have the willingness to make necessary trade-offs and to work together to resolve unexpected issues.

**Collaboration and Trust**

The third category of CSFs regarding vendor relationship management is mutual collaboration and trust. As agency theory suggests, the establishment of joint problem solving, information sharing, trust, and shared values are important ingredients in IT/IS outsourcing projects (Rai et al. 2009). Analysis of the data shows that in additions to (formal or informal) contracts, there are several other factors that would help achieve a successful user-vendor relationship. The first is mutual trust. Building mutual trust not only enables a vendor to go beyond its own self-interested actions; it also augments the likelihood of long-term and future partnerships. Information sharing is the second theme. Vendors and users are encouraged to share dashboards, reports, and technology expertise with each other. By giving users access to this information, vendors are more likely to earn trust, and to help users considerably reduce monitoring costs. The third theme is communication. Continuous communication is a very positive signal showing that both parties are committed to the partnership. The fourth theme is joint problem solving. It helps both vendors and users identify potential issues and provides the opportunity to solve them earlier.

First-order themes on the topic of vendor relationship management along with supporting quotes are provided in Table 14.
<table>
<thead>
<tr>
<th>Second-Order Concepts</th>
<th>First-Order Themes</th>
<th>Representative Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>select cloud vendors</td>
<td>Flexibility. What</td>
<td>“Flexibility. What kind</td>
</tr>
<tr>
<td>that provide flexibility</td>
<td>of flexibility they</td>
<td>and support. Support is</td>
</tr>
<tr>
<td>and support</td>
<td>provide; and</td>
<td>an important one, when</td>
</tr>
<tr>
<td></td>
<td>support. Support is</td>
<td>you outsource, you</td>
</tr>
<tr>
<td></td>
<td>an important one,</td>
<td>want to make sure you</td>
</tr>
<tr>
<td></td>
<td>when you outsource</td>
<td>get good support.”</td>
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<td></td>
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<tr>
<td>secure good service</td>
<td>Need to identify a</td>
<td>“Need to identify a good</td>
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<td>service provider</td>
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<td></td>
<td>who has a long</td>
<td>has a long term view</td>
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<tr>
<td></td>
<td>term view on Infra</td>
<td>on Infra and Apps -</td>
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<tr>
<td></td>
<td>and Apps - Service</td>
<td>Service deployment for</td>
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<tr>
<td></td>
<td>deployment for</td>
<td>cloud.”</td>
</tr>
<tr>
<td></td>
<td>cloud.</td>
<td></td>
</tr>
<tr>
<td>no other add-on</td>
<td>We cannot allow</td>
<td>“We cannot allow one of</td>
</tr>
<tr>
<td>products from the</td>
<td>one of the vendors</td>
<td>the vendors if equity of</td>
</tr>
<tr>
<td>vendor except the</td>
<td>if equity of the</td>
<td>the vendor is selected.</td>
</tr>
<tr>
<td>required</td>
<td>vendor is selected.</td>
<td>Let’s say Google gets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the job. They can say</td>
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<tr>
<td></td>
<td></td>
<td>by the way, we have</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Google Plus. Oh! No,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>doesn’t work this way.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It has to be a brand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>new RFP, but one of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>major requirements of</td>
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<td></td>
<td></td>
<td>that is the integration</td>
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<tr>
<td></td>
<td></td>
<td>between whatever is</td>
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<td></td>
<td></td>
<td>selected and Google</td>
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<td></td>
<td></td>
<td>Messaging. Google can</td>
</tr>
<tr>
<td></td>
<td></td>
<td>also not say Oh! We also</td>
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<td></td>
<td></td>
<td>have Google whatever it’s</td>
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<td></td>
<td></td>
<td>called does, no. No,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>because it's not part of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the arctic.”</td>
</tr>
<tr>
<td>extensive vendor</td>
<td>Extensive</td>
<td>“Extensive architecture,</td>
</tr>
<tr>
<td>analysis</td>
<td>vendor analysis,</td>
<td>extensive vendor analysis,</td>
</tr>
<tr>
<td></td>
<td>extensive</td>
<td>extensive getting</td>
</tr>
<tr>
<td></td>
<td>vendor analysis,</td>
<td>multiple suppliers, on</td>
</tr>
<tr>
<td></td>
<td>extensive</td>
<td>the side of any aspect</td>
</tr>
<tr>
<td></td>
<td>vendor analysis,</td>
<td>of system, there is</td>
</tr>
<tr>
<td></td>
<td>extensive</td>
<td>always A and B tech.”</td>
</tr>
<tr>
<td></td>
<td>vendor analysis,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>extensive getting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>multiple suppliers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>on the side of any</td>
<td></td>
</tr>
<tr>
<td></td>
<td>aspect of system,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>there is always A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and B tech.”</td>
<td></td>
</tr>
<tr>
<td>cloud service has to</td>
<td>We made the</td>
<td>“We made the decision</td>
</tr>
<tr>
<td>be aligned with the</td>
<td>decision based on</td>
<td>based on effect that the</td>
</tr>
<tr>
<td>existing technology</td>
<td>effect that the</td>
<td>other company did not</td>
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<tr>
<td>infrastructure</td>
<td>other company</td>
<td>integrate it that time</td>
</tr>
<tr>
<td></td>
<td>did not integrate</td>
<td>with our system. Our</td>
</tr>
<tr>
<td></td>
<td>it that time with</td>
<td>number one requirement</td>
</tr>
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<td></td>
<td>our system.</td>
<td>was full integration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with our existing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>infrastructure.”</td>
</tr>
<tr>
<td>carefully select</td>
<td>And some of the</td>
<td>“And some of the vendors</td>
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<td>vendors who are truly</td>
<td>vendors that I</td>
<td>that I interviewed didn’t</td>
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<td>qualified for providing</td>
<td>interviewed didn’t</td>
<td>know anything about the</td>
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<td>cloud services</td>
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<td>about the cloud.</td>
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<td>They just</td>
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<td>part of the</td>
<td>feel is like deer in a</td>
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<td>provider, but when</td>
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<td>select vendors who</td>
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<td>can provide long</td>
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<td>term services</td>
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<td>you add additional</td>
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<td>additional features</td>
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<td>and functions to</td>
<td>who are your next</td>
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<td>Verizon or AT&amp;T?</td>
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<td>Verizon or AT&amp;T?</td>
<td>of the company to deliver.”</td>
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<td>set up security</td>
<td>So we had to</td>
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<td>protocols to make sure</td>
<td>assure them that</td>
<td>that the data on our</td>
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<td>the vendor does not</td>
<td>the data on our</td>
<td>devices is firewalled.</td>
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<td>access to certain data</td>
<td>devices is</td>
<td>We cannot read the data</td>
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<td></td>
<td>firewalled.</td>
<td>on our devices without</td>
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<td></td>
<td>We cannot read</td>
<td>customer intervention.</td>
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<td>the data on our</td>
<td>You have to actually go</td>
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<td>devices without</td>
<td>and turn on the capability</td>
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<td>customer</td>
<td>for us to read what is</td>
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<td></td>
<td>intervention. You</td>
<td>on the disk drive. All we</td>
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<tr>
<td><strong>Mutual collaboration and trust</strong></td>
<td><strong>platform.”</strong></td>
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<tr>
<td>rigid and specific service-level agreements</td>
<td>“When you look at the way V company contracts with the content providers, there are some very rigorous service-level agreements. As part of SLA, V Company will say ‘if you got three hundred movies, and they are all 10GB, based on our network connectivity, we will guarantee that we can download 10 titles a day, or 30 titles a week.’ The SLA was very specific with how long would it take to transcode the title into a certain format. If Pixar said I want you to transcode this <em>Toy Story 2</em> that is viewable on an iPad, V Company will come back with very specific figures on how much time an effort it will take and what was the cost to be paid to Pixar to accomplish the mission. So these tend to be very detailed. It is a very rigid contract between the cloud provider and content provider.”</td>
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<tr>
<td>contracted professional team work onsite to provide technical support</td>
<td>“They are contracted year-by-year basis. For example, they had three people working 8 hours shifts, that effectively provide us with 24/7 knowledgeable support expertise. That becomes part of our network operation.”</td>
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<tr>
<td>willing to make trade-offs</td>
<td>“It was a little bit massaging and basically trade-off doubts. You know what is it was getting, losing, either positive or negative balance. N company eventually decided that that was very positive balance and we were the ones that were best able to treat the algorithms for them rather than trying to teach them or to build an interface that would allow them to do that.”</td>
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<tr>
<td>shared dashboards and reports</td>
<td>“Go forward. They give you dashboards and reports, so you can monitor how your system is operating.”</td>
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<tr>
<td>build mutual trust</td>
<td>“There were genuine concerns for making a good product for the customer. The mutual trust between T Company and the customer is huge. It is the trust that T Company has no intention to violate.”</td>
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<tr>
<td>work together to solve problems</td>
<td>“We were engaged with the clients and had partnerships. So we work through whatever comes together, trying to understand difficulties, strange challenges or opportunities around applications or just general applications of a cloud computing offer. As far as the management problem, when the goals are misunderstood. So we work through these problems together.”</td>
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<td>continuous communication</td>
<td>“Having that team available, having a standup everyday with the team, you know, 16-20 minutes phone call with the entire team together for basically two months, five days a week, really allowed us to continuously communicate any of the issues, either we were facing or N Company was facing.”</td>
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5.4.2.2 Implementation Preparation

Implementation preparation is a comprehensive process involving planning, design, appraisal, resource assembly, and other organization-specific activities. Preparation is a common phase shared by most—if not all—IT-related projects from a project management perspective. Yet, the data analysis revealed a lot of details under seemingly similar categories that in fact should be articulated more distinctly. Resource-based theory suggests that internal resources and capabilities are required for firms to implement strategies and to improve efficiency and effectiveness. From a resource-based perspective, preparation of cloud implementation is about pulling together various resources within the organization. These resources can be business drivers, management champions, technology planning, architecture design, expertise and tools. The CSFs associated with implementation preparation are divided into four second-order concepts: business and technology planning, resource assembly, architecture design, and organization-specific factors.

**Business and Technology Planning** is defined in this paper as a unified process not only comprised of planning for business strategy and technology, but more importantly, that emphasizes the connections between these two domains. Because IT managers and business managers tend to have disparate perspectives (Burn and Szeto 2000), the alignment of business and IT is key to the success of many IT-related projects (Reich and Benbasat 2000). First amongst all other concerns when considering a cloud initiative is to identify legitimate business drivers. Several interviewees emphasized the point that a business problem to be resolved, or a business objective to be achieved, determines whether an organization needs to implement a cloud solution in the first place, and how the technology will be implemented. Business drivers precede technology innovation—not the other way around. If cost reduction is one of the business objectives, for example, the complete technology design should be able to predict its cost. In short, an organization should have a clear understanding of its business requirements and objectives.

The second primary concern centers on understanding cloud technologies. Specifically, an organization needs to conduct a comprehensive analysis of what the cloud can and cannot do, and then develop appropriate expectations. Typical questions could be: What will change when
applications in a standalone environment move to a cloud environment? How much up time can a cloud vendor promise? What level of peak time performance can be expected? Will the cloud be able to scale up and down? Will the cloud environment provide sufficient security? With a good understanding of cloud technologies established, an organization will need to decide what applications or functions should be moved to the cloud. Organizations are recommended to develop a full migration program if they decide to move certain applications and infrastructure to the cloud. In the meantime, an organization should assess its current usage, and then estimate future usage of cloud services because this critical assessment is the foundation for and driver of capacity planning. An essential question of capacity planning centers on the scale of current and projected cloud services, the determination of which is no easy thing. Effective capacity planning enables an organization to meet current performance needs as well as respond to ever-changing market demands. The last step of business and technology planning is to look at cloud technologies in depth. A thorough technology investigation should be conducted to examine, for example, bandwidth, data storage, adapters, virtualization, encryption, repositories, compliance, programming language, and access control. In summary, there is a tremendous amount of technical work that needs to be done before rolling out cloud applications.

**Resource Assembly** is the second category of CSFs associated with the preparation for cloud implementation. Three types of resources have been identified from the data: political resources, human resources, and technology resources. The findings confirm the formulation of firm resources for IT projects in the literature (Barney 1991; Melville et al. 2004). Political resources include support and commitment from senior management, support from business teams, and trust. Senior management support is critical because without it a cloud initiative would not be conceived in the first place. Without senior management commitment, a cloud initiative would likely stall or be aborted should any major problems occur later on. In many cases, senior management is not just the provider of support and approval to the cloud initiative, they are the very champions that advocate for the campaign and drive the process: in those instances, they take ownership, cultivate the technology, and are willing to take risks. In addition to endorsements from the top, support from the business and application team is also important. Business/application teams need to be aware of the full program for migration and to understand the roadmap so that the technology teams and business/application teams can be on the same page. Collaboration from business/application teams helps to establish feasible agendas and to
mitigate unexpected risks. One thing that needs special attention is earning the trust of business teams. Because budgeting is always a challenge, a CIO needs to be transparent with the business team about costs and other potential problems.

Human resources in the context of resource assembly refer to the skills and expertise required to successfully implement cloud applications. In the early stages of a cloud implementation, an internal team with right skills needs to be assembled. The team should not only be comprised of tech-savvy people (i.e. software engineers), but should include a variety of personnel such as business analysts, subject matter experts, and even thought leaders. One of the benefits of having people from diverse domains in a team is to perhaps see things from a comprehensive perspective and to make sure that every angle to be covered.

Among the various roles, the role of the architect was highly stressed in the interviews. The architect becomes very critical because cloud initiatives don’t just bring change to IT services, they also change thinking processes. A systems-wide thought process is needed to integrate cloud services as an emerging technology into the existing enterprise infrastructure. The systems architect is the singular person who can provide that kind of perspective and understand the complexity of the process. If an organization is getting into an area that they are not familiar with (cloud computing in this case) and does not have adequate human resources internally, third-party consultation is very often a good practice.

Technology resources to be assembled include the infrastructure, system modules, and a bundle of tools for building cloud applications. Because cloud applications—especially software as a service (SaaS) and platform as a service (PaaS)—are essentially extensions of web services, the identity and access management module is seen to be an indispensable piece. This module can be used for the proof-of-concept in the early phases, and scaled up for production utilization later on. The tools for cloud applications include application development tools and system administration tools. Different tools are used for different applications. If a cloud application requires a considerable amount of database operations, ETL (Extract, Transform and Load) tools should be used.

**Architecture Design** is the third category of CSFs that are identified in the data. Broadly speaking, architecture design refers to using enterprise architecture principles, standards, and
artifacts to provide a solution for fulfilling business-system alignment and realizing certain system functions across an enterprise. At the conceptual level, an organization needs a good architecture that can support the cloud, and it could be very risky for an organization to rush into the cloud environment without thinking it through. On one hand, not all applications can be directly put into the cloud because they either require custom configuration or integration back to the existing system. A solid architecture provides organizations with a holistic vision of how the cloud can support the business and can help organizations to deal with various complexities in, for example, EA boundaries and security requirements. On the other hand, not all architectures have the capacity to support the cloud. For example, point-to-point solution are found to be inefficient in incorporating heterogeneous systems because this approach creates a lot of redundancy and requires more resources and more time to deliver new services. The integration of $n$ application systems requires $n(n-1)$ interfaces due to the non-reusable programming.

The question might then be asked, “What kind of architecture is suitable for cloud services?” A number of interviewees contend that the answer is service-oriented architecture (SOA). They believe that SOA helps to make services offered in the cloud more consumable, and thereby that organizations that have adopted SOA are more likely to be well prepared for the adoption of cloud solutions. One interviewee highlighted the connection between the cloud and SOA by saying that having a SOA constructed and then having it embraced with virtualization are two essential characters underlying the definition of the cloud. SOA, by building components into loosely coupled services, allows organizations to rapidly develop, and to integrate and reuse components to deliver flexible solutions. While the majority of interviewees believed that SOA is critical for implementing cloud services, a small minority felt that SOA is not necessary. When I presented the later opinion to a very experienced, high-level executive, he commented that some organizations might not need a solid SOA to implement one single application, but that it will pose a big problem in the future if they want to expand their implementation.

At the physical level of architecture design, organizations should pay attention to a number of things. First, instead of building everything from scratch, organizations are recommended to use reference architecture. Reference architecture provides generalizations of architecture structures and solutions. The diagrams, patterns and data vocabularies can prove to be very helpful in driving new solution designs all the way to business process outsourcing and software
development. Since reference architecture is essentially pattern-based, it is better to follow industry standards and approved patterns when designing from reference architecture. Second, applications and components should be standardized. It is evident that standardization offers flexibility and saves both time and resources. Third, detailed service catalogues need to be developed. As discussed earlier, not all services might be outsourced to the cloud within a specific organization. A service catalogue describes which cloud services will be used. Although cloud solutions are known to reduce costs, such assertions should be treated with caution when it comes to production utilization in reality. Whether or not cloud initiatives can save money depends on how they are used. One interviewee warned that if people simply put everything into the cloud, the cost could in fact be higher. A new cost model should be developed to assess the costs of various cloud services so that an organization can decide which applications should best be provided from the cloud. A detailed service catalogue provides a solid foundation on which the new cost model can be developed.

The last set of factors that affect an organization’s preparation for cloud implementation depend on organization-specific characteristics. Some of these might include: the scale of the project, size of the organization, information intensity, and the current level of outsourcing and virtualization. If an organization already has some experience in data virtualization and outsourcing, they may only need a few people to do the management work when leveraging cloud services. By contrast, if an organization has maintained all of its data in a proprietary data center and now wants to move everything into the cloud, a much greater amount of time and effort may be necessary to prepare for implementation.

First-order themes on the topic of Implementation Preparation—with supporting quotes—are summarized in Table 15.

<table>
<thead>
<tr>
<th>Second-Order Concepts</th>
<th>First-Order Themes</th>
<th>Representative Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business and technology planning</td>
<td>understand the requirement and business objective</td>
<td>“A lot of requirement gathering. Everything ranging from CIO surveys, understanding the complete landscape before executing a dollar of implementation budget.”</td>
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<td></td>
<td>thorough technical</td>
<td>“There was a tremendous amount of technical investigation.”</td>
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Table 15. CSFs of Implementation Preparation
investigation

How much bandwidth do you need to the content provider to take three or four different titles and high definition, and get them to these core libraries? A gold copy of a high definition movie can be many gigabytes, the network infrastructure you needed not just go across country, but just go from the content provider to the initial entry point, the VDMS solution needed to be looked at. How do you choose the right transcoder technology? How do you choose the right storage and server technology to develop this stuff?”

identify legitimate business drivers behind technology innovation

“We have business challenge that we have to solve. This means we lose revenue because we are losing customers. Because of the business challenge, IT came in and tried to solve this challenge. This is what I believe in the future is. You do not have an IT project without a business driver behind it.”

right expectation of what cloud can do

“So when you want to move to the cloud, the first question that the business team asks is what is going to be different when application in a standalone environment moves to the cloud. So the IT team has to be very clear that the service provider has promised 99.9% up time of the application of the infrastructure. There will be more latency in the application. During the peak times, we will not have slow access to the application, but the cloud will help in providing more resources during the peak times. These are some of the promises that cloud makes.

identify right applications to be in the cloud

“You choose the right application, and make sure that you have an application that is well understood. It can be changed. Being plausible. Especially for your first view, you may not be driven to go by the mission critical to your operation application. Maybe you can do a background application to understand the limitation.”

have the right scale of cloud applications

“You have to do the right scales in a given design that includes the service provider and architects. It includes possessing the hardware, and selecting the right data center to be able to ensure all security policies to be taken care of.”

good capacity planning and expectation on usage

“The second factor is about the end user. You need come up with a solution that goes beyond the end user. What I mean by that is when you are doing capacity planning, you don't just design a system that meets the current usage of end users, you have to have a good expectation in terms of the possible peak times. You need to have service catalogs. So it is the usage that drives the capacity planning.”

full migration program of infrastructure and applications

“Ability to draw a full program of migration of infrastructure and applications in a phase manner as not all infrastructure and applications can go on cloud through a clear visibility by
<table>
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<th>Resources</th>
<th>Assembly</th>
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<tr>
<td>applications</td>
<td>doing proof of concepts and acknowledgement from application /business teams.”</td>
</tr>
<tr>
<td>cost needs to be predictable</td>
<td>In terms of IT infrastructure, architecture, there are different critical success factors, because you have to make sure there is a predictable design. The design predicts its cost. You have to show return on investment. You can make a proposal to the management.</td>
</tr>
<tr>
<td>IT architecture experts work in conjunction with other departments</td>
<td>“what he did was he started out by contracting with the CIO to get a dozen of IT architecture experts, to work in conjunction with his networking experts, to figure out how do you put an IT platform seamlessly into the network and have it fit and function and get supported like it was a network element”</td>
</tr>
<tr>
<td>obtain support from application and business teams</td>
<td>“not all Infra and applications can go on cloud through a clear visibility by doing Proof of Concepts and acknowledgement from Application /business teams”</td>
</tr>
<tr>
<td>obtain support from senior management</td>
<td>“We had management buy-in of the concept of that technology. I think it is very important in every organization. You have management buy-in. For example, we have our CTO fully embraces cloud computing technologies. He has founded the laboratory and the people to run that laboratory.”</td>
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<tr>
<td>get appropriate tools</td>
<td>“Different applications require different resources, if you think about system administration is appropriate, you should get different tools out there, but it is increasingly more toward getting the ETL.”</td>
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<td>consult with third parties</td>
<td>“V Company has acknowledged the fact that they were getting into a territory that they were not familiar with, they did a number of things. They relied on a number of third parties to help them with the process. Deloitte consulting was very much involved.”</td>
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<tr>
<td>CIO needs to be transparent to build trust</td>
<td>“Now keep in mind, regardless of that relationship that we have, by the time you want to make a decision, try to get the money is always a challenge. The CIO has to be transparent in order to build trust. What I mean by transparent is not just implementing technology, open book transparency. They have problems to tell us. I have problems too.”</td>
</tr>
<tr>
<td>assemble a technical team with right skills</td>
<td>“You need to ensure that you have the right skills to go the technology that you will be building into the cloud. You need to ensure the training of the teams supporting the cloud.”</td>
</tr>
</tbody>
</table>
| build access and identity management modules | “Another thing that I included in my early plan, as part of my enterprise architecture roadblock, is building access and identity management. Those are the key points that I can share with you a lot of times when you talk about EA. The
way we partner with the line of business, when they want to implement their apps, they require user name and password. What I did is create a small footprint. Implementing the technology that can be scaled to become an enterprise-wide identity is next stage.”

**architects play critical roles in developing solution architecture**

“One of the biggest impacts and biggest role is not just the IT service change, the thinking process has changed. The role of architects will become very critical.”

**the amount of resources depends on the extent of virtualization and outsourcing**

“It will depend from client to client. If they already virtualize their data and lining up somebody else's data, they will only have a few people who will do management kind of work and manage their infrastructure, if it is already outsourced. But if the client has all the data in their own data center and they want to outsource everything to the cloud, then it is a two year journey for them. So they will have a lot of time to get prepared in terms of people, security and financial aspects. I don't know if it is a clear answer, but again, it depends on the stage where the client is.”

**service oriented architecture is critical for using cloud services**

“The service oriented architecture is kind of a requirement for integrating with large SaaS operations simply because if you don't have that, you limit yourself on a variety of levels. For instance, NM Company will integrate with numerous vendors, whether it is for advertising, whether it is for analytics, or for recommendations. Without service oriented architecture, they are not going to have nearly the amount of flexibility to treat their internal IT infrastructure to match with their business expectations to get out of their IT operations.”

**standardize the components**

“But these components reside on the top of the product. So that's how whether it's running on JBOSS, Redhat, WebSphere application servers. A lot of these things are the core products. That is how you want to create standardization.

**have the right architecture that can support the cloud**

“I put those architecture in place that allow me, when the cloud terminology coming in, we can enable that infrastructure to support the cloud. The key is the architecture building blocks—how do you build that foundation correctly so it can allow you to implement the new technology down the road.”

**follow the patterns when designing reference architecture**

“Pattern is approved things. You cannot argue with pattern. Everybody will follow it, you can talk to all lot of conversation even private company. I don't think it is on my own, this is there like 15 years ago. IBM implemented a lot of these already. So you will get some of these things we implemented. This is the current our production environment and all that.”
detailed service catalogue and SLA contract

“If you look at cloud services, we have to really deal with a lot integration points. You have to lay out the architecture, I call it solution architecture. You have to have a detailed service catalogue and SLA contract. A lot of cloud and outsourcing fail because we do not write the contract and service in much detail.”

build robust reference architecture and technology roadmap

“We created IT governance here. The IT governance is called technical review board. This board consists of 30% of the business and IT. I chair this board. We had the reference architecture that drives our vision where we want to go. I created the reference architecture, technology roadmap. I shared with those folks and at least they know whether we have the capability to support the business.”

5.4.2.3 Project Execution

Project execution describes a process ranging from technology readiness through implementation to the end point when the technology is ready for use. Resource-based theory suggests that during implementation, organizations continuously need resources such as political support, right project management tools and approaches, workplace practices and culture. The CSFs in this phase are classified into three second-order concepts along the same lines: proof of concept and pilot project; implementation and project management; and user involvement.

The Proof of Concept and the Pilot Project are common approaches for determining whether a cloud implementation would meet the expected objectives. Analysis of the interviews uncovered several good practices to assist an organization to achieve technology readiness. A proof of concept should be executed to evaluate the feasibility of the proposed technology and to identify potential problems. Managers and executives are encouraged to not be afraid of making decisions and to try out different things at this stage. If a particular proposed solution does not work out for a reason such as incompatible specifications, the organization should either quickly abandon that solutions or adjust its parameters. Following the proof of concept, a pilot project aims to create a fully functional system, up and running on a limited scale but with appropriate production quality. It further examines performance by allowing users to be involved. Organizations can simulate self-provisioning by modulating CPU capacity up and down so that they better understand the performance and cost of leveraging cloud services. Once the pilot
project has been completed and proves to be successful, the technology implementation can be scaled up and move into the production environment.

The **method of implementation and project management** encompass several critical factors that can make the project delivery successful during cloud implementation. In this stage, the project team needs sustainable support from management, just as in the preparation phase. Return on investment might be a persuasive argument to get management committed to the project. It is important to sustain measurable progress, and two techniques are recommended to measure it. One is to use a work breakdown structure, meaning that the project is broken down into signed tasks with timelines, usually with dependences between tasks. Thus, making sure each task is accomplished within its timeline is critical for the whole project to meet the final deadline. The second technique is to develop a tangible metric that can be used to track performance and to identify issues as early as possible.

When programming work is required for the sake of customization or integration, a development approach should be considered. It is suggested that agile programming has advantages over the “waterfall” approach because the former offers more flexibility and allows people to address emerging issues much earlier. However, a combination of these two approaches is said to be a good practice in some circumstances.

**User involvement** provides the third group of Critical Success Factors, covering the way the implementation team interacts with end users. One recommendation is to foster user engagement from all relevant stakeholders. Another recommendation is to establish appropriate user expectations, such as informing users when and how the system will be switched over. Getting user involved in the project offers two benefits: it allows the implementation team to gather user feedback from different perspectives, resulting in further improvements to system usability. It also mitigates potential user resistance stemming from the inevitable change to user habits.

First order concepts relating to Project Execution are summarized in Table 16.
<table>
<thead>
<tr>
<th>Second-Order Concepts</th>
<th>First-Order Themes</th>
<th>Representative Quotes</th>
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</thead>
<tbody>
<tr>
<td>do proof of concept to test out different features</td>
<td>“Basically clients will try to do all it takes during the proof of concept phase so that once we start on this journey, there is no going back.”</td>
<td></td>
</tr>
<tr>
<td>do a pilot before rolling out for production</td>
<td>“The way we partner with the line of business, when they want to implement their apps, they require user name and password. What I did is create a small footprint. Implementing the technology that can be scaled to become an enterprise-wide identity is next stage.”</td>
<td></td>
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<tr>
<td>build a self-provisioning private cloud</td>
<td>“I broke it down to different apps and certain thing right on the back I say application integration, package integration, large, I don’t put into the cloud everything, right there and I put it in a private cloud, shared service cloud, or advanced virtualization, which is your own data center. Once you start putting into the cloud upfront, then you have to be able to do self-provisioning via the web, bring it up and down your CPU capacity. You have to be able to see how much money that you can charge actually those will cost a lot to do that online.”</td>
<td></td>
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<tr>
<td>quickly abandon the wrong specifications and find the right solution</td>
<td>“The solution was to simply abandon that requirement that they had in their head that they didn't actually specify as part of the scope of work. There was an assumption that they would be able to do it was not nearly specific enough which is why it was missed in the pre implementation phase. So they essentially said, you know what, we were six week away from the project, we back off, we'll see how it works.”</td>
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<tr>
<td>sustainable management support</td>
<td>“You need to ensure that the management will support it for the next few years because the return on investment is worth the project once it is implemented.”</td>
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</tr>
<tr>
<td>meet tangible metrics during the implementation</td>
<td>“It is very challenging for us especially because during the SaaS implementation, we actually have tangible metrics that we have to meet during early stages of the implementation. We were looking at numbers and v-time, recommendation counts, effect on page load, network traffic time, global balancing at the very earliest stages.”</td>
<td></td>
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<tr>
<td>measurable progress of the project</td>
<td>“I basically have good personal relationships with them, make proposals and see how it works. We have criteria to measure the progress of the project. If there is a problem, we work with the customers to jointly solve it.”</td>
<td></td>
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<tr>
<td>combination of</td>
<td>“I use the combination trying to deal with the agile approach</td>
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</tbody>
</table>
different implementation approaches and waterfall approach. But the combination of these two really depends on what kind of project management environment you are walking into, and about the application first and foremost.”

break down the work into signed tasks with deadlines “You have work breakdown structure. They have signed tasks with deadlines. Because there are dependencies, so access to happen first before the next step. If you are making right progress on certain path, you know you will cut over date. It is normal project management that you check the task is complete and signed to the different folks.”

agile programming “In many ways, that ties into one of the modern software methodologies of agile programming where we have to be very flexible. We have to communicate constantly and we have to identify issues early so that we can address them early inside of the SaaS implementation, because if you follow waterfall method with the SaaS implementation, something is going to break in the end. It is guarantee. So following a more agile methodology in a SaaS architecture, you are going to be able to identify these problems a lot sooner, which is critical for big companies like this.”

User involvement

engagement from all concerned stakeholders “It was more about user engagement with the product than anything else. It is just sort of understanding shielding the product. It was about the usability from the perspectives of all of the concerned stakeholders. An officer's perspective on evidence gathering is very different than, say, chief's perspective which is very different than internal affairs or litigation department.”

notify users so that they have expectations when system switches over “When you go for the change management, you notify the customers, they will know about this collaboration or switchover you will expect that I mean you have to manage the communication with clients and all that stuff, you just don’t switch it over.”

5.4.3 Challenges

The success of a cloud implementation, similar to other IT/IS projects, calls on an organization not only to do things that are recommended, but to also be wary of threats that could jeopardize the whole initiative. So far we have discussed the CSFs for vendor management, implementation preparation and project execution. Next a list of challenges will be presented that could appear at any time throughout the cloud implementation followed by several caveats for organizations intending to implement cloud computing. It is contended that achieving the success factors
described above is a necessary, but not sufficient condition for making a cloud implementation successful. Failure to address unexpected problems and roadblocks could very well lead to undesirable consequences. The possible challenges that emerge from the data are categorized into five second-order concepts, namely: vendor management; politics and culture; lack of resources; incompatible architecture design; and data storage, transfer, and security.

**Challenges relating to Vendor Management.** Challenges in vendor management can arrive in several forms. More often than not, organizations find themselves dealing with a variety of individual cloud vendors, for applications, databases, and infrastructure. Working with multiple vendors creates a number of complexities. One of the major complexities is associated with the integration of different components from different vendors because not all of them are interoperable. The interactions between multiple vendors, customers, and even stakeholders within the organization can lead to architectural challenges because they substantially increase the scope of the architectural design and the effort required to accommodate a multiplicity of relationships.

When working with multiple, or even a single vendor, organizations may face three additional challenges. The first is to accommodate relationships that had not previously existed. An organization, for example, may have been using a particular vendor for communication services, but now they want to extend into another area such as content. This could create a very different relationship since all of the security applications and performance expectations might change. The second challenge is the possibility for disconnected technical communication. A lot more effort may be required to communicate effectively because of the misunderstandings arising from a lack of adequate technical expertise within the organization. The third challenge is a conflict of ownership that can occur when the vendor has the full ownership of algorithms, modules, or applications, but the client organization desires to have more control over them.

First-order themes relating to the Challenges in Vendor Management are summarized in Table 17.
Table 17. Challenges in Vendor Management

<table>
<thead>
<tr>
<th>First-Order Themes</th>
<th>Representative Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involving multiple parties poses an architectural challenge</td>
<td>“So it was a huge enterprise architecture problem that spans more than one enterprise. It involves a number of content providers, it involves V Company business, V Company network, and V Company wireless, and delivery mechanisms. It involves a number of retailers, Comcast, Cablevision, etc. and it involves the consumer at the end of the pipe. This was a muti-enterprise architectural challenge.”</td>
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<tr>
<td>Disconnected technical communication between user and vendor</td>
<td>“The second oversight or hurdle was there was a clear disconnect of the technical communication. The way that we provide the information over the SaaS network was essentially JASON code back and forth. They knew how to build the website. They had very technical people on website. They did not have the technical expertise with very specific way that we do with communication back and forth.”</td>
</tr>
<tr>
<td>Deal with relationships that have never existed</td>
<td>“A challenge from the fact that when you sell communication services to a studio, or to Comcast, there is one set of people within that organization that you will be dealing with. When you start dealing with a service that deals with family jewel, their content, it is entirely separated organization that you would deal with. So there were relationships that never existed before that had to be arranged.”</td>
</tr>
<tr>
<td>Complexities of dealing with various vendors</td>
<td>“There are a lot more details perhaps we can address that, depends on how much deeper you want to go through. For example, even the infrastructure, the vendors not just VMware only, I have to deal with the storage vendors, network, and database vendors. Underneath infrastructure, there are a lot of complexities.”</td>
</tr>
<tr>
<td>Potential integration problems if using multiple vendors</td>
<td>“Second, if you are not using cloud services from one single vendor, you have an integration problem. There are Google, Amazon, Microsoft, Saleforces.com, SAP, a variety of vendors. Not all of these infrastructures are interoperable.”</td>
</tr>
<tr>
<td>Conflict of the control over the algorithms</td>
<td>“There were some other resistance which was basically around the vendor having full control over the algorithms that NM Company wanted more control over how to treat the algorithms and how to create the greatest upscale possible.”</td>
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</table>

**Challenges relating to Politics and Culture.** Political and cultural issues have long been discussed in the realm of IS/IT initiatives (Giddens 1991; Walsham and Sahay 1999; Walsham and Waema 1994). Analysis of the data revealed that political and cultural issues exist both within the implementation team and beyond it. Political resistance to the organization’s cloud
initiative may in fact begin within the implementation team itself. The IT people may claim not to trust the cloud environment simply based on a service-level agreement, or may express doubts about cloud service performance, resulting in resistance to cloud conversion. While some concerns or doubts might be perfectly legitimate, others could equally be attributable to political and/or cultural reasons (Chapter Six will engage a lengthy discussion on this topic based on case study data.) One of the negative outcomes of such contrarian forces is that work efficiency could be substantially decreased, ultimately compromising the entire cloud effort. This form of resistance is also demonstrated in that many IT people are perceived to be opposed to learning the new skills or technologies that are recognized as useful in cloud implementation. A closer examination reveals that these two types of resistance are rooted in the organizational changes that have been brought about by implementing cloud services. Specifically, the interview subjects attributed this resistance to two factors. The first has to do with intangible changes in people’s beliefs, morale and culture. For example, IT professionals are concerned about job security. In traditional IT departments, employees did a lot of in-house programming, but when services are moved to the cloud, these skills and expertise are less relevant. The IT group could face downsizing since much of their former workload will be taken up by outside vendors; these employees may legitimately feel insecure about their position within the organization as they assist in implementing change. The second factor lies in the tangible changes in work processes. People accustomed to doing things a certain way before systems move to the cloud may now be asked to radically change the way they do things because some of their job functions have been aggregated into the cloud services. There is also a chance that they will be reassigned to positions they are not comfortable with because they are not mentally prepared for the change. In the same way that organizational changes as a result of cloud implementation explains the political and cultural resistance within the IT group, managing this resistance calls for effective change management approaches.

Political and cultural issues also exist beyond the IT group. One challenge that was frequently stressed is associated with collaboration across multiple groups. First, different groups may speak entirely different languages. A gap exists between IT and business because they tend to use different vocabularies. One comment in the interview data pointed out that the CFO from the business side may get irritated when CIO starts using technical terminology. Second, different groups may use different measurement systems and have different expectations. Take application
software selection for example: the IT group may set higher priorities on the technical aspects (e.g. speed, compatibility) of the performance while the business team is concerned more with cost, usability, and time to market. One interviewee commented that the business team does not care very much about the technical challenges faced by the IT team. Third, different groups may compete for investment dollars. In an example from the data, a telecommunication company was developing a new business service, which required support from both the IT group and the network group. Because the budget for the whole project was fixed, the groups were placed in opposition to each other in their attempts to get a larger portion of the budget. In addition to collaborative challenges, the implementation team may face political barriers when selecting cloud vendors. Vendors selected by the IT group (based on technical considerations) might not be approved by management (for other business reasons). Examples of such reasons include, the lack of a master agreement with the vendor, lack of a discount structure, and that the vendor is not a customer or partner.

First-order themes regarding political and culture issues are summarized in Table 18.

<table>
<thead>
<tr>
<th>First-Order Themes</th>
<th>Representative Quotes</th>
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<tbody>
<tr>
<td>The doubts that technical people have on cloud performance affects their work efficiency</td>
<td>“The resistance was to the virtualization of the environment. They go from an environment on a single piece of hardware to multiple environments on a single piece of agreement. They worried about the resources being strand or connection will be slow. Once you overcome these objections, you have to get these people effective because if they are not being effective and efficient on their work, then they are going to fight it all the way.”</td>
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<tr>
<td>Resistance from IT people</td>
<td>“First, political resistance. The automation of cloud services, especially IaaS, makes hardware and servers commodity. You don't need to worry about whether it is Linux Kernel, or Windows. IT people are fighting that all the time. By moving the system to the cloud, all of a sudden, they found their knowledge and expertise is less relevant and less useful. Originally you need 10 people to maintain the system, now you only need 5. People get fired. There is also a change in IT skills. You need a lot of application analytics, and capacity planning. As far as I am concerned, none of the current IT people have that kind of skill.”</td>
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<tr>
<td>Culture change in the workplace</td>
<td>“Yeah, you are talking about culture, you are talking about morale, and you are talking about uncertainty and even fear of people losing their jobs. So, there is resistance to change because of all of these plus there is a lack of money to retrain people.”</td>
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</table>
People are against learning new things

“The guy who was supposed to write the JASON code on the website was very much against learning how to write the JASON code on the website. So that was a little bit massaging on NM Company’s side.”

Face political barriers when selecting vendors

“Let's say you are a cloud architect at General Motors, and you find out, I really want to take out my email system, and I want to send it to Terremark, or RackSpace, if you are purchasing, people will tell you that they are not approved vendor, you cannot take your business there. We don't have a master agreement with them. We don't have a discount structure displaced with them, sometimes that comes down to "they are not customers of ours, why would we give them our business?" there are a lot of things the way company operates causes problems for enterprise architects that you really cannot anticipate.”

Collaboration challenges across multiple groups

“This is covering and exposing some cultural challenges within service provider. The network group at any service provider and the IT group were like one from the Mars and one from Venus. Historically, they all hated each other. Because if IT got the big piece of the budget, it was because network took a hit. The network got the bigger budget this year than last year because the IT group took a hit. Not only those groups speak entirely different languages, they are at odds with each other when it comes to competing for investment dollars. Now things like cloud computing come along, which involves convergence on a grand skill, convergence meeting, how do IT and network come together? How do wire line and wireless come together? It was challenge.”

Challenges resulting from a lack of resources. Failure to assemble the required resources for implementing a cloud initiative is identified in the data as a challenge. In addition to some common scenarios such as lack of time and money, some additional challenges are worth mentioning. As organizations gear up for new business services leveraged by cloud services, new skills should be conveyed to the implementation team. The interview data indicate that current IT personnel lack skills in application analytics, capacity planning, and architecture design. Training these personnel with new skills appears to be a feasible solution for this issue only if there is enough money to do so and if the employees themselves wish to be retrained. In addition to skills, a lack in certain knowledge areas could also present a challenge. As organizations try cloud computing for the first time, they are not very familiar with it from either the technology perspective and/or from the business model perspective. For example, some organizations do not have sufficient knowledge about what SaaS can do and how SaaS works. They fail to recognize the need to customize for their needs and treat SaaS as a single installation. As a consequence, a lot of unexpected issues are likely to come up during the implementation phase. Lastly, one
challenge is unique to government and federal agencies. Cloud initiatives in such organizations have very strict budgets. If the project cannot be completed within budget, the scope will have to be cut until it fits within the budget.

First-order themes under the category Lack of Resources are summarized in Table 19.

<table>
<thead>
<tr>
<th>First-Order Themes</th>
<th>Representative Quotes</th>
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</thead>
<tbody>
<tr>
<td>New business requires different skills</td>
<td>“There is also a change in IT skills. You need a lot of application analytics, and capacity planning. As far as I am concerned, none of the current IT people have that kind of skill.”</td>
</tr>
<tr>
<td>Lack of the knowledge about SaaS</td>
<td>“There were a number of questions that came up during the implementation phase that would have been very easily answered or very easily solved if there were just a single installation. Those results revolved a lot around some of the customization. That is one thing that I think there was a better overall understanding exactly what SaaS could or could not do.”</td>
</tr>
<tr>
<td>Lack of money to train people new skills</td>
<td>“There is also the flip side when I say, where is the money coming from with that trained people, some people don't want to be retrained.”</td>
</tr>
<tr>
<td>Government projects are constrained by tight budgets</td>
<td>“Look when you work in the government it’s different from working – because we don't have a way to generate more money, all the money we get is in converse. So unless I can do it within our budget we have to cut the scope in order to fill it within what he has and the CIO said, do it on the cheap.”</td>
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Architecture design complexities. Architecture design is probably one of the most problematic areas, and there is much in this realm that could go wrong if not handled correctly—especially when it comes to large scale SaaS implementations. Challenges with respect to architecture design have been identified in a wide range of areas including scale, integration, customization, hybrid environment, event and error systems, service profiles, and licensing.

Organizations should be extremely cautious in deciding whether they want to put everything into the cloud, because the data suggest that it is not necessarily a viable way to use cloud computing. One expert commented that putting everything into the cloud creates a tremendous number of integration complexities even at the conceptual level—not to mention from the architecture perspective. Under some circumstances, such a move could undermine the internal infrastructure
architecture, and one example from the data demonstrates the intrinsic logic of this statement. In it, an organization plans to complete a SaaS implementation with a large SaaS vendor. The organization is lured into migrating everything to the cloud because the vendor is large enough to provide almost all of the software applications the organization needs. The result, however, is that the internal architecture of the organization is now dictated by the vendor such that the vendor in effect has full control of all the interfaces in the system infrastructure.

For most organizations using cloud computing, they have some applications hosted in the cloud and the legacy system (e.g. database) maintained in their data center. In other words, they are using a hybrid environment. Challenges could be associated with identifying which applications go to the cloud and justifying the cost to migrate these applications from their data center. If certain operations are performed in the cloud, one question that needs to be asked is where are event and error messages going? If the event and error message mechanism resides on vendor’s site, how can it be integrated back to the organization’s data center? There are a lot of complexities around this.

Customization is an issue that organizations should consider carefully. One characteristic of cloud computing distinct from traditional outsourcing is that cloud computing aims to provide generalized services for an indeterminate present (Qian et al. 2009). Organizations should realize that cloud computing does not offer as much customization flexibility as in-house development does. It is the organization’s responsibility to look into how much customization flexibility the vendor can provide. In addition, organizations should not underestimate the importance of customization because the need for unexpected customization may cause a series of problems during the implementation.

There are also challenges associated with capacity planning. When the end users of a cloud application are the customers of an organization, it is difficult to estimate the service profile in terms of how many users will use the application during which time periods. Without a close prediction of the service profile, it becomes very challenging to engineer elements such as content delivery and repository configuration. An incomplete service profile also poses a challenge for software licensing negotiation and hardware capacity.
Architecture design can be viewed as a very important resource that an organization has to have. Without appropriate architecture design, things such as scaling, integration, customization, hybrid environment, event and error system, service profiling, and security could easily go wrong. First-order themes regarding Architecture Design Complexities are summarized in Table 20.

<table>
<thead>
<tr>
<th>First-Order Themes</th>
<th>Representative Quotes</th>
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<tr>
<td>SaaS may compromise internal architecture</td>
<td>“It depends right? I mean you have companies like SAP and things like that. It pretty much offers you all software services and even they say software as a service I want whole thing in cloud, right. And when you do that the disadvantage is it compromises our architecture. Basically the vendors dictate it so the hardware business should be done through the specific interfaces.”</td>
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<tr>
<td>Cloud users do not have as much flexibility as they can customize in house</td>
<td>“The only problem is that you have to select providers, look at the specifications and see if that is what you need. If it is cloud computing, you don't have as much flexibility as you customize in house. If it is in house, you can build everything for your requirements.”</td>
</tr>
<tr>
<td>Putting everything in the cloud is not a viable solution</td>
<td>“If you look at a lot of enterprise networks solutions like SAP or the financial they had all these component medium and you try to put all these into the cloud? That's not going to happen. How do you integrate them all, from the conceptual level. Okay. This is complex already.”</td>
</tr>
<tr>
<td>Integrate event and alarm mechanism if the operation center does not reside in the cloud vendor</td>
<td>“So all of a sudden a set of that event and alarm information coming to us, we had to make sure that all of the error messages that were coming off our platform were going to the V Company operation center. They would in turn contact us. So it caused us some challenges: how do we integrate our event and alarm mechanism to V Company. I guess the point being is implementing a cloud service causes challenges not just for the company implementing, also to the vendor communities sometimes that supply hardware, software services, and design to support that business. So it causes integration challenges beyond V Company.”</td>
</tr>
<tr>
<td>Unexpected customization</td>
<td>“There were a number of questions that came up during the implementation phase that would have been very easily answered or very easily solved if there were just a single installation. Those results revolved a lot around some of the customization.”</td>
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</table>
| Identify hybrid environments when application is in the cloud and legacy database is in a standalone data center | “The second is that you have very basic operations that cannot be looped. You can put these applications to the cloud. Under the surface, there are IT applications. You have legacy databases. The application moves into the cloud so it would be a hybrid environment where the application is in the cloud and legacy database is in a standalone data center. So the client has
challenges first to identify those environment, second is to identify the outsourced applications. Then they can justify the business cost to the transaction from a data center to the cloud.”

“Difficult to know the service profile in advance”

“But something like content delivery, you'll never know how many people are going to access their movies on Friday night 8 O'clock. You don't know what title can you access from the core library, or do you need to access from edge library much closer to the user. It is hard to engineer for these things because nobody knows what the service profile will look like when you turn this thing on, or when you add a new feature, or you start doing direct delivery of the content to the end user as opposed to going to the cable company.”

“Deal with software licensing and hardware capacity”

“When I talked about architecture solution, there is an impact in the infrastructure. What I mean by infrastructure include network, storage, database, virtualization, both hardware and software. The headache there is how do you deal with the licensing, and hardware capacity. That is the challenge when we start the virtualization work.”

“Dealing with software licensing and hardware capacity”

“It was a huge system integration challenge too continuing to be. You are talking about server, storage, and virtualization, encryption, security, bandwidth optimization technologies. You are talking about content management systems, asset management systems, how do you control the titles? You are talking about digital rights management, who can view these titles? How do you make sure that someone not 18 over does not view triple-X rated movies? How do you distribute content for a core repository to either a cable company, or directly to the end user? Do you point it out on distributed notes? Do you send it out over a big fat pipe from a central location? I mean, a tremendous amount of technical work—technical engineering, network engineering, IT platform engineering needed to be done in order to get this service operational.”

In summary, architecture design is fraught with hardship and complexity. Architects must accommodate not only a wide spectrum of technologies (servers, storage, networks, virtualization, libraries, security, and distributed systems) but also regulations and policies. A good architecture design calls for keen attention to details and requires a tremendous amount of technical work.

**Data storage, transfer and security.** Cloud computing offers a promising option that gives organizations access to more business intelligence by leveraging the unprecedented processing power of the cloud. On the other hand, organizations have substantial concerns when it comes to data security and existing enterprise systems. Agency theory suggests that asymmetric information, different business priorities, different perceptions of risks and uncertainties exist
between user organization and cloud vendor. Issues related to data storage, transfer, migration, security, and regulatory compliance remain a significant challenge in implementing cloud solutions.

The first question to answer about data is where to put it. Organizations need to figure out whether they wish to have their data stored in the cloud or maintained in a proprietary data center. This decision should be arrived at from multiple perspectives such as cost, performance, management, security, and compliance. In addition, organizations need to consider database features offered by a cloud vendor: Does the vendor provide customized data support? How much flexibility do they offer? Some organizations may choose to store data both in a proprietary data center and in the cloud, making data management even more difficult. Typical topics to be addressed in this area include: data cleansing, aggregation, and monitoring; data e-discovery; and access control. Data recovery mechanisms should also be considered when data are hosted in the cloud.

The second challenge is data migration. The use of cloud services frequently involves transferring data across different versions of the same application; different application systems; and different physical locations. The interview data highlights the fact that any of these scenarios is far from an easy task and that complexities should not be underestimated. Even though a lot of vendors provide ETL (Extract, Transform, and Load) tools, data migration is almost never as easy as expected and a lot of conversion effort is necessary. In organizations such as online retailers, cloud applications involve user interaction and data processing in real time, and a quick response time is key to the performance of the whole system. In such circumstances, extracting live data from the data center and transferring it to the vendor within a prescribed time limit could become very challenging. Failure to deliver updated data records in time means losing customers. It is also worth noting that bandwidth in some areas can substantially impact the performance of cloud service delivery. In the era of big data, internet speed should not simply be assumed to be fast. Many organizations do not have the best bandwidth options because of the limited budgets. It is good practice for organization to take into account internet speed when designing and assessing proposed systems.
The third challenge relates to data security and compliance. Security encompasses who has access to what data content and/or applications. Data security has become a big concern since confidential or sensitive data that organizations provide to the vendor may be accessible through vulnerabilities in the vendor system or leaking onto public clouds. There are also instances when data stored by the vendor has been lost, damaged and therefore unrecoverable. Organizations now have to deal with a number of security-related issues that did not exist in the traditional service delivery models. Analysis of the interviews suggests that security implications be considered when an organization stores its data on the vendor side. In assessing security requirements, some natural questions to be asked are: how secure are the data? Who has access? Are the data encrypted? To ensure that the data are uncontaminated and only accessible to authorized users, security measures such as firewalls, certificates, encryption, and tokenization need to be set up beyond the boundaries of the enterprise systems. While stressing the importance of data security, an interesting point was also made within the interviews, that the enforcement of security policies has its downside. One example described an instance where troubleshooting was prolonged because the vendor had to wait for the user organization’s authorization to see data and log information.

In addition to the data security challenges, organizations also face regulatory compliance issues. For example, a public cloud vendor may not be legally allowed to keep or handle certain data. And it should be stressed that every organization—not just government agencies but private companies too—will face some level of regulatory compliance: healthcare companies must comply with HIPPA; content providers must comply with digital property policies, and so on. Federal agencies, of course, face federal-level regulation. First-order themes relating to challenges in Data Storage, Transfer and Security are summarized in Table 21.

<table>
<thead>
<tr>
<th>First-Order Themes</th>
<th>Representative Quotes</th>
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<tr>
<td>Security policy could prolong the response time for troubleshooting</td>
<td>“Issue No. 2 was that they were looking for four hour response time on a particular outrage. We made the case that, we have to wait for you before we dispatch somebody, that could impact our ability to respond within four hours with the right person, right skill, right part to eliminate the problem. So once they feel comfortable, we could view the data, we control and arrange where the event and alarm information would actually go to two places&quot;</td>
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<td>Table Entry</td>
<td>Text</td>
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<tr>
<td><strong>Where to put the data and how to transfer the data</strong></td>
<td>“There is a challenge when you do this: where do you put the data and how do you transfer the data… improvement could be done in very different areas. For example, how to manage data. Some of the data are not easy to manage. If we want some reporting, it becomes more restrictive. All we have to do is downloading the data and report ourselves.”</td>
</tr>
<tr>
<td><strong>The performance of SaaS is subject to the speed of internet</strong></td>
<td>“Because like it or not, only 10% of the country has access to high speed network at home, only about 50% of the country has access to even moderately speedy, say DSL line. The rest of the country who are still customers of yours are working in a very slow environment. So every piece of SaaS you product in front of your customers has a cost, the time of travel cost, that is something that needs to be the most important factor when you look at a SaaS delivery model. You cannot assume that it is going to be fast.”</td>
</tr>
<tr>
<td><strong>Extracting data to the vendor fast enough is problematic than expected</strong></td>
<td>“Extracting the data that they need to provide to SaaS vendor was more problematic than they thought. So one of the issues working with a SaaS vendor was actually finding that tuning of the data/information, essentially ETL. Extracting the data from the database, transforming into something that we can interpret, then loading that data into our environment, was much more challenging than they thought. The biggest thing working with a SaaS vendor is you want continuous interaction with the data that the SaaS vendor has when it is interacting with the website. NM Company’s challenge was that they could not get information out of that system fast enough to deliver it to us to be able to have the record updated.”</td>
</tr>
<tr>
<td><strong>Data migration across different applications and different places is not easy</strong></td>
<td>“As people move from one application to another from different vendors. Even if you choose Microsoft exchange for example, and you go from one version to the next, that isn't necessarily easy. It is not just a software upgrade. A lot of time you have to migrate the legacy emails, it is a huge conversion effort. So there are tools, but it is a bit more difficult. It is hard enough to do it when your data is in your own data center. It is even more difficult when you data resides some places out.”</td>
</tr>
<tr>
<td><strong>Data management becomes more difficult when data are stored in a hybrid environment</strong></td>
<td>“Now you’ve got live data, some of them sit in your data center and some of them sit in your cloud service provider. How do you handle on watch where, how do you do e-discovery? What are you linking to the both environments to give you an accurate view of everything? I think it made manageability a bit more difficult, because you need tools that are virtual approved, works in both environments.”</td>
</tr>
<tr>
<td><strong>Data encryption and security implications need to be considered</strong></td>
<td>“There are security implications about when V Company stores this content in a data center, how secure is that content? That echoes to replace a dish drive. Are we walking away with a full copy of a movie that hasn't released yet? If that thing encrypted, should this dish drive get to the wrong hands? A lot of considerations that we have to take into account as part of the service that never factor into the traditional service offering.”</td>
</tr>
</tbody>
</table>
| **Compliance is a big issue** | “Compliance was a big issue for them at the beginning because using apps in the cloud, service oriented architecture is relatively new from a SOX-
for government users compliance perspective. There are some fits on this in relation to what acceptable, what not acceptable. Part of evaluation that any agency had to go through the use of .com sums to legal and compliance concerns with regards to evidence handling, retrieve custody. Whether they were legally allowed to keep information and store it. That will be the compliance portion. And if they were allowed to be stored, how would they be handled? That has to do with digital property policies and principles.”

5.5 Conclusion

A variety of issues related to cloud computing are being discussed in online forums, trade magazines, industry reports, and professional trade journals. However, little research or formal theorizing can be found in the literature with respect to ways to make cloud implementation successful, largely because cloud computing is a new phenomenon and academic study in this area is not mature. While cloud computing is arguably an irreversible trend, best practice in implementation is less likely to flourish without corresponding theoretical foundations and rigorous research work. Academically, the accumulation of knowledge with respect to factors that make IT initiatives successful is less likely to be achieved without a reexamination of existing theories in the new context of cloud computing.

This study investigated factors that determine the success of cloud implementation. Using a grounded theory approach, a list of Critical Success Factors (CSFs) at different levels of analysis, and at different stages in the process was developed. At the inter-organizational level, a concentration was made on how an organization manages the vendor relationship. At the organizational and individual levels, two broad stages of cloud computing implementation were focused on: preparation and execution. In addition to the key factors that will lead an organization to success in its cloud initiative, a number of key challenges were identified that could potentially undermine the cloud endeavor.

5.5.1 Discussion of the Findings

In order to develop the common ground that could be used to assess the Critical Success Factors for cloud initiatives, criteria were developed in three dimensions: business value, technical performance, and project delivery. From the perspective of business value, a successful cloud implementation should allow an organization to lower costs, to market new services rapidly, and
to focus on its core functions. Viewed from a technical performance perspective, a successful implementation should meet business requirements, simplify IT operations, and be accepted by end users. In terms of project delivery, a successful initiative should ensure that system migration and integration is seamless and ready to use within budget and on time.

The CSFs for Vendor Management are: vendor and technology assessment; formal and informal contract development; and, collaboration and trust. Organizations are recommended to conduct a thorough analysis of both technologies and vendors to ensure the cloud services they contract for will not conflict with existing infrastructure. An organization is encouraged to develop specific, rigid service level agreements, but also to look for vendors willing to foster strong informal (service) relationships. Developing mutual understanding and trust on all sides is very important, as is the need for personnel from both parties dedicated to the project.

The CSFs for Implementation Preparation are: business and technology planning; resource assembly; and, architecture design. It is worth emphasizing that planning for business-IT alignment should always be business-driven rather than technology-driven. During the planning, an organization should estimate both current and projected usage and develop a complete migration plan. In terms of resource assembly, the implementation team should accumulate the political resources for management buy-in; human resources from diversified work domains, and technology resources such as tools and modules. Organizations are highly recommended to pay special attention on architecture design because not all applications can—or should—be directly moved to the cloud, and not all architectures have the capacity to accommodate the cloud.

The CSFs in Project Execution are: viable proof of concept and pilot projects; sound implementation methodology and project management; and, multiple user involvement. Organizations are encouraged experiment widely and creatively during the proof of concept phase, and to fully capture the performance and cost of potential cloud solutions via dynamic self-provisioning. In cases where there will be a need for customization and/or integration, organizations should carefully choose a development approach, and sustained support from management is as important at this phase as it is in the approval phase. Organizations are encouraged to establish appropriate user expectations, and to mobilize all stakeholders to engage with the project.
Although attending to Critical Success Factors is pivotal, organizations should not ignore the potential obstacles and challenges that can negatively affect the success of cloud initiatives. The challenges fall into the categories that track closely with the CSFs. They are: vendor management challenges; political and cultural issues; architecture design complexities; a lack of resources; and, data storage, transfer and security. Vendor management presents challenges because working with multiple vendors can introduce complexities in system integration, communication, coordination, and conflicting ownership. Political and cultural issues in various forms can cause resistance both within and beyond the IT department, and substantially weaken morale and efficiency. The complexities of architecture design can be challenging when it comes to scaling, integration, customization, hybrid environments, event and error systems, service profiling, and licensing. Last but not least, challenges associated with data storage and transfer; access control and security; and regulatory compliance are recognized as focal concerns for many organizations.

Because cloud implementations are quite often dependent on unique situations and peculiarities of organizational conditions, there has been no commonly accepted model of phases for cloud computing. Cloud implementations can be complex and take place over time. To fully take advantage of the CSFs and gain control over the challenges, it is important to understand how the CSFs and challenges can be distinguished across phases. Based on data analysis, this study provides an initial speculation about the applicability of CSFs and challenges to different phases. Figure 3 and Figure 4 outline the mappings of CSFs and challenges to phases, respectively. The phases in these two figures are adopted from a cloud life cycle model developed by Conway and Curry (2012). The four phases include: Architect (investigate, identify, strategy, and design); Engage (select and negotiate); Operate (rollout and management); and Refresh (review). It is noted that a CSF or challenge spreads over multiple phases instead of one phase, and that a CSF or challenge applies to one particular phase more than others. For example, the CSF “vendor and technology assessment” is relevant to “Engage” the most, but also applicable to “Architect” and “Operate”. The shading in each box represents relevance of a CSF or challenge to different phases. The informed speculation here can be used to overcome the concern of treating cloud implementation as an atomic action. They are, however, appropriate for elaboration, refinement and testing in future research.
## Figure 3  Mapping Critical Success Factors to Phases

<table>
<thead>
<tr>
<th>Architect</th>
<th>Engage</th>
<th>Operate</th>
<th>Refresh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vendor and technology assessment</td>
<td>Formal and informal contracts</td>
<td>Mutual collaboration and trust</td>
</tr>
<tr>
<td></td>
<td>Business and technology planning</td>
<td>Resource assembly</td>
<td>Architecture design</td>
</tr>
<tr>
<td></td>
<td>Architecture design</td>
<td>Proof of concept and pilot projects</td>
<td>Implementation method and project management</td>
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<td></td>
<td></td>
<td></td>
<td>User involvement</td>
</tr>
</tbody>
</table>

Legend: Shading in each box indicates speculative applicability of CSFs to phases

## Figure 4  Mapping Challenges to Phases

<table>
<thead>
<tr>
<th>Architect</th>
<th>Engage</th>
<th>Operate</th>
<th>Refresh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vendor relationship challenges</td>
<td>Political and cultural issues</td>
<td>Lack of resources</td>
</tr>
<tr>
<td></td>
<td>Architecture design complexities</td>
<td>Data storage, transfer and security</td>
<td></td>
</tr>
</tbody>
</table>

Legend: Shading in each box indicates speculative applicability of challenges to phases
5.5.2 A Model of Factors that Determine the Success of Cloud Implementation

The results discussed above are summarized into a new proposed model of factors that determine the success or failure of cloud computing implementation; the model is depicted in Figure 5 (version one) and Figure 6 (version two). In this model, the success of the cloud implementation, or the “dependent variable” (measured by business value, technical performance and project delivery), is dependent on two broad categories of variables—Critical Success Factors (CSFs) and challenges. As defined here, a CSF is a particular area in which successful fulfillment will increase the likelihood of the success of the initiative. A challenge, by contrast, is an area of difficulty that if not overcome will constrain or weaken the chances for success of the initiative. The model argues that attending to the CSFs is necessary, but not sufficient to guarantee success for the cloud initiative, because challenges must also be taken into consideration.

Even though CSF literally means factors that are vital to the success of the implementation, in actuality different strengths (strong vs. weak) can be observed in terms of the extent to which they can contribute to overall success. Strong CSFs can move the initiative along much more so than weak CSFs. For example, “Top Management Support” can be viewed as a strong CSF because it ensures that the implementation team will have the right resources to move the project forward, while a lack of support could leave the whole initiative stranded. “Shared Dashboards and Reports” can be viewed as a relatively weak CSF because it simply makes system-monitoring tasks easier. Likewise, challenges can also be strong or weak. A strong challenge functions as a specific restriction that an organization must work around to achieve success. It cannot be overcome without significant outlays of new resources or without significant changes to existing external constraints. In contrast to a strong challenge, a weak challenge is a barrier that can be conquered or ameliorated with less significant effort or resources. Strong and weak challenges may be categorized on the basis of multiple dimensions of criteria, such as social and regulatory environments; scarcity of resources required; extent of re-allocating resources; difficulty of cultural transformation. Scoring high on one of these dimensions would be sufficient to call it a strong challenge, such as challenges associated with budget, data compliance policy and slow bandwidth. If a challenge scores low on all of these challenges, it can be categorized as a weak challenge. For example, “collaboration challenges across multiple groups” is a weak challenge.
challenge because it requires insignificant effort of management intervention and little extra resources. It is worth noting that strong or weak CSFs and challenges are not binary, but rather in continuity. A strong or weak challenge can be attributed to either external or internal factors. It does not necessarily follow that a strong challenge always results from external restraints. For example, “Lack of money to train people new skills” is a strong internal challenge as a result of tight budget in organizations such as federal departments or agencies. Besides, the strength or weakness of CSFs and challenges may vary from time to time and from organization to organization. A challenge may migrate from strong to weak as organization-specific or external situations change. And, a strong challenge in organization A may be a weak challenge in organization B, depending on their respective contingency factors.
Figure 5. A Model of Factors that Determine Successful Cloud Implementation (Version One)
Figure 6. A Model of Factors that Determine Successful Cloud Implementation (Version Two)
A close examination of the interview data reveals two types of mechanisms that can affect the dependent variable. First, some CSFs can have a direct, positive effect on the dependent variable (marked by a solid directional line with “+”). Similarly, some challenges can have a directly negative effect on the dependent variable (marked by a solid directional line with “-”). In this understanding, the CSFs and challenges do not have direct interconnections but rather exert parallel influences on the dependent variable. In stating “no direct interconnections,” it is meant that a particular CSF does not have corresponding challenge or vice versa. For example, “securing good service providers” is a first-order CSF that functions independently from challenges that appear in vendor management. Likewise, “accommodate new relationships” is a first-order challenge that is not explicitly related to any of the CSFs. Second, there exist mediation and/or moderation effects in the causal sequence from CSFs/challenges to the dependent variable. A mediation model describes a mechanism in which the effect of an independent variable on a dependent variable is transmitted by a third independent variable (James and Brett 1984). A moderation model is one in which a variable affects the strength or direction of a causal relationship between an independent variable and a dependent variable (Baron and Kenny 1986). In the mediation version of the model (as shown in Figure 5), a challenge/CSF can give rise to a mediating role (MacKinnon et al. 2007) between a CSF/challenge and successful implementation. That is, a CSF contributes to the success of cloud implementation by overcoming a corresponding challenge, or a challenge poses negative impacts on the success of cloud implementation by sabotaging the fulfillment of a corresponding CSF. For instance, “set up security protocols to make sure the vendor does not access to certain data” is a CSF that addresses the challenge of data security. The challenge of “disconnected technical communication between users and vendors” can decrease the probability of the implementation success by inhibiting the occurrence of the CSF “Continuous communication”. In the moderation version of the model (as shown in Figure 6), a challenge presents an obstacle but can be partially mitigated by a CSF so that the negative effect of the challenge on the dependent variable is weakened. For example, the challenge “unexpected customization” can be weakened if an organization has the “right expectation of what cloud can do”. Likewise, the positive effect of a CSF on the dependent variable can be decreased by the presence of a challenge. For example, the more “difficult to know the service profile in advance”, the less likely an organization can “have the right scale of cloud applications”, and the less the CSF can contribute to the success of cloud
implementation. While I present both versions of the model separately, it is possible that the two versions may be combined. In other words, the mediation and moderation effects could occur at the same time in a cloud implementation.

The model also depicts a hierarchical structure of concepts. For example, “vendor and technology assessment” is a CSF included in the category of “vendor management,” which is in turn a subcategory included in “CSFs”. The first-order themes are not displayed in the model due to the limited space. The number of first-order themes within each second-order concept, however, is exhibited in parentheses. Thereby, the model also represents a chain of evidence by showing how lower level concepts are abstracted into higher level categories.

5.5.3 Contributions and Implications

Theoretical Contributions

This study employed two theories to help make sense of the findings. At the inter-organizational level, agency theory was used to interpret the CSFs and challenges associated with the inter-organizational relationships between a user organization and a cloud vendor. From the agency theory perspective, joint problem solving, information sharing, collaboration and trust, and shared culture and values are important incentives in promoting the establishment of a successful user-vendor relationship, which is critical for the success of cloud implementation. Risks and challenges, such as data security and recovery, monitoring and control, and regulatory compliance, can be addressed through the formation of formal and informal contracts between a user and a cloud vendor. At the intra-organizational level, the study views success factors for cloud implementation as internal resources and capabilities that organizations have to acquire. The resources include technological IT resources, human IT resources and complementary organizational resources such as organizational structure, policies and rules, workplace practices, and culture (Melville et al. 2004). Resource-based theory provides a framework for examining the availability and readiness of IT/IS resources and capabilities for carrying out a cloud strategy.

The paper contributes to the literature in multiple streams. First, this study suggests a reexamination of CSFs in light of the distinct features of cloud initiatives as opposed to traditional IT initiatives. Although some categories at the higher level seem similar with the
findings from previous work (Al-Mashari and Zairi 1999), the first-level CSFs underneath the general categories can be very different and contextualized. A detailed comparison of CSFs between this study and prior work is provided in Table 22. Even for the same CSFs, the exact meaning in the context of cloud computing may have evolved. For example, the technology planning in Enterprise Application Integration basically involves process redesign (Akkermans and van Helden 2002; Grover et al. 1995; Harrison and Pratt 1993; Raymond and Blili 2000; Sarker and Lee 2002), whereas in cloud application, the emphasis is more on application analytics, capacity planning, and migration planning.

<table>
<thead>
<tr>
<th>CSF category</th>
<th>Relevant CSFs in prior work</th>
<th>Context and literature</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vendor and technology assessment</td>
<td>Core competence management; vendor resource exploitation; choosing the right provider; a clear idea of what is sought through outsourcing</td>
<td>IT Outsourcing (Gonzalez et al. 2005; Gottschalk and Solli-Sæther 2005)</td>
<td>Vendor and technology selection may be more complicated in the case of cloud implementation because some cloud vendors may be not well qualified and cloud technologies may not be well aligned with existing infrastructure</td>
</tr>
<tr>
<td>Formal and informal contracts</td>
<td>Contract completeness; proper contract structuring;</td>
<td>IT Outsourcing (Gonzalez et al. 2005; Gottschalk and Solli-Sæther 2005)</td>
<td>Formal contracts in the context of cloud computing are likely to contain rigorous service-level agreements (SLAs). Because cloud computing provides shared services, the SLAs in cloud computing are service based, as opposed to customer based in IT outsourcing.</td>
</tr>
<tr>
<td>Mutual collaboration and trust</td>
<td>Client acceptance; monitoring and feedback; communication; trouble shooting; joint action; information sharing</td>
<td>Enterprise Resource Planning (Holland and Light (1999b); IT Outsourcing (Lee and Kim 1999)</td>
<td>Success factors in the category of mutual collaboration and trust are similar to those in prior work</td>
</tr>
<tr>
<td>Business and technology planning</td>
<td>Alignment of IT infrastructure and strategy; technology planning; external orientation and learning; effective use of consultants; clear goals and objectives;</td>
<td>Enterprise Resource Planning (Plant and Willcocks 2007; Somers and Nelson 2001) Enterprise Application Integration (Lam 2005; Reich and Benbasat 2000; Van Oosterhout et al. 2006; Zairi and Sinclair 1995)</td>
<td>The technology planning in Enterprise Application Integration involves process redesign, whereas in cloud computing, the emphasis is more on application analytics, capacity planning, and migration planning.</td>
</tr>
<tr>
<td>Category</td>
<td>Success Factors</td>
<td>New Success Factors</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Resources assembly</td>
<td>Adequate resources; top management support; selection of the right tool; championship and sponsorship; IT competency</td>
<td>New success factors in the category of resources assembly include: architecture skills; access and identity management modules; and the impacts of the extent of virtualization and outsourcing on the amount of resources required.</td>
<td></td>
</tr>
<tr>
<td>Architecture design</td>
<td>effective process redesign; project team competence; software configuration</td>
<td>New success factors in the category of architecture design include: service oriented architecture; component standardization; creation of reference architecture; and detailed service catalogue.</td>
<td></td>
</tr>
<tr>
<td>Proof of concept and pilot projects</td>
<td>Selection of the software package; use of prototype</td>
<td>Success factors associated with proof of concept and pilot projects were not explicitly emphasized in prior work.</td>
<td></td>
</tr>
<tr>
<td>Implementation method and project management</td>
<td>appropriate use of methodology; strong interdepartmental communication;</td>
<td>In cloud implementation, selection of agile approach has advantages over the “waterfall” approach because the former offers more flexibility and allows addressing emerging issues much earlier. Other factors in this category are similar to those in prior work.</td>
<td></td>
</tr>
<tr>
<td>User involvement</td>
<td>user training and education; human involvement</td>
<td>User training and education is less relevant in the context of cloud computing unless a new system is adopted, because cloud computing merely changes the way the existing service is delivered. However, it is recommended to establish appropriate user expectations, such as informing users when and how the system will be switched over.</td>
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</table>

Second, this study reveals a number of new CSFs that have not been seen or highlighted in other IT implementation initiatives. The new emergent CSFs in the context of cloud implementation include: right expectation on cloud usage, capacity planning, right architecture to support the cloud, to name a few. Table 22 provides more details about the new CSFs.
Third, this study contends that achieving the success factors is a necessary, but not sufficient condition for making a cloud implementation successful. Failure to address unexpected problems and roadblocks could very well lead to undesirable consequences. Therefore, a number of key challenges were identified. While most prior CSF studies did not discuss challenges, to identify and discuss challenges along with CSFs is certainly beneficial to form a complete cloud implementation picture.

Fourth, in addition to identifying a list of CSFs and challenges, this study further constructs a new model of factors that determines the success of cloud implementation. The model proposes two mechanisms in terms of how the success of cloud implementation could be affected by CSFs and challenges. The proposed relationships based on interview data may be used as hypotheses that can be tested later. In addition, the model points out that CSFs and challenges can have different strengths, and depicts a hierarchical structure to show how lower level concepts are abstracted into higher level categories.

Fifth, this study represents one of the first efforts that attempt to theorize how an organization can make cloud implementation successful. It contributes to the accumulation of knowledge in the area of organization-wide IT innovation by systematically identifying patterns and constructs with contextual details using qualitative data. It paves the way for conducting more rigorous quantitative analyses in the future.

**Practical Implications**

Cloud implementation is, more often than not, both part of and tied to the strategic movement of an organization. A better understanding of the CSFs for cloud initiatives has significant practical implications. First, this study highlights the fact that the success of cloud implementation requires far more than just a good understanding of technology; it requires a great deal of effort from the business side as well. An organization should mobilize both internal and external resources to collaborate in this endeavor.

Second, the CSFs developed in this study can be used as a check-list for identifying key areas that require significant attention. This study not only provides recommendations in terms of what an organization should accomplish, but also offers caveats with respect to what an organization
should overcome. As shown in the proposed model, these two aspects together determine the success or failure of a cloud initiative. Overlooking either aspect may cause the cloud implementation to be less successful, if not a total failure.

Third, this study finds that it is critical to anticipate the potential influence of a cloud initiative on the organization, and particularly on the IT department. Without addressing potential political and cultural resistance emanating from the IT department, the whole cloud endeavor could be put in jeopardy because IT department is itself the primary implementer of the initiative.

Fourth, the importance of architectural design cannot be emphasized enough. For organizations in which cloud implementation is a one-time effort or small in scope, a successful transition might be achieved without much effort dedicating to architectural design. But for larger organizations, a lack of good architecture design may not only affect the integration of cloud services with the existing infrastructure, it may also substantially limit the flexibility to accommodating additional cloud services in the future.

5.5.4 Limitations

Two limitations of the study should be acknowledged. The first is related to sample size. Fourteen interviewees may not be regarded as a large sample, but at time the data were being collected, cloud adoption at the organizational level was a novel phenomenon, even though individual use of cloud services was pervasive. This study only considered organization-wide cloud implementation. In addition, organizations that only used infrastructure as a service (e.g. renting servers from Amazon) were also ruled out, as such applications require little effort to implement, therefore reducing the potential sample pool. This study only targeted organizations that had implemented large-scale, fairly complicated cloud applications that required a certain amount of effort and resources. The second limitation relates to the “generalizability” of the current findings and implications. The results and findings reported here were based on interview data from organizations of different sizes and of different industry sectors. Idiosyncratic characteristics pertaining to each organization may have affected the research results. For example, government agencies demonstrated more security concerns in regard to cloud services than commercial companies.
Chapter 6. Study II: THE IMPACTS OF CLOUD IMPLEMENTATION ON THE IT FUNCTION

6.1 Introduction

Globalization, mergers and acquisitions, tremendous amounts of electronic data, and ever-changing customer demands have created a proliferation of intensive information-processing issues. These challenges have required organizations to rethink their business models and structures, and these changes have necessarily been facilitated by innovations in IT. In order to remain financially viable, many organizations have been forced to become more flexible, more cost efficient, and more innovative. The emergence of cloud computing has provided a promising solution for the challenges that confront modern enterprises.

Cloud computing has been defined in a variety of ways, each stressing different aspects of the concept (Armbrust et al. 2009; Buyya et al. 2008; Staten 2008). The generally accepted definition was made by the National Institute of Standards and Technology (NIST), which defines cloud computing as “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” In its essence, cloud computing is a shared services model for delivering IT-based solutions. From the perspective of a service boundary, cloud applications can be categorized as public, private, hybrid or community. Cloud computing is especially popular with organizations that have limited resources because of its inherent economies of scale; high elasticity and scalability; and quick development of new services (Armbrust et al. 2009; Buyya et al. 2009; Rochwerger et al. 2009).

As a new trend in the IT industry, cloud computing has created both opportunities and challenges for IT practitioners. Academically, it also represents a novel research context for theory development. Over the decades, much of the IS literature has focused on investigating the role of the IT department or IT function in IT innovation implementations (Barthélemy and Geyer 2005; Byrd and Davidson 2003; Cragg et al. 2002; Melville et al. 2004; Ross and Weill 2002). The IT department has long been viewed as both an initiator for, and executor of IT innovations to
perform tasks such as assembling resources, facilitating processes, and monitoring the key factors that determines the success of IT initiatives. But are IT departments always advocates for new IT initiatives? The answer may be “probably not” if we use cloud computing to reexamine the situation. Responding to the pervasiveness of cloud computing, IT professionals—especially those who are accustomed to the on-premises computing environment—remain skeptical and hesitant (McAfee 2011). In other words, IT departments can inhibit the adoption of new forms of IT initiatives. The underlying reason for the skepticism or resistance may be that cloud systems are perceived by IT professionals to bring about change they do not like. People are creatures of habit (Samuelson and Zeckhauser 1988), and cloud computing to some extent emerges as a destructive force on the status quo in terms of how computing resources are provided and how organizational IT is operated (McAfee 2011).

![Diagram of IT Department and IT Initiative](image)

**Figure 7.** The Interplay between IT Departments and IT Initiatives

It is surprising, then to find that a literature survey shows that the topic of whether and how the IT function can be affected by IT initiatives is a void area. Although there are previous studies that concentrate on how IT initiatives can bring about a variety of changes to the organization as a whole in business performance, competitive advantage, organizational structure, culture, and management style (Kettinger et al. 1997; Sabherwal et al. 2001; Sharif et al. 2004), findings of these studies offer little insight into the impacts of IT initiatives on the IT function specifically. To address this missing link, I propose a unified conceptual framework in which IT departments and IT initiatives can be mutually affected in the context of cloud computing implementation (Figure 7). This framework highlights the interplay between the IT function and the IT initiative and suggests that either link should not be overlooked in developing a complete understanding about the connections of these two entities. The previous study (Study I—the CSFs of Cloud Implementation) addressed one of the research directions: from the IT department to the IT
initiative. This study focuses on the other direction: from the IT initiative to the IT department. In particular, this study investigates the reconstruction effect of cloud implementation on organizational IT. Under this objective, two research questions are asked: 1) How does cloud computing implementation affect the external role of the IT function? 2) How does cloud implementation affect the internal composition of the IT function?

In addition to theoretical implications, the inquiry into the impacts of IT initiatives on the IT function also has a practical significance. The previous chapter pointed out that managing political or cultural issues arising inside the IT department is one of the Critical Success Factors for cloud implementation. A close examination reveals that the political and cultural issues are by and large attributable to the IT staff’s perception of changes that will result from a cloud initiative. In order to address these potential political and culture issues, as well as other emerging issues, it will be argued that it is critical to shed light on what the actual impacts of cloud computing on IT function will be in the first place, because it is perceived impacts that can account for the emergence of various negative issues within the IT department.

This paper is organized as follows: In section 6.2, the literature of IT-enabled organizational change at both the organizational level and at the IT-department level will be reviewed. Section 6.3 describes the research design, including method, data collection, and data analysis, including an overview of the two case study sites. Section 6.4 presents research finding of six areas in which the IT function can be affected by cloud computing implementation. Section 6.5 concludes with the implications of the findings for theory and practice.

6.2 Literature Review

A preliminary survey of the literature shows that the way IT function can be affected by IT initiatives has not been well studied. The review therefore turned to a broader area: the impacts of IT initiatives at the organizational level. It must be acknowledged that in addition to the level of analysis, IT-enabled organizational changes can be very different in nature from IT function changes as driven by IT innovation. Many of the IT-enabled organizational changes are goal-driven, expected, and explicitly controlled. For example, organizations adopt IT innovation because they want to improve business operation efficiency, which is a desirable and expected
organizational change. By contrast, reshaping IT function is rarely one of the primary business objectives for organizations adopting IT innovations. Changes involving IT function can thus be unplanned and unexpected, simply occurring without much outside attention. One example could be the inconspicuous culture change in the IT work place as discovered in the previous chapter. Although findings about IT-enabled organizational change cannot be unconditionally applied to the IT function, it is contended here that these two research areas are to some extent connected and may share similar theoretical foundations and principles.

6.2.1 Implications of IT in Organizational Change

Researchers have tended to converge on the argument that IT is not simply a tool for automating existing processes, but is more importantly an enabler of organizational changes that can lead to strategic advantages (Dedrick et al. 2003). IT plays a moderating role in the relationship between organizational characteristics (e.g. structure, size, culture, learning, and international relationships) and organizational outcomes (Dewett and Jones 2001). For example, the level of IT infrastructure capacity is found to have an impact on the speed and nature of business process change (Broadbent et al. 1999). While IT is an enabler of many positive organizational changes, it can also be a potential inhibitor, especially when the IT in use is inflexible (Bashein et al. 1994; Brancheau et al. 1996; Davenport 1993). Organizations may not be able to achieve the desired outcomes due to the misalignment of IT solutions with organizational characteristics (Markus 2004).

The majority of research on IT-enabled organizational change has focused on examining the organizational impacts of IT at both the business performance and strategic levels. Improvements in business performance attributable to IT innovation includes the quality and timeliness of intelligence and decision making; production; communication and integration of information; strategic planning; and business flexibility (Dennis et al. 1997; Huber 1990; Sabherwal and Chan 2001). At the strategic level, IT is viewed as a critical force for shaping organization with respect to the transformation of competition, firm structures, and firm boundaries (Kambil and Short 1994). In synthesizing ten generic principles of business process change, Kettinger and Grover (1995) proposed a high-level theoretical framework which delineates a strategic version of the interrelated roles of organizational changes. In the proposed framework, business process change
is an initiative led by top management. The cultural readiness, the willingness to share knowledge, learning capacity, and balancing network relationships, support the implementation of prescribed process management practices and change management practices.

Enterprise Application Integration (EAI) and Business Process Reengineering (BPR) are two technological innovations that have often been used to showcase how IT can effectively transform organizations. EAI is a broad concept that covers business process, business models and organizational transformation (Sharif et al. 2004). Sharif et al. (2004) suggested that an evaluation of the impact of EAI should adopt a stakeholder-based view. This view addresses the attributes of the underlying technology and also other aspects of EAI including the capacity for the organization to learn and adopt integrated information management practices, and analysis of decision-making flow. Similarly, Kambil and Short (1994) found that electronic integration dramatically alters the business network of small businesses by leveraging the capabilities of various other organizations and previously separate business networks through contracts. These views imply a shift of the focus from intra-organizational components to inter-organizational components.

BPR is another rich research context for process change. It involves attempts to transform the organizational subsystems of management (style, values, and measures), people (skills, roles, and culture), information technology (data, knowledge, decision, and modeling) and organizational structures (informal and formal structure, power distribution, and team and coordination mechanisms) (Kettinger et al. 1997). Some business impacts of BPR include cost reduction, efficient processes, rapid development of revenue-based services, closer relationships with suppliers, and new business opportunities (Broadbent et al. 1999). BPR can also result in cultural and behavioral transformation. Many of the BPR practices that failed or stalled can be attributed to inadequate attention to individual behavior and the collective changes (Bieberstein et al. 2005). The influences of BPR in this regard include, for example, fostering teamwork, matching skills and roles to services, new work styles, and new measurement metrics (Bieberstein et al. 2005).
6.2.2 Implications of Cloud Implementation on IT Departments

Most of the literature on IT-enabled organizational change concentrates exclusively on the unidirectional process of the way IT departments implement or promote IT initiatives. The expertise of the IT staff and quality of the technology are factors often used to explain firm performance (Barthélemy and Geyer 2005; Byrd and Davidson 2003; Cragg et al. 2002; Melville et al. 2004; Ross and Weill 2002). But one significant area that has been overlooked in the literature is the ways that IT function can itself be shaped by IT initiatives.

The dual role of technology in organizations was first examined by Orlikowski (1992), who argued that technology may not simply be an independent external factor influencing people and organizations, but can also be a dependent product subject to strategic choices, human action and design. Aside from this broad discussion, little research effort has been dedicated to the study of changes in IT departments under the influence of IT innovation (Weiss and Anderson Jr 2003). At the same time that IT has been used to successfully transform business processes and services with added value, the IT function has also gradually been restructured within organizations. For example, the role of the IT department has shifted from service provider to strategic partner (Van Grembergen et al. 2003; Venkatraman 1999). IT leaders are now assumed to take more responsibility for creating strategic alignment between IT and business, and for change management (Boynton et al. 1992; Varon 2002; Weiss and Anderson Jr 2003). Meanwhile, the role of the IT staff has shifted into areas of communication, business problem solving, and understanding the political and cultural issues of end users (Weiss and Anderson Jr 2003). Meanwhile, ever-evolving technology innovation has created several challenges for IT departments and professionals. Some of the challenges include the need to achieve economies of scale in IT when mergers are completed (De Haes and Van Grembergen 2005), and to maintaining technological competence (Gallivan 2004; Schambach and Blanton 2002). A number of approaches can be used by management to deal with rapid IT changes, including education and training, internal procedures, and vendor and consultant support (Benamati and Lederer 2001).

These findings are certainly useful in directing future research. They are, however, insufficient to provide fine-tuned insights into the question at hand. Furthermore, it is yet unknown whether
existing findings based on various IT innovations may be applicable to the context of cloud computing. While previous studies were only able to capitalize on particular facets of the issue, this study contributes to the accumulation of knowledge by offering a comprehensive analysis of how the IT function can be affected by cloud computing implementation.

Based on the limited findings from previous work as well as the new features of cloud computing, it is posited here that the IT function in organizations implementing cloud solutions will be affected in the areas of: functionality; roles and responsibilities; job redefinition; professional expertise; CIO leadership; and employee turnover. The primary change domains are expanded with brief descriptions in Table 23. The framework developed here will guide the research design and the development of areas to be explored in the case studies (Yin 2003). Precise pre-conceptualization of new concepts, constructs, or patterns prior to data acquisition will be avoided because such speculation might interfere with the discovery of unexpected but interesting findings, jeopardizing the generation of new knowledge. This preliminary framework will be revised and refined based on findings in the data.

<table>
<thead>
<tr>
<th>Table 23. A Preliminary Framework for Affected IT Areas</th>
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<tbody>
<tr>
<td>Domain</td>
</tr>
<tr>
<td>IT Functionality</td>
</tr>
<tr>
<td>Roles</td>
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<tr>
<td>Job Redefinition</td>
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<tr>
<td>Professional Expertise</td>
</tr>
<tr>
<td>CIO Leadership</td>
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<tr>
<td>Employee Turnover</td>
</tr>
</tbody>
</table>
6.3 Research Methodology and Context

The case study approach is used in this study (Sarker and Sahay 2003; Sarker et al. 2006; Walsham 1995b) to guide data collection and analysis. The case study develops an understanding of the issue of interest within single settings (Eisenhardt 1989a); and it involves in-depth analysis of the research question, particularly when the phenomenon under study is not separable from its context (Stake 1995; Yin 2003). The underlying paradigm of case study research varies depending on the philosophical assumptions of the researchers (Myers 1997). A case study can be positivist, post-positivist (Yin 2002), or interpretive (Walsham 1995a). With either or both quantitative and qualitative evidence, researchers can use case studies to achieve multiple research goals such as phenomenon description (Kidder 1981), hypothesis testing (Pinfield 1986), and theory generation (Gersick 1991). In this study, a post-positivist research paradigm (Gephart 2004; Guba and Lincoln 1994; Lincoln and Guba 1985) is adopted to mirror the reality of the phenomenon as closely as possible by making sense of the data in its natural setting.

The case study is chosen here over other methods because of the nature of the study; it is among the first attempts to develop new theories on the ways that IT departments can be affected by IT innovation. Unlike mature research, which normally uses quantitative data for formal theory testing, nascent research is characterized by less meaningful constructs and undefined measures. For the latter, open-ended, rich and detailed data are more suitable for theory generation (Edmondson and McManus 2007). A case study, therefore, is a particularly valuable tool for getting close to theoretical constructs and for unraveling the underlying dynamics of a phenomenon—especially when the phenomenon is not comprehensible outside of its contextual environment (Siggelkow 2007; Stake 1995; Yin 2003). The case study approach allows researchers to take advantage of multiple data sources, which is very useful in investigating a technology’s implications for organizations because the behaviors and interpretations that create social patterns are more apparent and meaningful when studied within its context.

6.3.1 Case Selection

Cloud computing has been widely used by individuals, firms, and government agencies. But even within the context of a given organization, cloud usage can be found at different levels: group, department, and organization-wide. In this study, case analysis was conducted on two
community clouds. According to the NIST definition, the community cloud model states that “The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations).” (Mell and Grance 2011). One significant advantage of using the community cloud model is that it can be cost effective for an organization wishing to provide a public cloud option, and both flexible and secure as private cloud option.

Fig. 8. The Structure of the Community Cloud

The two community clouds selected for case study are in different sectors: one from the healthcare industry, and the other is a federal department. The selection is a reflection of both theoretic choices and pragmatic opportunities. This study was limited to examples of community clouds to minimize variations that might derive from different boundaries for cloud services. The benefit of selecting cases from the same cloud deployment model is that it facilitates creation of common benchmarks by which the two cases can be compared. Second, the two selected cases share common characteristics in several respects—they each have a centralized service provider and a number of affiliated user organizations (Fig. 8). Within each community cloud, the user organizations share similar backgrounds in terms of budget concerns; mission; and, security and policy considerations, and similarities between the user organizations allows the researcher to
find common patterns within each case. The third factor was access to informants. By design this study required interview participants from both user organizations and service providers. My academic advisor’s connection with the two sites facilitated access to the participants from both parties.

6.3.2 Research Sites

Site One – Health Information Technology Consortium

The Health Information Technology Consortium (hereafter HITC) was an association of 17 rural hospitals in the same geographical region in the United States. HITC functioned as a shared data center that offers a variety of healthcare IT services and resources to the participating hospitals. HITC was officially established with two principles: 1) shared purchasing for cost saving, and 2) shared health IT infrastructure instead of standalone data centers. HITC not only provides direct IT services such as IS staffing, hardware, and software to its members to meet various clinical, financial, and administrative needs, but also acts as a knowledge-sharing platform for hospitals to collaborate on technology-related projects and to share their experiences. It was a fairly mature community cloud model that had been established for years.

HITC had been very successful in supporting its member's health IT functions and more importantly, in helping the rural hospitals remain independent and financially viable. Member hospitals benefited from the licensing and bargaining power that HITC has with technology vendors such as Meditech, Cisco, and Epic. Hospitals shared all overhead costs associated with the maintenance of the data center at HITC, and are charged based on service usage.

HITC helps its members develop technology directions and strategic planning for IT initiatives. The mechanism is that each member hospital has one vote on the board. Regardless of size, each hospital has the same influence on the collective decision-making. If one hospital decides to carry out a new IT initiative on its own, HITC provides technical support to help assess the initiative and to roll it out. A substantial amount of trust exists between HITC and the hospitals.

The HITC site provides a very rich context for investigating the research question. HITC has been cited as a unique, yet successful approach to overcoming financial obstacles and providing
access to health information technology resources for rural and small hospitals. In this consortium, each of the 17 independent healthcare facilities can be treated as mini-cases with their own stories.

**Site Two – Federal Government Business Center**

The Federal Government Business Center (hereafter FGBC) was a federal services provider that offered diverse, but integrated business solutions primarily for one federal department, but also to a number of other federal agencies. It was founded by the consolidation of several data centers within The Department. Its original mission was to improve operational efficiency and economies of scale by establishing a centralized organization that could provide shared services.

Since 2011, the Department to which FGBC was attached had committed to implementing an enterprise initiative to consolidate its various existing data centers by leveraging cloud and virtualization technologies by 2013. Their next stage of establishing a shared services cloud was to enable new processes and services to be fully automated and flexibly delivered by 2016. The business driver behind the initiative was that The Department had been losing revenue with its traditional mainframe service model. A pivotal component of the initiative was establishment of a community cloud environment in which all shared services infrastructure contracts could be centrally managed by a single service provider facility. The strategic move to the cloud was motivated by a situation in which federal agencies were continually challenged to do more with tight budgets and changing administration priorities. FGBC saw cloud computing as an opportunity to improve business operations by eliminating redundancy, improving agility, and reducing cost. The shared cloud services that FGBC provide include agency-specific applications; consolidated and shared business processes; public outreach and information services; and Information and Communication Technology (ICT) infrastructure. Virtualization and automation led to substantial reductions in the time required for service provisioning. Since its inception, the FGBG has now grown to serve approximately 150 government agencies with shared infrastructure resources.
### 6.3.3 Data Collection

**Health Information Technology Consortium-HITC:** In November 2011, the research group had its first meeting with HITC, and the CEO and the Director of Meaningful Use\(^{11}\) shared the overall story of HITC. In May 2012, the group visited HITC and six of its member hospitals. Interviews and document gathering were used to collect data. The interviews were semi-structured to allow for digression and probing based on the interaction during the interview (Alvesson 2003; Blee and Taylor 2002). A “purposive sampling” technique (Kalleberg et al. 1990) was adopted to select key informants from each organization. The essence of the key informants approach is that the chosen respondents assume a key informant role because they can provide aggregated reports on organizational entities rather than personal reflections (Segars and Grover 1998; Venkatraman 1989). All six hospitals were critical access hospitals. Twenty people were interviewed in total, of which two were from HITC and eighteen were from various positions within their hospitals. A brief description of each facility and the positions of participant interviewees are summarized in Table 24. The real names of the individuals and organizations are disguised for confidentiality.

#### Table 24. Organizations and Profiles of the Interviewees in HITC

<table>
<thead>
<tr>
<th>Organization</th>
<th>Brief Description</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>HITC</td>
<td>A consortium of 17 critical access hospitals; functioned as a shared services data center that offers various healthcare IT services and resources to its member hospitals.</td>
<td>Interim CEO and CIO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Director of IT</td>
</tr>
<tr>
<td>Hospital #1</td>
<td>25-bed critical access hospital; about 400 employees, which include three hospital employed IT workers.</td>
<td>Director of health information management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clinical informaticist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Director of informatics &amp; long term care</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IT support</td>
</tr>
<tr>
<td>Hospital #2</td>
<td>25-bed critical access hospital; in Phase two of</td>
<td>Director of quality and health information systems</td>
</tr>
</tbody>
</table>

\(^{11}\) Meaningful use is “the set of standards defined by the Centers for Medicare & Medicaid Services (CMS) Incentive Programs that governs the use of electronic health records and allows eligible providers and hospitals to earn incentive payments by meeting specific criteria.” http://www.healthit.gov/policy-researchers-implementers/meaningful-use
| Hospital #3 | 25-bed critical access hospital; over 700 employees; one HITC employed IT worker and four hospital employed clinical IT analysts performing IT support functions. | Information system manager  
Clinical analyst |
| Hospital #4 | 24-bed critical access hospital. The IT department consisted of seven employees, and 12 to 15 servers for local storage and small departmentalized applications. | Chief Information Officer  
Clinical analyst |
| Hospital #5 | 14-bed critical access hospital with an attached 28-bed long term care. It was the smallest hospital among all HITC members, and probably had the lowest computerization on medical records because they don't have a large volume of patients. One designated IT employee who reports to the CFO. | Chief Executive Officer  
Chief Financial Officer  
IT manager |
| Hospital #6 | 25-bed critical access hospital. The most technically advanced hospital among all HITC member hospitals. The IT department had two HITC employed IT workers and one hospital employed IT worker to oversee the implementation of electric health information systems and all kinds of ancillary applications. | IT manager  
Health Information System manager |

In each facility, interviews were conducted as a group. Group interview is a suitable technique as it can use resources more efficiently and add valuable insight by facilitating group discussions (Frey and Fontana 1991). All interviews followed the same protocol. At the beginning of each interview, the objective of this research was briefly explained. The interview participants were given a confidentiality document to assure them that their identities would remain anonymous. They were also informed that they could request to turn off the recorder at any time should they choose to do so. Out of courtesy, key questions were sent to the subjects before the interview so they could prepare initial responses ahead of time. Each interview began with some brief rapport-building questions (Spradley 1979) about the individual and their organization, and then quickly moved on to the more substantive questions. The questions were arranged in a rough order from easy to complex. Because this study is exploratory in nature, our conversations were not strictly bounded by the prepared interview questions and the discussion occasionally turned
to truly interesting topics that were beyond the original scope of the research. After each interview, a field note was composed to capture the key points, processes, and impressions from the conversation.

**Federal Government Business Center - FGBC.** The first phone meeting was held in February 2012 to establish a mutual understanding of the research goals and the cloud initiatives led by the FGBC. In May 2012, the CTO of the FGBC helped secure a list of four interviewees from both the FGBC and one of the Federal Agencies (FA) that was a consumer of FGBC services. A site visit was then made to the FGBC, during which presentations, discussions, and interviews were conducted. These meetings led to a greater understanding of the background for how the FGBC operates between the government agencies it serves, and the FGBC's role in providing various shared ICT services to these agencies. Representatives of the Federal Agency described the social media platform project it had implemented through the FGBC. The profiles of the interviewees are summarized in Table 25.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Brief Description</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGBC</td>
<td>A federal services provider that offered integrated business solutions for federal government departments and agencies. FGBC served more than 150 government agencies with shared infrastructure resources.</td>
<td>Chief Technology Officer</td>
</tr>
<tr>
<td>FA</td>
<td>A federal agency that oversaw and regulated a specific type of transportation. Had over 1000 people working on IT related tasks.</td>
<td>Knowledge Architect</td>
</tr>
</tbody>
</table>

A similar interview technique to the one developed for the first case study and described above was used here. All four participants were interviewed as a group. The interviews provided two types of data: (1) the interviewee’s general opinion about the impacts of cloud computing on IT departments, and (2) specific examples of impacts that had been observed within their own organizations. Other data sources included presentations, discussion notes, and relevant documents shared by the FGBC.
6.3.4 Data Analysis

All audio files were professionally transcribed and then audited by the author to correct errors. The data from the audio transcriptions and field notes consisted of descriptions of events, activities, and decisions over time, and were narrative in nature. The charm of narrative data lies not only in its richness, but also in the fact that organization members use the same type of data themselves to plan, interpret, and evaluate activities within their organizations (Pentland 1999). The narrative approach focuses on contextual detail and conveys a great degree of subtlety that cannot be achieved by large samples (Golden-Biddle and Locke 1993; Langley 1999).

Data analysis employed a three-phase strategy drawing on building case study research developed by Eisenhardt (1989a). In Phase One, “in-case” data were analyzed. This process treated each case as a standalone unit in which unique patterns were discerned before moving on to cross-case generalization. The generic procedure proposed by Barley (1990) was followed to detect patterns, and patterns were identified through a computer-aided text analysis tool. In Phase Two, cross-case patterns were identified based on patterns emerging from the in-case data, pointing to similarities and differences between the two cases. In Phase Three, propositions were developed along with specific observations and explanations. The preliminary conclusions generated from the in-case and cross-case analysis were polished and shaped through an iterative process to the extent that the generalized statements fit well with the evidence from both cases. It is noted that the process of shaping the generalized propositions employed judgment on the part of the researcher because statistical tests do not apply in this study (Purao et al. 2002). The foundation of this three-phase strategy was analytic induction, which is a method of cumulative theory development which employs constant comparison of existing theories with crucial cases (Glaser and Strauss 1967). The three-step strategy is depicted in Figure 9.
6.4 Findings

Although data analysis was conducted in an incremental manner, only the final results will be reported given the limited space in this paper. Data analysis of the two cases reveals six areas in which the IT function was affected as a result of the adoption of community cloud services. The affected areas include: 1) functionality and role; 2) leadership; 3) jobs and skills; 4) formal structure; 5) size; and 6) culture. The first two areas describe the nature of the relationships between the IT function and business units or vendors. They address the first research question: How does cloud implementation affect the external role of IT function within an organization? The other four areas focus on issues within the IT department, such as structural arrangements, activities, professional profiles, and governance styles, etc. (Guillemette and Paré 2012). These areas address the second research question: How does cloud implementation affect the internal composition of the IT function? The research questions and corresponding findings are summarized in Table 26.
Table 26. Research Questions and Corresponding Findings

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Findings</th>
</tr>
</thead>
</table>
| How does cloud implementation affect the external role of IT within an organization? | - The role and functionality of IT departments has been reshaped.  
- The role of IT leadership (CIO) has evolved to be more business-centric. |
| How does cloud implementation affect the internal composition of IT function?       | - **IT jobs and skills** have been fundamentally transformed.  
- Cloud computing exerts downward pressure on the size of IT departments.  
- The **formal structure** of IT departments has changed.  
- The **culture** of the IT department has been impacted. |

The remainder of this section is organized to correspond to these six areas and will be covered in sections 6.4.1-6.4.6. Propositions and observations with respect to how the IT function is affected in each area are discussed with corresponding case evidence. Note that because the data were collected from both vendors and user organizations, the findings presented here are a synthesis from both perspectives. The focal unit of analysis, however, is the IT departments of the user organizations only. The IT departments that were studied in both cases were all centralized, meaning that all IT services were consolidated in one location within their organizations.

### 6.4.1 The Functionality and Role of the IT Department

The data reveal that cloud implementation has led to changes in the functionality and role of IT departments, and these changes reveal themselves in several ways. First, many of the IT functionalities that were traditionally maintained in standalone data centers have been removed from the organization to a centralized, shared data center referred to as “the community cloud.” In the Case One, none of the hospitals studied had an in-house data center with full functions. Resources including network access, the email system, firewalls, and databases were all provided by HITC. One of the hospital staff commented,
“If we haven't had HITC, mostly when I think of what we have added from a software perspective, I mean, we would need a network administrator on site, we would probably need a CIO for sure, we would need a data center.”

The rationale for having a shared data services center is cost advantage. As one hospital executive explained, HITC was able to get discounted purchase pricing because of the large volume of the purchase. In addition to hardware and software infrastructures, HITC also provided a first-level and second-level help desk\(^\text{12}\). Whenever a hospital employee ran into a technical issue, he or she could directly contact HITC. HITC then created a ticket for that issue and assigned someone to provide either onsite or remote technical support.

A similar observation was made in the second case. Federal agencies did not generate all necessary IT services in proprietary data centers, they instead leveraged FGB’s cloud environment for shared services ranging from networks, storage, databases, and virtualization to servers and software applications. It is stressed that this service delivery model should be distinguished from traditional hosting or outsourcing models because of its different cost model. The traditional Total Cost of Ownership model (Cullen et al. 2005) in outsourcing has been replaced by a more cost effective model in which the agencies are charged based on the real use of services.

Second, the way that the IT department supports business operation has changed. It no long functions as a direct service provider, but instead shifts its focus to IT project management and business application support. Evidence for this transformation was found in both cases. At HITC, the owners of many application modules were no longer IT staff, but super users within clinical departments. These super users did not need sophisticated programming skills, but were instead able to use existing tools and components to assemble solutions (Hoyer and Stanoevska-Slabeva 2009). To be more specific, the hospitals had people from nursing services, for example, do some of the software support as part of their job description. As a result, IT departments did not have to maintain as many dedicated people for software support. The rise of “super users,” referred to as knowledge workers by Cherbakov et al. (2007), plus the fact that HITC was

\(^{12}\) First-level help desk means that HITC can provide direct technical support to address the service requests from the hospitals. But in a few occasions when HITC cannot solve the problems on its own, they will have to resort to the vendors (e.g. Meditech). This is called second-level help desk.
providing shared infrastructure and services, has fundamentally changed the role of the IT department. Hospital IT was less likely needed to directly provide software application solutions that might have otherwise involved a considerable amount of programming. Instead, they acted more as an enabler and facilitator for the healthcare application systems. Because HITC took care of data center related issues, the hospital IT staff had more time to focus on things such as service governance. In many occasions, IT staff supported the super users from a project management perspective. As two hospital IT employees commented:

“We are able to focus more on finding other piece of software to help the efficiency of our end users I think. And dedicate more time to that, concentrate on that, actually making software work and within the workflow.”

“I oversee the two analysts and two techs, and they help to support maybe from like a project perspective. If there are things that need to or help, enhance, maybe check. But, then from a department standpoint we have HITC, and imaging and pharmacy and in some cases they are the super users for those modules. Every manager is like responsible for their own modules—Meditech modules. So, K is the manager of lab imaging, she oversees the Meditech lab and imaging modules as well as the PAC system. B is pharmacy. He oversees the pharmacy module. J oversees or Sus HIM, she oversees abstracting and HIM and kept transcription and things like that.”

The reduction of infrastructure management and accretion of business application support did not simplify the functionality of IT departments; quite the contrary, developing and supporting business applications involves a lot challenges because IT personnel now face a complex business environment characterized by a combination of highly interconnected software components, servers, and data. The CTO from FGBC witnessed the IT role shift from infrastructure management to business application development:

“There is a shift, once we have virtualization on infrastructure, managing infrastructure become much simpler. Like we said, that IT type of administrative, right? Though will be reduced, but what is going to become more complex is building the application... if they want to survive they have to shift from infrastructure, to building apps.”
Third, the IT department plays a different role in vendor relationship management. In Case One, hospital IT personnel communicated with HITC on a daily basis. They collaborated on various things such as making service requests, helping requirement gathering, collaborating on projects, and problem solving. They monitored system performance, collected feedback and provided recommendations to HITC. The hospital IT department assumed an intermediary role (Hoyer and Stanojevska-Slabeva 2009) between the end users both in and outside the hospital and HITC. Hospital IT staff recognized this changing role:

“\textit{I’m like just serving as a liaison between managers and administration and HITC. That’s a lot of my job is I’m kind of a go between. ‘We want to do this, will you talk with HITC?’ Yeah, I get about rolling like for example cardiac rehab, just implement a new cardiac rehab system. They want an interface. Now it’s my job to go to HITC: we want to purchase this interface. I work with them to get it set up and things like that.”}

“\textit{Everything we kind of started doing with Meditech was if we are going to get new module, well I tend to have Meditech is a demo and then I invite every department whether I think they are going to be impacted or not they will try to come to the demo, see how it’s going to work and they can kind of see for themselves this is going to impact this process, this is going to change this for our department.”}

In addition to the intermediary role, data from Case Two contributed another observation: IT departments are playing a more active role in managing the vendor relationship. In the “old days” organizations paid upfront to buy software products from vendors and hired consultants to integrate their products. Today, vendors tend to be a little more reactive because IT departments have more choices and thereby more negotiation power. The availability of standardized software modules enabled by open source, virtualization, and cloud computing allows corporate IT to bring more negotiation power to the table. As one architect explained:

\textit{“We negotiate with the vendor the bandwidth that the vendor is going to give me, we really negotiate anything they believe and then you can decide I don’t know how this particular SLA is going to be negotiated between us and the selected vendor on messaging, but one way to look at it is if the vendor meets all the requirements, the vendor gets this amount of money. If the vendor fails to meet all the requirements, certain}
amount of money is deducted from them, the money that is altered and if the vendor exceeds, certain amount of money is provided. So, there are incentives going in both directions.”

Another comment highlighted that the redistribution of power between organizations and vendors affected not just the information technology and business, but also the way that organizational IT develops business applications from the cloud perspective and from the artifact architecture perspective. Table 27 summarizes the findings on changes in IT Functionality and Role.

Table 27. Findings on IT Functionality and Role

<table>
<thead>
<tr>
<th>Findings</th>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proposition:</strong> The role and functionality of IT departments has been reshaped by cloud computing.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Observation One:</strong> Many data center functions have migrated to the cloud.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Observation Two:</strong> IT departments shift focus to project management and business application support.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Observation Three:</strong> IT departments play a greater role in vendor relationship management.</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

“✓” stands for “with evidence.”

6.4.2 Role of IT Leadership

Leadership at the head of IT departments is the second area affected by cloud computing. Data from both cases indicated that the primary role of the head of IT (e.g. the CIO if it exists) has evolved from maintaining and managing existing IT infrastructure into a more business-centric role that requires working with business executives to redirect organizational strategies and renovate business processes. This finding was further demonstrated by two specific observations: First, IT leaders now concentrate more on services and business models. The logic underlying this evolution is that in order to better support business operations and to leverage appropriate cloud services, IT leaders need to understand the core business first. One hospital CIO stated:
“Well, I get heavily involved in even the business models, and the moving from cost based to all the cart pricing order services. I worked on a lot of that stuff and so forth. So, I have spent a lot on our business side more than probably, you know, my credentials are more in computer science and Math and I am spending a lot on business these days.”

Analysis of Case Two also suggested a shift in CIO focus from infrastructure management to business applications. It is the CIO’s responsibility to transform IT infrastructure and capabilities into business operations (Chun and Mooney 2009). One executive elaborated:

“...Based on this there is a shift, once we have virtualization on infrastructure, managing infrastructure become much simpler. Like we said, that IT type of administrative, right? That will be reduced, but what is going to become more complex is building the application. So, the CIO, if they want to survive they have to shift from infrastructure to building (business) apps.”

The executive continued to describe a project that they carried out for another federal agency. In this project, the agency built the framework for an application store in which all business applications could be installed. The business applications—whether built by businesses or external vendors—had to be reviewed before they were put into the application store. The executive emphasized that this was an important step to maintain the integrity of the whole architecture. The review of business applications as a matter of course requires CIOs to work more closely with the business side to understand their operations. For example, one of the responsibilities of the CIO was to provide the service catalogues associated with business applications.

Second, IT leaders have become more involved in decision making not only at the business process level but also at the strategic level. While organizations are relying more and more on IT innovation as a means to gaining a competitive edge, business units and organization executives often find it difficult to decipher technical terminology, or to understand the capacities and limitations of cloud applications without the involvement of IT leaders. These are the circumstances in which CIOs play a role in decision making—to help management and business units understand the technology. One executive from the second case elaborated:
“Unless you have to be able to translate the IT terminology to business terminology, so they can understand okay, that's service. Otherwise, how are you going to sell? In the future, I think the future is going to be that the CIO has to be very savvy to translate that. Then in the backend you can use whatever terminology used on the IT organization.”

At the business process level, hospital IT leaders and clinical teams together made decisions within respect to which software modules to purchase and what custom changes to make. One hospital IT manager explained:

“I think even if we have a little thing that we might want to change, we better check with clinical analysts because this might affect nursing you know, and you are always having that in the back of your head now. You don't just do something and go well we wanted and work for us. We are going to check with other departments. One big thing we rolled out and we didn’t realize what it affected. The nursing staff has changed something and it affected the documentation of medical record piece, and we were like what was just changed because it benefited us.”

At the strategic level, IT leaders and business leaders (most likely C-level executives) discussed strategic direction and planning together. One hospital IT manager explained:

“Strategic planning here is pretty much under the umbrella of the tech group. That meets once a month or more often or less often depending on how much it is needed but yeah, pretty much take care of the strategic planning. But the tech group as all the necessary people and JC he is the CIO or the CFO, the money guy and CEO goes there, the director of nursing is there. So, we have all the important people that can come together to make the decision and do the direction and strategic planning fit perfectly right in along with all that.”

Case Two also showed this kind of evidence. One executive pointed out that in the past CIOs (especially in the government) were never at the same level with program executives. As technology has come to play an important role in business development, CIOs have become part of the strategy team.
The findings related to changes in the role of IT leadership are summarized in Table 28. They remain consistent with the trend suggested in the literature, which indicates that IT leaders now take more responsibility in creating strategic alignment between IT and business, and in change management (Weiss and Anderson Jr 2003). However, the influence of IT leadership on strategy decision making is very dependent on the extent to which the organization’s strategy is IT-centric (Chun and Mooney 2009).

<table>
<thead>
<tr>
<th>Findings</th>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proposition:</strong> The role of IT leadership (CIO) has evolved to be more business-centric.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Observation One:</strong> The focus of the CIO has shifted from infrastructure management to business applications.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Observation Two:</strong> The CIO is more involved in decision making not only at the business process level but at the strategic level.</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

6.4.3 IT Jobs and Skills

The third finding about the impact of cloud computing on IT function focuses on IT jobs and skills. As the penetration of cloud computing into business and organizational IT increases, IT jobs and skills have been fundamentally transformed (Schmidt-Wesche et al. 2011). Three observations were gleaned from the data. First, demand for traditional IT positions has decreased. In Case One, all of the hospitals interviewed had at most one or two hardware personnel on site for maintaining servers, networks, printers, and other devices. This was largely because HITC services freed hospital IT from routine day-to-day tasks. Programming skills, at one time assumed to be important for developing interfaces for healthcare information exchange systems, became less relevant because HITC took over the system development and customization tasks for the hospitals. Case Two revealed similar results. One of the architects from the federal agency made the point that jobs such as system administrators, data administrators, and developers would be rare today. In particular, programmers who used to create custom interfaces were no longer needed because the cloud vendors provide web services
with interoperable interfaces. The observation of diminishing IT jobs, revealed from both cases, was consistent with Wyld’s opinion which predicted that manual work such as data center “racking and stacking” and software installation/upgrades will diminish as a result of using cloud implementation (Wyld 2010).

Second, changes to IT functionalities and tasks call for new IT skills and new job positions. Compared with traditional IT jobs, new jobs such as “business analyst” and “architect” are more business-oriented. As hospitals began using shared services from HITC, they created a new position called “clinical analyst.” This position supports electronic medical records from a clinical perspective. As one hospital IT manager described,

“She oversees coding, transcription, the scanning of the electronic record, so any of the pieces that have to be scanned into the electronic record over that and transcription… Those are the pieces I think that over the last couple of years the clinical analysts have brought – they are very good at asking the medical records department what is it that we are missing or do we need something that brings a documentation into it so that we can code properly the documentations that are supported, and also that not only is it in the electronic medical record but it's in the legal record. Those are the pieces sometime that don't connect that modules and so those are the pieces we are always looking for is the electronic or the legal record that we write off for anything if they request a record it's not the EMR. So we are making sure that that flows into the legal record as well.”

It is worth noting that the clinical analyst position was not necessarily based within the IT department because in some facilities members of the nursing unit took over this work as part of their job responsibilities. Another new emergent position is “application analyst.” The major responsibility of the application analyst is to support healthcare applications and software modules. While some hospitals had dedicated application analysts in the IT group, most simply used application analysts contracted from HITC for technical support. Hospital application analysts could work on service requests directly, or if they were not able to resolve the issue, reported the problems to and worked them out with HITC. Data from Case Two also revealed a new category of IT job, although the new jobs were different from those in Case One.
All of the people interviewed agreed that the move to the cloud requires thorough knowledge and expertise in policy, strategy, business, and IT. They especially emphasized that the role of both the architect and system architecture should be viewed to be of paramount importance because using cloud services involves—among other things—building frameworks and developing standards. The role of the architect was highlighted by one executive:

“A lot of cloud and outsourcing fail because we do not write the contract and service in much detail. A lot of government agencies do not know about it. The only people that know the complexity of what is included and what is not in the cloud is the role of architect.”

Enterprise architects can be subdivided into several specific roles, including but not limited to: data, infrastructure, solution, security, business, and reference architecture. One of the interviewees from Case Two was a knowledge architect responsible for knowledge management. Although he worked on IT, his job was much more about people and business.

Third, some of the existing IT jobs have been redefined. Even working under the same title, IT employees may take on different job responsibilities. Hospital IT workers who had previously maintained physical servers now dealt with virtual systems as well. Data backup and disaster recovery between physical servers and virtual systems has become one of their key responsibilities. One hospital IT employee described:

“Indeed, you did use to have physical server or data center and then you switch through the virtual system. We are in the process and that’s one of the main things. Disaster recovery is another one. Disaster recovery, business community, we have a meeting once a week on that, where we cover a bunch of different issues...We have to analyze make sure that the physical servers are all getting backed up, make sure that we are getting backup or snap shots of the virtual servers. And then documenting everything and testing it in some middle environment and making sure that, if this version of it dies we can easily bring this other virtual snapshot up.”

The data show that hospital IT departments and HITC work together toward strategic planning on a regular basis. As managing contracted cloud services became an important part of IT
functionality, hospital IT employees who had previously conducted internal system analysis and project management were forced to pay more attention to both negotiation and collaboration with HITC. This observation confirmed Wyld’s assumption which posited that IT professionals would need to develop expertise in service specification, negotiation, and service-level agreement management (Wyld 2010).

Shifts in job focus were also observed in Case Two. As the Federal Agency moved to the cloud environment and service oriented architecture, there were fewer opportunities to customize applications and services. Many IT professionals had to shift their focus from service development to service management because they only needed to pay for use once the cloud system was implemented. In addition, moving to the cloud environment also meant more demand for skills in business analysis and planning. In particular, IT employees were required to concentrate more on architecture design. The following quote from a document exemplifies some of the architecture jobs:

“..address the impact on business processes and eliminate any technical barriers including performance, authentication/authorization, integration, bandwidth latency, software architecture legacy, connectivity, sizing (storage, database, content) and many others pertinent with IT Architecture domains.”

Table 29 summarizes findings relating to Changes in IT jobs and skills.

<table>
<thead>
<tr>
<th>Table 29. Findings on IT Jobs and Skills</th>
<th>Case 1</th>
<th>Case 2</th>
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</thead>
<tbody>
<tr>
<td><strong>Proposition:</strong> IT jobs and skills have been fundamentally transformed by cloud computing.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Observation One:</strong> Demand for some traditional IT job positions has decreased.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Observation Two:</strong> New IT skills are required and new job positions have emerged.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Observation Three:</strong> The focus of some existing IT jobs has shifted.</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
6.4.4 IT Staffing Levels

The fourth finding that was revealed in the case studies is associated with the size of IT departments. The adoption of cloud computing and the shared services model has been observed to create pressure on the size of IT departments, meaning that IT staff are downsized, and maintained at a smaller level than under previous IT regimes. There are many causes for this phenomenon. As discussed previously, changing IT functionality, and evolving IT skills and jobs are two areas that affect IT staffing. Because part of the IT functionality has moved to a shared data center, this downsizing of IT functionality will necessarily lead to fewer IT job openings. Meanwhile, as some skills have become less relevant in the cloud environment, IT employees who have not been able adapt to the new skill requirements will likely lose their jobs (Murugesan 2012)—especially when organizations are under tight budgets. The literature indicates that internal working environments, such as job characteristics, is a factor affecting IT worker turnover (McKnight et al. 2009; Thatcher et al. 2003). To excel under conditions of transformation, IT professionals do best when they are able to weave new business knowledge and competencies into their existing IT skills (Shao and David 2007).

In addition to downsized IT functionality and obsolete job skills, two more causes were identified: one from each case study. In Case One, all of the hospitals retained relatively small IT departments using contract employees from HITC rather than hiring full-time employees on their own. This was justified by two reasons: most of the hospitals used the same or similar software modules, so in addition to shared infrastructure services, hospitals were also able to take advantage of shared technology support provided by more experienced and better trained HITC IT experts. Second, using contract personnel has economic advantages: Hospitals pay full salaries to full-time employees—even if they were underutilized—but the hospital pays contract HITC employees by the hour, and only when they are in needed. The following two comments provide evidences:

“I think if we did not have HITC we would have probably three or four different clinical – different analyst here because you would need somebody for financial, somebody for clinical, somebody for administrative.”
“We will be contracting for portion of this project manager’s time that came to us from HITC. Because she has some extremely good experience with the e-clinical works application, which is the ambulatory application that we implemented and went live with a week ago. We will be contracting for her probably 32 hours a month that we would contract with her for support of the CW application through the rest of this fiscal year. And then will kind of reanalyze at the end of this fiscal year for example how much of her time we would contract for.”

The observation about contract IT personnel, however, was not seen in Case Two, probably because at current stage of their community cloud they merely shared hardware and software services rather than human resources. Case Two revealed another observation with respect to the downward pressure on the IT staffing level resulting from cloud implementation. The federal agency found that by leveraging cloud applications, IT efficiency was considerably improved, leading to a lot of redundancy. This meant that they needed fewer people to deliver the same amount of work. One architect explained:

“So, you have X-number of people doing the job that can be done by much smaller number especially if we are going to cloud environment, where the vendor is responsible for providing everything. So, we no longer are able to hug our own servers so to speak. We have federal employees and we have contractors. In many cases federal employees manage the contract staff. However, if we are able to create efficiency that means that we have enough access to take less people to do the job that we have right now. So, if we have let's say 5,000 people between employees and contractors, and the same thing can be done in three years, let's say by 1500 people that means that 3500 people are gone. I'm just using – I mean they are not exact numbers.”

Although the above story was based on a hypothetical situation, the point being made is valid. It was confirmed by another real-world case in which the number of administrators maintained for VPN password administration had been decreased to ten from 30 following cloud implementation at the enterprise level. The reason why this observation was not seen in Case One was probably because the community cloud in Case One was created on the basis of a consortium of the hospitals that had been established for many years. IT services and
management in each facility had been operated efficiently since the beginning of the community cloud. By contrast, the community model in Case Two were in a process of consolidating existing resources and services by eliminating redundancies. Table 30 summarizes the findings relating to IT Staffing.

<table>
<thead>
<tr>
<th>Findings</th>
<th>Case 1</th>
<th>Case 2</th>
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<tbody>
<tr>
<td><strong>Proposition:</strong> Cloud computing exerts downward pressure on the size of IT departments.</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td><strong>Observation One:</strong> IT functionality is scaled down as traditional IT jobs and skills become obsolete.</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td><strong>Observation Two:</strong> Organizations use contract employees rather than full-time employees.</td>
<td>√</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Observation Three:</strong> Cloud computing improves IT efficiency, but creates job redundancies.</td>
<td>N/A</td>
<td>√</td>
</tr>
</tbody>
</table>

“N/A” stands for “lack of evidence.”

### 6.4.5 Formal Structure of the IT Department

The formal structure of the IT department is the fifth area affected by cloud computing. Formal structure is normally an organization-level concept that describes official relationships between organization members (Mintzberg 1979). Elements of a formal structure include activities, assigned roles, and hierarchy of authority (Weber 1997). Analysis of the data led to four observations about how IT departments can be restructured.

First, organizations may choose not to have a full-fledged IT department. In the context of a community cloud environment, resources (people, software and hardware) seen to be common and shared among member organizations, are now centrally governed and provided by the cloud vendor. This change removes the justification for each organization to maintain its own complete IT function, which in this context is neither cost, nor operationally efficient. In Case One, staff from the clinical side took over some of the IT tasks because the hospitals did not have (and did not need) a formal IT department or group. It was also observed that there was no clear boundary
between IT and clinical units. Internally, all IT-related activities were overseen by either the clinical IT committee, or the Chief Financial Officer. One clinical analyst commented:

“Most of what we do is software support and probably end user support as it relates to applications. But as staff, we probably work the most closely with HITC. Within the organization I would say, outside of our technicians. We don’t have an IT department. We just recently inaugurated with our clinic and so we are in the process of developing a specific IT structure within the organization but right now we all report in some way to the CFO.”

The mechanism of the clinical IT committee was also observed in a previous study, which posited that steering committees comprised of IT and business staff are created to provide high-level direction for business-IT alignment in the context of a centralized shared services model (De Haes and Van Grembergen 2006). Case Two showed evidence as well. The Federal department that FGBC attaches to committed to an at least 45% reduction in physical data centers from 210 to 115 by fiscal year 2015. The plan included a staggered reduction of IT infrastructure with a strategic migration to maintaining a mission-critical data center configuration. The result of data center consolidation, and migration to the shared services model means that agencies will no longer have standalone IT departments.

Second, organizations may not necessarily have a designated CIO. Instead, several organizations may share one CIO. In Case One, all but one of the hospitals studied did not have a designated CIO, but depended on IT leadership from the CIO at HITC. Because the hospitals shared similar missions and IT strategy directions, by sharing one CIO from HITC, they were still able to meet their strategic needs for IT without bearing the full (financial) responsibility of maintaining a full-time CIO. As one IT manager stated:

“No, there is no CIO. I am the highest it goes here IT manager. I would consider probably M up at HITC, the CIO. So, once again we share a CIO. Some people might disagree with that, that's kind of like the unofficial. There are other HITC hospitals I think there is only one that has a CIO.”
In Case Two, federal agencies under the Department were moving toward the creation of a shared CIO. According to the CTO of FGBC, where there had originally been thirteen CIOs, there would be only one by 2014. It is worth noting that although both cases have shared CIOs, the trajectories for this evolution were different. The hospitals shared CIOs from the very beginning of the establishment of the shared services community, while the federal agencies in Case Two went through a process similar to a merger and acquisition.

Third, IT employees assumed multiple roles. This was especially true in Case One. The rationale was that since HITC had been running a large portion of the IT services for the hospitals, it would be extremely cost inefficient to hire a full-time employee for each type of IT operation. As a result, HICT employees have become generalists; they have multiple job titles and cover multiple job areas. As one IT manager described:

“When I first got here I was more of a tech manager and I had to do everything, I had to order the PCs, get them in the door and put them on the desktop, put it in the database and keep track of it and then run all the other problems. Once I got a tech then it was more of an analyst and some management. Now that the budget is growing and there are many projects going, I run the tech committee and the IT applications committee and security officer and database.”

The tendency for IT workers to take on multiple roles is consistent with the argument made by Menken and Blokdijk (2009), who suggested that IT professionals need to be niche generalists in a fast-changing area such as SaaS and Web Services. The reason why this observation was not confirmed by Case Two was probably attributed to the fact that federal agencies were large organizations with relatively large IT departments. IT employees could still be well utilized even though they specialized on one role. By contrast, IT employees of small organizations, such as the hospitals in Case One, would be very much underutilized if each person only focused on one or two IT tasks. It would not be cost efficient for the hospitals. Table 31 summarizes the findings relating to changes in formal structure.
Table 31. Findings on Formal Structure

<table>
<thead>
<tr>
<th>Findings</th>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proposition:</strong> The formal structure of IT departments has changed in the context of cloud computing.</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td><strong>Observation One:</strong> Organizations may not maintain a full-fledged IT function.</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td><strong>Observation Two:</strong> Organizations may not have a designated CIO.</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td><strong>Observation Three:</strong> IT employees take on more roles than before.</td>
<td>√</td>
<td>N/A</td>
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</table>

6.4.6 IT Department Culture

Culture is defined as “…the pattern of basic assumptions that a given group has invented, discovered, or developed in learning to cope with its problems of external adaption and internal integration, and that have worked well enough to be considered valid, and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.” (Schein 1984, p. 3). IT employees are likely to be conservative in the adoption of cloud computing as they have justifiable concerns about some of the undesirable impacts that cloud computing may create for themselves. As a result, various culture issues have emerged in the IT workplace. The analysis reveals IT culture can be affected in four aspects.

First, IT professionals are concerned about job security, and they see adoption of cloud computing as a threat to their jobs. In the Case One, many of the hospital IT employees were nervous when their hospitals were in the process of joining the consortium. They feared that the hospitals wanted to cut costs and remain financially viable by introducing the new technology delivery model; the IT staff was afraid of being laid off because many IT services would be operated by HITC. One executive explained:

“And there are individuals who work there who I have spoken to last year who had real fear actually as if we were firing because they had such fear going in this other direction becoming a part of larger healthcare organization. And I think with some of the staff there was possible threat of loss of employment. You know, we all join HITC because our organization they want to cut expenses within our facility and one of those expenses is my job to offset the cost you were paying that, you know, I think those type of things is that
constant fear of ‘am I going to lose my job tomorrow?’ Then you want to revolt against those who are potentially I think.”

A similar observation was made in Case Two. Because of the impacts of cloud computing on jobs and skills discussed above, many IT workers faced the possibility of either losing their jobs or being forced to shift their work to other areas. One architect commented:

“Some of those can lose their jobs through retirements. So, that’s not a problem. But, some others who were staying will have the fear of losing their jobs, plus there is something else on doing job A today, it’s no longer needed. Where is the money coming from management’s point of view, especially in today’s type of budget environment to provide me with a training to retain me to do something different?... you are talking about culture, you are talking about morale, and you are talking about uncertainty and even fear of people losing their jobs. So, there is resistance to change because of all of these plus there is a lack of money to retrain people.”

Second, the changes in workflows and habits led to political resistance. The analysis above has elaborated the impacts of cloud computing on IT functionality, IT jobs, and even formal structures, but underneath these explicit changes, the impacts can actually go much deeper. As discussed above, the cloud initiatives require substantial changes in the approach to and procedures for IT tasks. There has been an effect at the cultural level because these technical changes also involve changing habits (Lorenzi and Riley 2000). It is generally assumed that people form habits that guide automatic behavioral processing (Baronas and Louis 1988). The requirement to change habits naturally causes resistance, which can manifest as declining employee morale and job commitment (Cascio 1993). An IT manager from Case One explained in detail how their workflows and habits had been changed.

“The thing is here all of us wear many hats. The pharmacist, she is the owner of the pharmacy module, but she is also the pharmacist. So, we don’t have one person. So they are doing the day-to-day work plus maintaining their modules; same thing with the lab... So we don’t have somebody sitting here just doing the Meditech piece and then somebody doing the data work, day-to-day work. So we are all doing, wearing many hats...Yeah, with that Meditech cost, rolled in their stuff tattoo and to you know, how much time that
we spent customizing in building Meditech where it's going to be. It's not just the hardware and software repurchases. User habits, culture, work processes, everything has to change.”

Case Two further pointed out that resistance stemming from changing habits and work procedures can be aggravated by two additional factors. From the financial perspective, federal agencies are short of money to provide appropriate training for IT employees to smooth transitions in their work. From the psychological perspective, IT employees were not mentally prepared for the changes, and were therefore reluctant to learn new things. One architect stated:

“And there is one other word that we haven't used yet. It’s called culture. It is very important. That causes a lot of resistance from people, because they are used to doing something in certain way and now we are asking that to radically change the way they are doing things, they don't have to go and take your service because that's done by the service provider. So, what I'm supposed to do now? I used to do X now, I don't do X any more, what I'm supposed to do Y, Z, money has to be identified to rearrange these individuals to do something different. They have to acquire new skills, which is very difficult in this situation, today’s situation as they are budget constraint, so agency is not going to provide funding – secondly you don’t have that mindset for change because now I’ve got at least 20 years, I don't care my door is secured. So, I'm not mentally prepared for learning new technologies. So, that mental constraint or the mental block is there so those all are.”

Clearing up resistance is extremely challenging but also extremely critical because IT departments may become a hindrance to rather than an advocate for cloud computing (Cherbakov et al. 2007). It is critical to gain cultural buy-in from IT employees to create a culture that encourages and embraces change.

Third, the adoption of cloud computing has changed the thought process of IT professionals. IT management was traditionally viewed from a technology perspective. When services are provided by a cloud vendor, IT functionalities need to be managed from a business perspective. This is because with service level agreements or SOA compliance, issues such as, “why is my application not working?” will be excluded from consideration. A better term that can be used to
highlight the business aspects of IT is “IT governance,” which is about the way organizations draw on business principles to utilize IT resources to achieve their strategic goals (Weill 2004). In addition, changes in the thought process can also be reflected in the ways that IT costs are calculated. Traditional models such as “total cost of ownership” will give way to the new pay-as-you-go model, which eliminates the needs of upfront investment and proprietary licensing fees. Before the adoption of community cloud model in Case One, hospitals shared all overhead cost in maintenance of the data center in HITC. After adopting the cloud model, hospitals were charged back based on usage of the services as well as hospital size. One executive from FGBBC confirmed this shift:

“One of the biggest impacts and biggest role is not just the IT service change, the thinking process has changed. When I did the pilot with FA, a lot of people still calculate the cost based on the traditional way. I was almost falling off my chair, ‘what? Why costing this much?’ We already negotiated with the software licensing, and security. We don't need to CAN (commercial property insurance) any more. We already have these cost laid out, virtualization laid out. How can we get the old cost? I have to go through all the process, decision making process.”

Fourth, the political power of IT departments has been impacted. The redistribution of political power—especially decision-making power—was witnessed in both case studies. Introducing cloud computing requires a willingness to give up control and ownership of at least some decisions and assets. For example, the healthcare application modules were no longer centrally maintained and controlled by hospital IT. Instead, this responsibility was taken over by the members of various clinical departments who maintained ownership of the modules. When it came to software purchasing decisions or decisions relating to IT-initiated strategic moves, the decision-making process was almost always characterized by the involvement of people from the clinical side in addition to senior management. As mentioned above, IT-centric strategic decisions were often made by a clinical IT committee that included the CEO, CFO, Director of Nursing and the IT manager. An interesting observation is that IT staff not only had to share their decision making rights with people from the business side, but quite often business-side management had more power than the IT members on decision making concerning IT initiatives. An architect from the second case study elaborated:
“Program manager obviously said talk to rents. IT will say, I don’t know, what do you need, server, two servers, backup? As they come after the next few months and say we need to upgrade it because we have so much bandwidth and so many users, we need to tell IT pro they have to do that. But if you have a cloud infrastructure, IT can say why do you need it? It’s going to affect our SLAs; it is going to affect our standards. So what it does is IT can push back business crew what are the requirements. So they have more control over the IT than the IT guys.”

It is worth noting that findings of Section 6.4.2 indicate that CIOs are more involved in decision making at both business process and strategy levels. The involvement of CIOs, however, does not mean that CIOs will play a dominant role in decision making. The observation discussed above further elaborate that CIOs have to share the decision-making power with business units. The findings related to IT department culture are summarized in Table 32. IT professionals who have expertise in on-premise computing are likely to have deep emotional attachments to it. In facing cloud implementation, they may become conservative and skeptical of the initiative for the sake of protecting themselves and their positions. It is a paradox that traditional IT people are often not among the first advocates for the adoption of cloud computing (Creeger 2009). In short, the move to the cloud is as much a transformation of culture as it is a technological shift. It is very important to address cultural challenges and to obtain cultural support from extant IT departments (Wyld 2010).

<table>
<thead>
<tr>
<th>Table 32. Findings on IT Department Culture</th>
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<tbody>
<tr>
<td>Findings</td>
</tr>
<tr>
<td><strong>Proposition</strong>: The culture of the IT department has been impacted by the move to the cloud.</td>
</tr>
<tr>
<td><strong>Observation One</strong>: IT staff concern about job security.</td>
</tr>
<tr>
<td><strong>Observation Two</strong>: The changes in workflows and habits often give rise to resistance.</td>
</tr>
<tr>
<td><strong>Observation Three</strong>: Cloud computing changes the thought processes of IT professionals.</td>
</tr>
<tr>
<td><strong>Observation Four</strong>: IT departments have to share political power in decision making with business units.</td>
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</tbody>
</table>
6.5 Conclusions and Implications

Cloud computing as a new business model is gaining momentum quickly in a growing number of organizations in various sectors. It has not only changed the way that IT services are being delivered, it has also comprehensively transformed the entire organization in terms of human resources, business processes, and systems. IT departments—the very carriers of IT innovation—have now been forced to change accordingly. This study exclusively focused on the impacts of cloud computing on IT departments or the IT function. Using the case study approach, it extensively investigated the way that IT function is reshaped by the adoption of cloud computing.

6.5.1 Discussion of the Findings

Analysis based on two community cloud cases identified a wide spectrum of areas where IT function has been impacted in the era of cloud computing. First, as many of the data center functions or low-level infrastructure services have been migrated to the cloud, the role and functionality of IT departments has been transformed from a “product-oriented” service provider to an “application-oriented” service enabler or facilitator. By “application-oriented,” it is intended to emphasize the business focus of IT services. The primary role of IT is to enable and support a variety of business applications in a complex and ever-changing environment. In addition, the role that IT plays in vendor relationships has also changed in multiple ways. Second, the IT leadership has evolved toward a more business-centric role. In parallel to the shifts in IT functionality, IT leaders have become more involved in decision making about IT initiatives not only at the business process level but also at the strategic level. Third, while the demand for traditional IT tasks such as programming and database administration decreases, new job positions such as business analyst and enterprise architect have come into existence. Consequently, new skills in managing virtual systems, service specification, negotiation with vendors, system planning, and architecture design must be developed. Fourth, IT departments have either downsized or will remain small. This is attributable to three causes: downsizing in-house IT functionality; operation efficiency boosted by cloud computing; and use of contract IT workers. Fifth, the formal structure of an IT department has been reshaped. Organizations may not necessarily have either full-fledged IT departments, or designated CIOs. IT workers who
used to specialize on one area are likely to become generalists assuming multiple roles. Sixth, culture in the IT workplace is changing. Resistance may arise as a result of concerns about job security, changing work habits, unwillingness to learn new skills, and redistribution of political power.

6.5.2 Contributions and Implications

Theoretical Contributions

The paper contributes to the development of IT/IS studies on IT-enabled organizational change in several ways. First, this study suggests a reconceptualization of the interconnections between IT function and IT initiatives. A unified framework in which these two areas can mutually affect each other in the context of cloud computing is proposed. This study has substantiated with case study data that the IT function can actually be impacted by IT initiatives in the context of cloud computing. This is believed to be a useful framework that can help researchers establish a holistic view when their studies involve IT function and IT initiatives.

Second, the way that the IT function can be both impacted and reconstructed through IT initiatives is a theoretical void in the IT/IS literature. This study arguably represents the first effort to investigate this missing area in some depth. Although a few previous studies have implicitly alluded to, or projected, the impacts of IT innovation on some aspects of IT units, those findings were incomplete and isolated and thus less likely to offer a comprehensive understanding of the phenomenon.

Third, this study develops new middle-range theories by identifying areas where the IT function can be affected, and by elaborating specific ways these affects can manifest themselves. Propositions in each area are made along with specific observations. Rich details of first-order analysis and background information are provided so that readers can evaluate the plausibility and generalizability of the findings to other settings.

Fourth, this study extends the theories of IT-enabled organizational change into an uncharted area—IT department. While a vast majority of previous studies concentrated on the impacts of IT innovations at the organizational level, this study sheds light on the impacts on the IT
department in particular. The study highlights that even though reshaping IT function is rarely a primary business objective for adopting IT innovations, it is an important topic that should not be overlooked.

**Practical Implications**

A clear understanding of the impacts of cloud computing on the IT function paves the way for more effective management practices to deal with undesirable outcomes. This study offers at least five managerial insights: First, it highlights the fact that a successful cloud strategy goes well beyond a good understanding of technology, and that success depends on the organization’s ability to anticipate the business impacts of cloud computing on the IT function.

Second, the way that services are delivered and managed with a cloud model may substantially disrupt the existing IT operating model; management needs to be aware of this fact and make appropriate adjustments.

Third, changes in IT functionality and the possible downsizing of IT staff do not reduce the importance of the IT function; on the contrary, IT departments now play an even more important role as designers of service architectures that accommodate and facilitate business applications.

Fourth, the adoption of cloud computing may pose great challenges to IT staff because it requires new skills and less manpower; management should take measures to alleviate employee worries about job security in the work place, such as retraining employees with new skills and offering the opportunity to continue in newly-defined positions. Failing to address this issue could lead to serious resistance and low morale.

Fifth, cloud computing reshuffles the power distribution between IT departments and business units, as the former loses control over IT resources and the latter takes a more active role in service purchasing decisions. This perceived loss of power makes IT departments a less likely advocate for implementing cloud solutions; CEOs should not let IT departments exert too much influence over the decision to move to the cloud. As an analogy drawn by McAfee says, “Delegating the move to the cloud to traditional IT people is like putting the crew running the boiler and stream turbine in charge of electrifying a factory.” (McAfee 2011, p. 126).
6.5.3 Limitations

The findings and implications in this study are bound by two limitations. The first is the small sample number of user organizations in the Case Study Two. The data were not as rich as those we collected in the first case study because access to more federal agencies was not possible. This limitation may be alleviated to some extent by the aggregated input from FGBC, which not only spoke as a cloud vendor, but also shared a lot of valuable information about conditions across many of its customers. The second limitation may lie in the transferability of the findings to other settings. The use of cloud computing varies greatly from case to case. It can be implemented organization-wide, or for groups or individuals; and there are different deployment models such as public clouds, private clouds, hybrid clouds and community clouds. In terms of service models, it can be software as a service (SaaS), platform as a service (PaaS), or infrastructure as a service (IaaS). That is to say, the degree to which an IT department can be affected by cloud computing depends directly on how the organization uses the cloud. To counterbalance this shortcoming, detailed background information for each setting were provided along with the context for each proposition being developed.
Chapter 7. DISCUSSION AND CONCLUSION

Cloud computing as a new business model is gaining momentum quickly in a growing number of organizations in various sectors. It substantially changes the way that IT services are being delivered, but also comprehensively transforms the entire organization in terms of people, business processes, and systems. As a relatively new phenomenon, cloud computing provides a fertile field for theory development. On one hand, little research or formal theorizing can be found with respect to how an IT department can implement a cloud initiative successfully, mainly because it is a new phenomenon and academic studies lag behind industrial practice. On the other hand, it has been observed anecdotally that IT departments (the very carriers of IT innovation) are simultaneously being affected by changes that result from the cloud implementation itself. This dissertation brings together these two previously isolated research streams and suggests that the dynamics of cross-influences between IT departments and cloud implementation should be studied jointly. Specifically, the research sheds light on two related research topics: what are the key factors that determine the success of cloud implementation in organizations? And, what are the impacts of cloud implementation on the IT function? In addressing the first question, a qualitative study using the grounded theory approach was conducted. A list of critical success factors as well as key challenges of cloud computing implementation was developed. In addressing the second question, case studies of two community cloud computing models were conducted. A range of areas where the IT function can be impacted as a result of cloud implementation were identified. This chapter provides a discussion of the key findings of the research, followed by a discussion of theoretical implications and practical recommendations.

7.1 Discussion of the Findings

The first study investigated factors that determine the success of cloud computing implementations. Critical Success Factors were identified and categorized into three domains: vendor relationship management; implementation preparation; and, project execution. In opposition to the Critical Success Factors, a number of key challenges that can undermine cloud endeavors were also identified and discussed.
Identifying objective measures by which to assess the success or failure of a cloud initiative is the prerequisite for identifying factors that will make it or any other IT/IS project successful. To this end, three groups of criteria were identified: business value, technical performance, and project delivery. Criteria for business value include lowering costs, marketing new services rapidly, and the ability to focus on core business functions. Criteria for success at the level of technical performance include the ability to meet established technical requirements; simplification of IT operations; and, acceptance by end users. Criteria for success from a project delivery standpoint include seamless system migration and integration; and, the ability to complete implementation within budget and on time.

Following the development of the assessment criteria for success in cloud implementations, a series of CSFs were developed through three levels of abstraction of the data from the interviews. These CSFs can be grouped into three main categories that are somewhat different from the assessment criteria. The primary categories of CSF are: vendor management; implementation preparation; and project execution. The sub-categories of CSFs relating to vendor management are: vendor and technology assessment; formal and informal contracts; and, collaboration and trust. An organization is recommended to conduct a thorough assessment of both cloud technologies and cloud vendors to make sure the services they contract for will not conflict with existing infrastructure. Organizations are also encouraged to create both specific and rigid service level agreements, and to foster mutual understanding and trust with people from both parties dedicated to completing the project.

The sub-categories of CSFs relating to implementation preparation are business and technology planning; resource assembly; and architecture design. It is worth emphasizing that planning for business-IT alignment should always be business driven rather than technology driven. During planning, an organization is recommended to estimate current usage and to develop a comprehensive migration schedule. In terms of resource assembly, the implementation team should accumulate the political resources for management buy-in; human resources from diversified work domains, and technology resources such as tools and modules. Organizations are highly recommended to pay special attention on the architecture design because not all applications can be directly moved into the cloud and not all architectures have the capacity to accommodate cloud services.
The sub-categories of CSFs relating to project execution are: proof of concept and pilot projects; implementation methodology and project management; and, user involvement. Organizations are encouraged experiment widely and creatively during the proof of concept phase, and to fully capture the performance and cost of potential cloud solutions via dynamic self-provisioning. In cases where there will be a need for customization and/or integration, organizations should carefully choose a development approach, and sustained support from management is as important at this phase as it is in the approval phase. Organizations are encouraged to establish appropriate user expectations, and to mobilize all stakeholders to engage with the project.

Although attending to Critical Success Factors is pivotal, organizations should not ignore the potential obstacles and challenges that can negatively affect the success of cloud initiatives. The challenges fall into the categories that track closely with the CSFs. They are: vendor management challenges; political and cultural issues; architecture design complexities; a lack of resources; and, data storage, transfer and security. Vendor management presents challenges because working with multiple vendors can introduce complexities in system integration, communication, coordination, and conflicting ownership. Political and cultural issues in various forms can cause resistance both within and beyond the IT department, and substantially weaken morale and efficiency. The complexities of architecture design can be challenging when it comes to scaling, integration, customization, hybrid environments, event and error systems, service profiling, and licensing. Last but not least, challenges associated with data storage and transfer; access control and security; and regulatory compliance are recognized as focal concerns for many organizations.

The second study examined the ways in which the IT function is affected and reconstructed during a cloud implementation. Analyses of two case studies of community cloud-enabled organizations showed that organizational IT is affected in: role and functionality; leadership; skills and jobs; staffing levels; formal structure; and workplace culture. General propositions were developed in each of these six areas and evidence is provided from the two case studies. These findings are summarized below.

1). Role and Functionality: As data center functions and low-level infrastructure migrate to the cloud, the role of the IT department has transformed from a “product-oriented” service provider
to an “application-oriented” service facilitator, which is a shift in function to emphasize a business-facing focus of IT services. The primary role of IT in these organizations is to enable and support a variety of business applications in a complex and changing environment. Lastly, the role that IT departments play in mediating the vendor relationship has also changed.

2). IT Leadership: IT leadership (at the C-level for example) has become more business-centric. In parallel with shifts in IT functionality, IT leaders have become more involved in decision making about IT initiatives at both the business process level and the strategic level.

3). Skills and Jobs: While the demand for traditional IT tasks such as programming and database administration have decreased, new job positions such as business analyst and enterprise architect have come into existence. Consequently, new skills in managing virtual systems, service specification, negotiation with vendors, system planning, and architecture design must be developed.

4). IT Staffing: Cloud migration has led to downward pressure on staffing levels in IT departments, and many IT departments have either downsized or will continue to remain small. This transition can be attributed to the downsizing of the IT functionality; the operational efficiency achieved by cloud computing, and use of contract IT workers.

5). Formal Structure: The formal structure of IT departments changes following cloud implementation. Organizations tend to shed full-fledged IT departments; and they may either function without a person at the CIO level, or may share that role across several similar organizations. IT workers had trained to be specialists, are now becoming generalists in a new environment where it is necessary that IT workers assume multiple roles.

6). Culture: IT workplace culture is significantly impacted by cloud initiatives. Resistance may arise as a result of concerns about job security, changing work habits and requirements, an unwillingness to learn new skills, and the redistribution of intra-organizational political power.

The findings of the core investigations of this research project support the integrative research framework proposed in section 3.3. Essentially, Study I (Factors for Successful Cloud Implementation) describes the Critical Success Factors that organizations (and in particular IT departments) should pay attention to, and the potential challenges to be overcome in successfully
implementing a cloud initiative. Study II (Impacts of Cloud Implementation on the IT Function) substantiates the proposition that cloud implementations have significant reconstructive effects on organizational IT function. These two topics were studied together because a clear understanding of the second topic is essential for dealing effectively with the often negative, and certainly transformative impacts that cloud initiatives have within IT departments. This understanding, in turn, can be viewed as a key factor that affects the success or failure of cloud initiatives as discussed in the first topic. These two studies taken together help to draw a more complete picture, in which multidirectional and multifaceted—rather than unidirectional, simple—relationships exists between IT departments and IT innovation. Furthermore, if we examine the findings of the two studies together, these subtle relationships become more apparent.

The research objective and corresponding finding of each study are summarized in Table 33. The cloud services/models selected for each study are provided in Table 34.

<table>
<thead>
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<th>Table 33. Summary of Research Objectives and Corresponding Outcomes</th>
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<td>Research Objectives</td>
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<td>To examine the factors determining the success of a cloud initiative</td>
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<td>To investigate the “reconstruction effect” of cloud implementation on organizational IT</td>
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<table>
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<tr>
<th>Table 34. Cloud Services/Models Selected for Each Study</th>
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<tr>
<td>Cloud Service/Model</td>
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<tr>
<td>Study I</td>
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The selection of two community clouds is a reflection of theoretical choices and pragmatic opportunities (see Section 2.3 on page 11).

The degree to which an IT department can be affected depends on how the organization uses the cloud. Background information needs to be evaluated in deciding the generalizability of the findings to other settings.

It is safe to say that IT departments carry out IT initiatives because doing so is one of the core, traditional roles of IT departments—a relationship in which IT departments promote IT initiatives. On the other hand, it becomes clear in the data in Study II that when it comes to cloud initiatives, IT departments are not always the advocates or champions one might naturally expect. IT employees may resist cloud initiatives because they have the potential to change their work habits; force them to abandon old skills and learn new ones; and most significantly to jeopardize their employment. This is a situation in which IT departments may in fact inhibit the cloud initiative. On the other hand, IT initiatives are what in fact justify the very existence of IT departments in the first place; there would be no IT departments at all if there was not a regular and continuous need for IT innovation in the business environment. A more subtle reading of the findings in Study II shows that successful cloud implementation transforms IT departments into active business partners, a trend characterized by a strong and ongoing IT presence in business transformation and innovation (Guillemette and Paré 2012). Viewed from this perspective, this outcome promotes a relationship in which the cloud initiative promotes the overall importance of IT departments. However, the downside that also emerges from the data in Study II is that cloud initiatives almost always exert downward and transformative pressure on staffing levels and job descriptions for previously existing IT departments. Although a successful cloud implementation can significantly improve business performance as defined by the success criteria laid out in section 5.4.1, the transformative effects on the IT department itself are important for organizations to understand and ameliorate as they move toward a successful implementation.

These intricate relationships between IT departments and IT initiatives can be best captured by the term “Xiang Sheng, Xiang Ke” transliterated from one of the oldest Chinese canonical texts.
the “I Ching” or “Classic of Changes”\textsuperscript{13}. The doctrine Xiang Sheng, Xiang Ke describes a paradox in which two things in a pair may at the same time create or promote each other (Xiang Sheng) but also constrain or overcome one another (Xiang Ke). The deeper meaning can perhaps be better understood through an example—for example the relationship between grass and the goat. The grass feeds the goat and the goat spreads the grass by carrying seeds in her droppings. This is the “Xiang Sheng” effect. But the goat can damage the grass by overeating and some kinds of grasses produce toxins that even goats can’t digest. This is the “Xiang Ke” effect. While cloud initiatives can have a destructive, transformative effect on IT Departments, when successfully implemented, both organizational strength and IT function can be improved.

7.2 Theoretical/Research Contributions

The essential contribution of this dissertation is in establishing a suggestive theory for cloud computing implementation that will provide a basis for further inquiry. It contributes to the literature in 1) extending and revising extant theory on IS/IT innovation by developing a taxonomy of CSFs in the novel context of organizations leveraging external cloud services for business operations; 2) building new theories for IT-enabled organizational change by exclusively focusing on heretofore overlooked effects of cloud implementation on the IT function; 3) reconceptualizing the role of the IT department in an IT initiative by substantiating that an IT department and an IT initiative can promote and inhibit each other.

Study I contributes to the literature on the Critical Success Factors of IT innovation. First, the study suggests a reexamination of CSFs in light of the distinct features of cloud implementation as opposed to traditional IT initiatives. Although some categories at the higher level seem similar with the findings from previous work (Al-Mashari and Zairi 1999), the first-level CSFs underneath the general categories can be very different and contextualized. Even for the same CSFs, the exact meaning in the context of cloud computing may have evolved. Second, the study reveals a few new CSFs that have not been seen in other IT implementation initiatives. Even though a detailed and thorough comparison was avoided, this study at the least offers some examples of the new emergent CSFs in the context of cloud implementation, which may inspire future research. Third, in addition to identifying a list of CSFs, this study further constructs a

\textsuperscript{13} http://en.wikipedia.org/wiki/I_Ching
new model of factors that determines the success of cloud implementation. The model proposes three types of causal relationships in terms of how the success of cloud implementation could be affected by CSFs and challenges. The proposed relationships based on interview data may be used as hypotheses that can be tested in the future. In addition, the model also points out that CSFs and challenges can have different strengths. Lastly, this study represents one of the first efforts that attempt to theorize how an organization can make cloud implementation successful in some depth. It contributes to the accumulation of knowledge in the area of organization-wide IT innovation by systematically identifying patterns and constructs with contextual details using qualitative data.

Study II contributes to the IT/IS literature in several ways. First, the study suggests a reconceptualization of the interconnections between IT departments and IT innovation. A unified framework in which these two entities mutually affect each other in the context of cloud initiatives is proposed. This framework will be useful to researchers looking to establish a holistic view when their topic involves IT departments and IT initiatives. Second, the ways that IT departments can be impacted and transformed by IT initiatives has so far been a theoretical void in the IT/IS literature. The study arguably represents the first effort to look into this missing area in some depth. Although a few previous studies have implicitly alluded to the impact of IT innovation on some aspects of IT units, the findings were at best incomplete and isolated, and failed to offer a comprehensive understanding of the phenomenon. Third, the study develops new mid-range theory by identifying areas in which IT departments can be affected, and elaborating the ways these effects are manifested. Observations are made in each area along with evidence from the data. The rich details of first-order analysis and setting information are provided so that readers can evaluate the plausibility and generalizability of the findings to other settings. Forth, this study extends the theories of IT-enabled organizational change into an uncharted area—IT department. While a vast majority of previous studies concentrated on the impacts of IT innovations at the organizational level, this study sheds light on the changes of the IT department in particular.
7.3 Practical Contributions

Cloud computing is arguably an irreversible trend\textsuperscript{14}, but the practice of implementing cloud solutions is less likely to be effective without corresponding theoretical foundations and rigorous research work. This dissertation offers a number of practical suggestions for practitioners with respect to how to make a cloud implementation successful. In particular, having a clear understanding of the impacts of cloud implementation on the IT function (the topic of Study II) can be viewed as one of the core CSFs.

A better understanding of the CSFs of cloud implementation has significant practical implications. First, the study highlights the fact that a successful initiative requires far more than a good understanding of technology; it requires a lot of effort from the business side as well. An organization should mobilize internal and external resources to collaborate on this endeavor. Second, the CSFs developed in this study could be used as a check-list to identify the key areas that will require keen attention at all stages of implementation. The study not only provides recommendations in terms of what an organization should accomplish, but also offers a list of possible challenges that organizations may have to overcome. As shown in the proposed model, these two aspects together determine the success or failure of a cloud implementation because failure to either: a). achieve the CSFs, or b). overcome potential challenges could lead to delay or failure of the whole initiative. Third, the “Xiang Sheng, Xiang Ke” between IT departments and IT initiatives implies that it is critical to anticipate the potential organizational transformation that will result from cloud implementation—especially on the IT department. Without addressing the political and cultural resistance that may arise within the IT department, the whole cloud endeavor could be placed in jeopardy because the IT department is the turnkey location for cloud implementation. Fourth, the importance of the architectural design cannot be emphasized enough. Organizations with simple or one-time cloud implementations may not need to dedicate much effort to it, but for most organizations, a lack of good architecture design may not only affect the smooth integration of cloud services with existing infrastructure, but could also substantially limit the flexibility to accommodate other cloud services or respond to changing business needs in the future.

\textsuperscript{14}According to a recent Merrill Lynch research note, cloud computing is expected to be a “$160\text{-} billion addressable market opportunity, including $95\text{-}billion in business and productivity applications, and another $65\text{-}billion in online advertising”.
A clear understanding of the impacts of cloud initiatives on IT departments paves the way for more effective management practices to deal with these impacts. This study offers at least five managerial insights on that regard. 1) A successful cloud strategy requires far more than a good understanding of technology; success depends on the organization’s ability to anticipate the business impacts of cloud computing to the IT function. 2) The way that services are delivered and managed with a cloud model may substantially disrupt the existing IT operating model; management needs to be aware of this fact and to make appropriate adjustments. 3) Shifts in IT functionality and the possible downsizing of IT departments does not reduce the importance of the IT department as a whole. Rather, IT departments may in fact play the even more important role of designing service architectures that will accommodate and facilitate business applications. 4) Adoption of cloud services may pose great challenges to IT staff because it may simultaneously require new skills with less manpower; management should take measures to alleviate worries about job security by, for example, providing adequate resources to retrain workers to cope with the new IT environment, and offering opportunities for lateral movement within the organization. Failure to address these issues may cause serious resistance and low working morale within the department responsible for successfully implementing the new IT initiatives. 5) Cloud initiatives reshuffle the power distribution between IT departments and business units, with IT often losing control over IT resources while business units take a more active role in service purchasing decisions. The perceived threat of the loss of intra-organizational power makes IT units less likely to advocate for cloud initiatives. On the other hand, CEOs should take care to let the IT department exert too strong an influence on the decision to implement a cloud solution; as an analogy drawn by McAfee says, “Delegating the move to the cloud to traditional IT people is like putting the crew running the boiler and steam turbine in charge of electrifying a factory.” (McAfee 2011, p. 126)

7.4 Limitations and Future Direction

Several limitations of this research should be acknowledged. The first relates to the sample size of the first study. Fourteen interview participants may not be regarded as a large enough sample size. However, at the time data were being collected, cloud adoption at the organizational level was a novel phenomenon (even though individual use of cloud services was quite pervasive), and Study I only considered organization-wide cloud computing adoption. In addition, organizations
that only used infrastructure as a service (IaaS) (e.g. renting servers from Amazon) were also ruled out as implementing these services require little effort, thus further reducing the potential sample pool. Study I targeted organizations that had implemented large-scale, fairly complicated cloud applications that required significant organizational effort and resources.

The second limitation regards the small number of user organizations surveyed in Case Two (FGBC) of Study II. Data from Case Two were not as rich as those collected in the first case, but this resulted from the fact that greater access to more agency clients of the FGBC was not possible. This limitation is somewhat ameliorated by the aggregated inputs received from FGBC, which not only spoke as a cloud vendor, but also shared a lot of valuable information about perspectives from across many of their customers.

The third limitation regards the transferability or “generalizability” of the findings and their implications. The empirical research reported in the first study was based on interview data from organizations of different sizes and of different industry sectors. Idiosyncratic characteristics pertaining to each organization may have affected the research results. For example, government agencies have more security concerns about cloud services than do commercial companies. Likewise, caution should be exercised when transferring the findings of the second study to other settings. Deployment of cloud computing varies greatly from case to case; beyond organize-wide, group, or individual use, deployment models (public, private, hybrid or community) can vary widely, as do the service models (software as a service, platform as a service, or infrastructure as a service). That is to say, the degree to which an IT department can be affected by a cloud initiative depends very much on the way the organization intends to use the cloud. To counterbalance this shortcoming, detailed background information for each setting was provided along with the contextual observations for each proposition being developed. Readers are encouraged to evaluate this information in deciding to what extent the findings can be generalized to their own particular setting.

Two future research directions are suggested by the results of this research. First, the CSFs, challenges and their connections identified in the model of Study I would be a good starting point for building statistical models. Future research could define the measurements of the identified variables (CSFs and challenges) and quantify the strength of each independent variable.
in relation to the dependent variable. Second, as an alternative to the case study approach employed in Study II, a process-oriented approach (Kettinger and Grover 1995; Tallon et al. 2000; Van de Ven and Huber 1990) might be very useful for understanding the way that changes associated with organizational IT emerge, evolve, and stabilize over time. A longitudinal case study is also suggested to unravel the underlying dynamics of this phenomena (Siggelkow 2007).
REFERENCES


Stake, R. 1995. The art of case study research, (Sage Publications, Inc.


Appendix A: Submission to the Institutional Review Board (IRB)

Submitted by: Shuguang Suo
Date Submitted: October 28, 2011 2:40:36 PM
IRB#: 34397
PI: Shuguang Suo
Review Type: Exemption
Protocol Subclass: Social Science
Approval Expiration: July 1, 2013
Class Project: No

Study Title

1>Study Title
An investigation of the interplay between IT function and Cloud Computing

2>Type of eSubmission
Modification

Home Department for Study

3>Department where research is being conducted or if a student study, the department overseeing this research study.
Information Sciences and Technology

Modification Questions

4>Is the study permanently closed to enrollment?
No

Provide the following information:

5>Total number of participants/samples currently approved by the IRB
50

6>Number of participants/samples entered/consented
0

7>IRB-approved age range of the participants
26-65
8> Choose all of the changes that are being made in this modification request.

[X] Inclusion criteria  
[X] Recruitment – Advertisement  
[X] Title change  
[X] Study procedures  
[X] Informed consent procedures and/or forms  
[X] Data collection methods/Instruments [questionnaires, surveys, interviews, etc.]

9> Does this modification affect the risks to participants?  
No

10> Does this modification affect the benefits to participants?  
No

11> Describe the reason(s) for the anticipated modifications.

There are two reasons for this modification. 

First, case study as a new research method for the second part of this study is added. A case study can help researchers get a comprehensive picture of the phenomenon of interest. The unit of the analysis will be organizations rather than individuals. Data will be collected from two sources. 1) semi-structured in-depth interviews with multiple informants from different departments; 2) documents.

Second, email script for recruitment is changed. An abstract of this study was appended in the email script. This will help potential interview candidates to know more about this study.

12> Will this modification affect currently enrolled participants’ willingness to continue in the study (i.e., revised study procedures, changes in compensation, etc.)?  
No Currently Enrolled Participants

Review Level

13> What level of review do you expect this research to need? NOTE: The final determination of the review level will be determined by the IRB Administrative Office.
Choose from one of the following:  
Exemption

14> Exempt Review Categories:

Choose one or more of the following categories that apply to your research. You may choose more than one category but your research must meet one of the following categories to be considered for expedited review.

[X] Category 2: Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observations of public
behavior unless:

**Basic Information: Association with Other Studies**

15> Is this research study associated with other IRB-approved studies, e.g., this study is an extension study of an ongoing study or this study will use data or tissue from another ongoing study?
   No

16> Where will this research study take place? Choose all that apply.
   [X] University Park

17> Specify the building, and room at University Park where this research study will take place. If not yet known, indicate as such.
   307G, Information Sciences and Technology Building

18> Does this research study involve any of the following centers?
   [X] None of these centers are involved in this study

19> Describe the facilities available to conduct the research for the duration of the study.
   Telephone
   audio recorder
   pen and paper

20> Is this study being conducted as part of a class requirement? For additional information regarding the difference between a research study and a class requirement, see IRB Policy I – “Student Class Assignments/Projects” located at http://www.research.psu.edu/policies/research-protections/irb/irb-policy-1.
   No

**Personnel**

21> Personnel List
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<th>Department Affiliation</th>
<th>Role in this study</th>
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<td>Techatassanasoontorn, Angsana</td>
<td>Information Sciences and Technology</td>
<td>Co-Advisor</td>
<td>96674</td>
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<td>04/08/2011</td>
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</table>

**Suo, Shuguang (Principal Investigator)**

**PSU User ID:** szs214

**Phone:**

**Email:** szs214@psu.edu

**Email Notifications:** Yes

**PSU Employment Status:** Not Employed or Student

**Dept:** Information Sciences and Technology

**Address 1:** 307G Information Sciences and Technology Building

**Address 2:**

**Mail Stop:**

**City, State, Zip:** University Park, PA 16802

**Procedures:** Shuguang Suo is the principal investigator in this study and responsible for administering this study. The procedures he will perform include research design, survey questionnaire and interview questions design, data collection, data analysis and writing.

**Experience:** He acted as the principal investigator in a similar research project which also involved interviewing people.

**Purao, Sandeep, PhD (Advisor)**

**PSU User ID:** sup14
Dr. Sandeep Purao is an experienced researcher in performing social science studies involving human participants.

Dr. Techatassanasoontorn has a rich research experience in performing social science studies involving human participants.

Funding Source
22> Is this research study funded? Funding could include the sponsor providing drugs or devices for the study.
   No

   NOTE: If the study is funded or funding is pending, submit a copy of the grant proposal or statement of work for review.

23> Does this research study involve prospectively providing treatment or therapy to participants?
   No

Conflict of Interest

24> Do any of the investigator(s), key personnel, and/or their spouses or dependent children have a financial or business interest(s) as defined by PSU Policy RA20, “Individual Conflict of Interest,” associated with this research? NOTE: There is no de minimus in human participant research studies (i.e., all amount must be reported).
   No

Exemption Questions (Prescreening)

25> Does this research study involve prisoners?
   No

26> Does this research study involve the use of deception?
   No

27> Does this research study involve any FDA regulated drug, biologic or medical device?
   No

28> Does this research study involve the use of protected health information covered under the Health Insurance Portability & Accountability Act (HIPAA)?
   No

Exemption Questions

29> Maximum number of participants/samples/records to be enrolled.
   50

30> Age range – Check all that apply:
   
   [X] 26 – 40 years
   [X] 41 – 65 years

31> Describe the steps that will be used to identify and/or contact prospective participants. If applicable, explain how you have access to lists or records of potential participants.
   This study is divided into two parts.
   The first part will use interviews as the research method. The participants will be IT managers
and professionals whose organizations have plans of using, or have been using cloud computing services. The PI will develop a list of qualified organizations that may grant access. Both PI and his adviser will work on getting access to these organizations. The second step is to identify several interview candidates (different positions) from each organization.

The second part will use case studies. Qualified organizations should have finished or almost finished implementation of cloud computing and are using cloud services. The PI's adviser will help get access to these organizations. Data will be collected from two resources—interviews and documents. Interview candidates will be approached via emails with a consent form attached and be explained about the research context and objectives. After the interviews, interview participants will be asked if they or other people can provide related documents (either digital or hard copies). People who have those documents will be assured that 1) only the PI has the access to these documents and 2) any use of these documents will not disclose the identities of any individuals as well as the organization.

A list of potential documents include:
The following lists out the potential documents to be collected:
IT department/group description;
Business plan (IT-related part);
Overview of sourcing contract;
New hiring positions (IT-related);
Job announcement (IT-related);
Work procedures (IT-related);
Performance appraisal matrix (IT-related);
IT employee turnover reports from HR department.

Choose the types of recruitment materials that will be used.

[X] Telephone Script (Verbal)
[X] In-person Script (Verbal)
[X] Email

When and where will participants be approached to obtain informed consent/assent? If participants could be non-English speaking, explain how consent/assent will be obtained. If consent/assent will not be obtained, explain why consent/assent will not be obtained.

Interview participants will be given a consent form through email before interviews. They will be asked to read the consent form and then to reply to the researcher whether they want to participate in this research.
The second part of this research also uses documents as another data source. After interviews, interview participants will be asked whether they can or they know somebody else can provide some related documents. They will be assured orally or via email that 1) only the PI has the access to these documents and 2) any use of these documents will not disclose the identities of any individuals as well as the organization. Their agreement on providing documents will be taken as implied consent. A consent script for recruiting participants for documents is uploaded.
Provide the background information and rationale for performing the study.

Globalization, mergers and acquisitions, tremendous amounts of electronic data, and ever-changing customer demands have created new challenges for information processing. These challenges require organizations to rethink their business models and these changes are often facilitated by IT innovations. Cloud computing and Service Oriented Architecture (SOA) are two emerging paradigms and together they represent a promising solution for a variety of information-processing challenges in modern organizations. This study defines cloud-based SOA as an application architecture within which all functionalities are defined as independent services with cloud-based APIs that can be used to leverage external computing resources through ubiquitous Internet access. Cloud-based SOA is essentially an IT-enabled enterprise transformation. It is a new form of IT innovation. Cloud-based SOA represents a new research area with great potential for theory development and theory extension. As a new trend in IT industry, cloud-based SOA creates both opportunities and challenges for IT departments during the enterprise-wide transformation of business processes and services. This study proposes to examine the duality of IT departments in affecting and being affected by IT-enabled enterprise transformation using cloud-based SOA as a research vehicle.

Summarize the study’s key objectives, aims or goals.

1. Identify factors (and connections among them) that make cloud-based SOA successful
2. Identify the impact of cloud-based SOA on the IT function and vice versa

Describe the major inclusion and exclusion criteria.

Participants who will be included:
IT managers and professionals, managers of other departments (e.g. finance, marketing) from organizations that may have the plans of using, or have been using cloud computing services.

Participants who will be excluded:
Researchers

Summarize the study’s procedures by providing a step-by-step process of what participants will be asked to do.

The first part of the research will use interviews as a method for data collection. Interviews will be conducted as below:
1. participants will be given a number of open-ended questions. The conversation will be audio recorded with the consent of the participants.
2. Transcribing. Transcripts will be made from voice recordings.

The second part of the research will use case studies as a data collection approach. data will be collected from two sources.1) semi-structured in-depth interviews; the procedure will be the same as above. 2) documents. After interviews, interview participants will be asked if they can or they know somebody else can provide related documents. Researchers will ask for permission before use of any documents (except those publicly available information). Identities of related persons or the organization will be removed in the writing.
38> Indicate the type(s) of compensation that will be offered. Choose all that apply.

[X] Compensation will NOT be offered

39> Will any type of recordings (audio, video or digital) or photographs be made during this study?

Yes

40> What type of recordings will be made (including digital)? Choose all that apply.

[X] Audio

41> Where the recordings/photographs will be stored?

All documents and data will be stored in a locked cabinet and in a password-protected computer.

42> Who will have access to the recordings/photographs?

All recordings and transcriptions will only be accessible to the research investigators.

43> How will the recordings be transcribed, coded and by whom?

The recordings will be transcribed with identifiers blackened out by the principal investigator.

44> Will the recordings/photographs be destroyed?

Yes

45> How and when will the recordings/photographs be destroyed?

All copies of audio recordings will be destroyed 3 years after the original recording dates.

46> Will any data collection for this study be conducted on the Internet or via email (e.g., on-line surveys, blogs or chat room observations, on-line interviews, email surveys)?

No

47> Does this study involve any foreseeable risks and/or discomforts to participants – physical, psychological, social, legal or other?

No

48> Will data be stored securely and accessible only to the research personnel listed on this application?

Yes

49> Describe how data confidentiality will be maintained.

All recordings and transcriptions will be stored without identifiers. Only research investigators will have access to the data. All documents reviewed will be stored without identifiers, or with identifiers blackened out. Data will be stored in a locked cabinet and in a password-protected computer.

**Document Upload**

APPROVAL LETTER

Document 1001 Received 04/27/2011 05:24:01 PM - --Exemption Determination Email
CONSENT FORMS
   Document 1001 Received 07/10/2011 18:07:53 - Adult Form consent form for phone interview
   Document 1002 Received 07/10/2011 18:08:42 - consent form for interview in person
   Document 1003 Received 10/28/2011 14:07:57 - Adult Form A Consent Script of Recruiting Participants for Related Documents

DATA COLLECTION INSTRUMENTS
   Document 1001 Received 07/10/2011 18:09:23 - interview questions (first part)
   Document 1002 Received 07/10/2011 18:10:04 - interview questions (second part)

RECRUITMENT
   Document 1001 Received 10/28/2011 14:34:07 - Recruitment Materials email scripts
   Document 1002 Received 10/28/2011 14:39:52 - Recruitment Materials In-person script

REVIEW - REQUEST INFO
   Document 1001 Received 06/22/2010 10:01:12 AM - Returned for Additional Information
   Document 1002 Received 07/02/2010 03:37:06 PM - Returned for Additional Information
   Document 1003 Received 04/18/2011 02:41:14 PM - Returned for Additional Information
   Document 1004 Received 10/05/2011 01:31:00 PM - Returned for Additional Information
   Document 1005 Received 10/18/2011 11:27:21 AM - Returned for Additional Information

SUBMISSION FORMS
   Document 1001 Received 10/18/2011 11:16:27 AM - Application Auto-generated by eSubmission Approval
Appendix B: Informed Consent Form

To be read to participants:
Informed Consent Form for Social Science Research
The Pennsylvania State University

Title of Project: An investigation of the interplay between IT function and Cloud Computing

Principal Investigator: Shuguang Suo, PhD Candidate
307 G IST Building
University Park, PA 16802
(814) 321-4879; szs214@ist.psu.edu

Advisor: Dr. Sandeep Purao
316B IST Building
University Park, PA 16802
(814) 863 0017; spurao@ist.psu.edu

1. Purpose of the Study: The purpose of this research study is 1) to identify factors (and connections among them) that make cloud-based SOA successful. 2) to investigate the impact of cloud computing on the IT function and vice versa.

2. Procedures to be followed: You will be asked to answer some questions in a phone interview which will be audio recorded.

3. Duration: It will take about one hour to complete the interview.

4. Statement of Confidentiality: The interview will be recorded. Your participation in this research is confidential. The recordings will be stored and secured in a locked cabinet and in a password-protected computer. Only research investigators will have access to the data. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared. All copies of audio recordings will be destroyed three years after the original recording dates.

5. Right to Ask Questions: Please contact Shuguang Suo at (814) 321-4879 with questions or concerns about this study.

6. Voluntary Participation: Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer.

Do you agree to participate in this research study?
Appendix C: Semi-Structure Interview Questions for Study I

[Script]

Hello, I appreciate your willingness to participate in this interview. The objective of this research project is to identify factors that make cloud computing implementation successful, to investigate which of these factors are unique to cloud computing implementation, and to find out how they may be inter-connected. I am interviewing expert IT professionals from such as yourselves who have experience with cloud computing. With your permission, I will record this conversation. It is my promise that your identity will remain completely confidential. The interview should take no longer than 1 hour. Do you have any questions? Shall we begin?

To begin with, I would like to ask you some background questions.

1. We are having this conversation because <your company—use specific name here> has some experience in cloud computing. Can you tell me your specific role with <your company – use specific name>’s cloud computing implementation project?

2. Let’s consider a specific project in the recent past. Can you tell me a little about this project, for example:

   → What was the objective of this project?
   → How many departments have been influenced?
   → What was your role in this project?
   → Shuguang responds: Ok, let's give this project a name <come up with a name>

3. Was that project a success? How successful – a little, a lot? <this language can vary based on what the interviewee says>

4. How did you define success? If the project is not yet completed, how do you think you will be defining success?

Now, I have some questions to ask you about critical success factors of cloud computing implementation. The questions will be based on things you or your company have already done.

5. Can you describe any preparations you or your company did before initiating this project <name>?

   → In terms of IT infrastructure?
→ In terms of setting up human resources?
→ In terms of obtaining buy-in and support from the business groups?
→ In terms of obtaining funding?
→ Any other preparations you would like to emphasize? Please describe.

6. How did you or your team manage the vendor-relationship to make <this project – use name> a success? OR How are you and your team managing the vendor-relationship to make <this project – use name> a success?

→ Can you describe a specific example where your vendor-relationship approach has helped or is helping?
→ Can you describe another specific example where your vendor-relation approach has not helped or is not helping?
→ Based on the examples you have described and also drawing on anything else you may recall, what are the important factors that one must address to effectively manage the vendor-relationship with providers of cloud computing infrastructure?
→ Can you reflect on this list of factors and point out the factors that are unique to the cloud computing initiatives compared to, say, IT outsourcing?

6. How did you or your team execute the implementation to meet the project goals?

→ What was the approach of project management?
→ How did you or your team mobilize resources, manage activities, and control time & cost?
→ Can you reflect on this list of factors and point out the factors that are unique to the cloud computing initiatives compared to traditional IT project (e.g. ERP)?

Well, you just told me something that have contributed to the success of this project. I also want to know the problems or obstacles that you came across in this project.

7. What were the problems or obstacles that you think impeded your cloud computing effort?

→ Do you perceive any resistances from individuals, other departments or even IT department itself?
→ Are these factors unique to cloud computing implementation?

8. How did you or your team solve these problems?
→ Please provide some examples.

Next, I want to ask you something that you or your team didn't do, but you think are important to the success of this project.

9. What are the areas that, if improved, could lead to a greater success of this project?

→ Are these factors unique to cloud computing implementation?

Okey, you've mentioned a number of critical areas for the success of the project, including (read the list of critical factors that I have noted down).

10. Among these areas, are there any interconnections?

→ If so, please describe some examples to show how they are related.

11. I've finished with my questions now. Before we end, is there anything else you think it would be useful to add?

All right. thank you very much for spending time to talk with me. Your input is going to be very valuable to the continuing development of this project.
Appendix D: Semi-Structure Interview Questions for Study II

Script

[Participant’s name], my name is [interviewer’s name] and I am from the college of Information Sciences and Technology at Penn State University.

We are interested in learning more about the mechanisms of creating and sustaining HIT partnerships, and about the impacts of HIT partnerships on IT function.

Could you please read the consent form and sign it if you have no objections?

Do you have any questions? Shall we start?

To begin with, I would like to ask you some background questions.

1. We are having this conversation because <your organization-use specific name here> has established a Healthcare IT partnership with other hospitals. Could you give me a brief overview of this partnership?
   → (*) How and when did the HIT partnership originate?
   → What were the drivers?
   → (*) What are the roles of each partner?
   → Anything else you want to emphasize?

2. What was your role in creating and/or maintaining the partnership?

3. What is the current status of this partnership?
   → (*) Is it a success? How successful?
   → On what basis do you define success?

Now, I have some questions about the structure and governance of this HIT partnership.

4. From a technical perspective, how does this HIT partnership work?
(*) What IT resources/services do you provide to, get from, and share with other hospitals?

(*) Where is the data center located? And who is doing the maintenance?

Do you recall a scenario where you and your partner need to jointly solve a technical problem? Can you tell me about it?

5. What are the technical challenges in this partnership?

(*) Did you come across any technical problems? Can you elaborate a little more?

6. From a managerial perspective, how does this HIT partnership work? (Optional)

(*) In terms of cost sharing, contract, training and problem-solving?

(*) Can you think of one example where your hospital and partner hospitals jointly solve a managerial issue? Can you elaborate a little?

7. What are the managerial challenges in this partnership? (Optional)

(*) Can you describe a specific example for each of the challenges?

(*) (Ask IF not brought up) Did this partnership require any change in business process?

Now I have some questions about the impacts of this HIT partnership on IT functions.

8. How does this partnership affect your IT group/department?

(*) Do you think the role of your IT group has changed? How?

(*) How do you think the leadership of CIO (or head of the IT group) has changed? In what ways?

(*) Does your hospital require different IT skills after the partnership initiated? How different?

(*) Is there any adjustment of job positions in your IT group? How are the current job positions different from those before the HIT partnership?

(*) Do you see people leave because of the partnership? Is it because their skills do not match with the current job positions? How many people have left? On what positions?
(*) Has the size of your IT group changed? Is it now bigger or smaller?

(*) Has the structure of your IT group changed? How?

Anything else you want to emphasize?

Thank you very much for spending time to talk with me. Your input is going to be very valuable to the continuing development of this project. You can contact me if you have any questions about the study.

Note: * means important probing questions.
Shuguang Suo

EDUCATION

Ph.D.  Information Sciences and Technology  2013
College of Information Sciences and Technology, The Pennsylvania State University
Concentration: cloud computing, IT Integration, service oriented architecture

M.S.  Management Information Systems  2007
School of Information, Renmin University of China, China
Concentration: computational modeling, social simulation

B.S.  Information Management and Information Systems  2003
School of Management, Shandong University, China

PUBLICATIONS


• Angsana Techatassanasoontorn and Shuguang Suo (2011). Influences on Standards Adoption in De Facto Standardization. Information Technology and Management, 12(4), 357-385.


