12-2011

Information Technology for Service Innovation: The Impact on Business Productivity and Channel Disruption from Cloud Computing and Smart Device Computing

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Research Proposal for ICIS 2011

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1. Introduction

In recent years, the advancement of information technology (IT) has tremendously contributed to various aspects of our society such as economic growth, public welfare, new business development, new social phenomena and trends, and changes in people's way of doing their lives (Lyytinen and Rose 2003). Business entities are leveraging IT resources for commercial ends and have achieved a great deal of efficiency and productivity in their business operations and performance. For individuals, the trajectory of IT evolution has introduced various types of devices, applications, and services to satisfy individual needs for fast communication, easy information access, and digital entertainment (Yoo 2010). Such a large scope of IT engagement in both organizations and individuals reinforces the salience of IT as a strategic business enabler and an influencing driving force of social transformation.

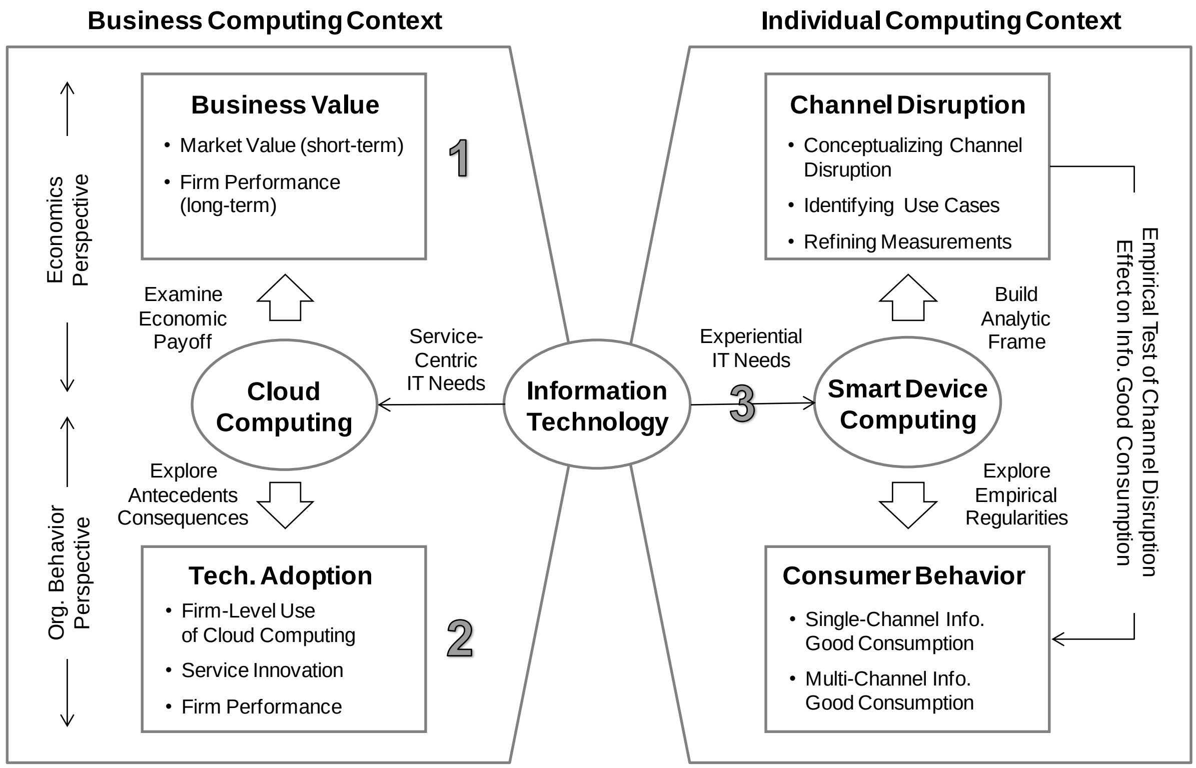
Yet, today's rapidly changing business environment requires each firm to build comprehensive and solid business competence to swiftly bring innovative products and services in the market. Accordingly, customers' appetite and expectation for products and services is getting more complicated and higher. The situation implies that, as an operant business resource, IT is still in need of transforming itself to eventually take more evolutionary features for both business computing and individual computing (Fichman 2001).

For business computing, due to highly competitive and global business environment, firms are more interested in cost-effective IT capability provision to meet budget constraint and technology agility to speed up their business strategies and operations (Plummer 2009; Staten 2008). To address industry request, the concept of cloud computing has recently emerged and become commercialized. In spite of its infancy of commercialization and arguments of risks (e.g., security, service quality, and inadequate service model), cloud computing is now recognized as a paradigm shift of IT service design and delivery to response to today's growing need for service-centric IT. For individual computing, ever-improved technology feature such as miniaturization of computer and communication H/W, ever-increasing processing power and storage capacity, and digital convergence leads to new era of ubiquitous computing embedded our everyday life, which is referred to as experiential computing (Yoo 2010). In this new IT phenomenon, smart devices (e.g., smart phone and tablet PC) are known to play a pivotal role in facilitating experiential computing. Smart devices are the other paradigm shift in which individuals get connected Internet every time and everywhere. Under such circumstance, individuals are to consume various types of information goods and entertainment services without temporal and spatial limitations and experience real-time global communications through online social networks. Considering the features of smart devices, it would be expected that they can be a game-changer in telecom and digital content industries due to high possibility to bring technology-mediated disruption on consumer behavior in the market.

The two shapes of IT evolution are major contexts for this proposed thesis study. Although there is large amounts of interest in cloud computing and its application to firms' service innovation from business entities, but few studies have investigated this new IT and business phenomenon. The emergence of smart devices provides great impetus for telecom firms to develop and deliver new information and entertainment services. So they are in need for investigating such smart device computing effects on information goods consumption. Based on the research background, the proposed thesis study seeks to better understand new paradigm shift in information technology and its impact on a firm's business productivity and consumer behavior in the market. More specifically, subsets of research objectives of the study is (1) to assessing the new IT service model, cloud computing, from economics and organizational behavior perspectives and (2) to investigate dynamically changed consumer behaviors upon the new technology use such as smart device computing.

Aligned with these mega directions, the structure of the study consists of three sub-studies: (1) Economic Payoffs from Cloud Computing Deployment; (2) Organizational Use of Cloud Computing – Antecedents and Consequences; (3) Channel Disruption and Smart Device Effects on Info Goods Consumption. The overall structure of the proposed study is illustrated in Figure 1.

Figure 1. Structure of the Study



2. Overview of Cloud Computing Study

A long-lasting key question for IS researchers and practitioners is whether and how IT can contribute to better business performance. In particular, as the business environment has been increasingly competitive and globalized, firms are being required to improve their strategic and technological agility and reduce the complexities of their business and IT operations to sustain their competitive advantages in a rapidly changing environment (Sambamurthy et al. 2003).

Responding to these business challenges, today's IT has evolved into a new shape, becoming increasingly centralized as various types of IT resources move into data centers in order for such resources to be available wherever and whenever they are needed. As a new form of IT deployment, cloud computing is an innovative way to provide various on-demand IT resources to multiple clients using Internet technologies in a pay-per-use manner (Armbrust et al. 2009; Plummer 2008).

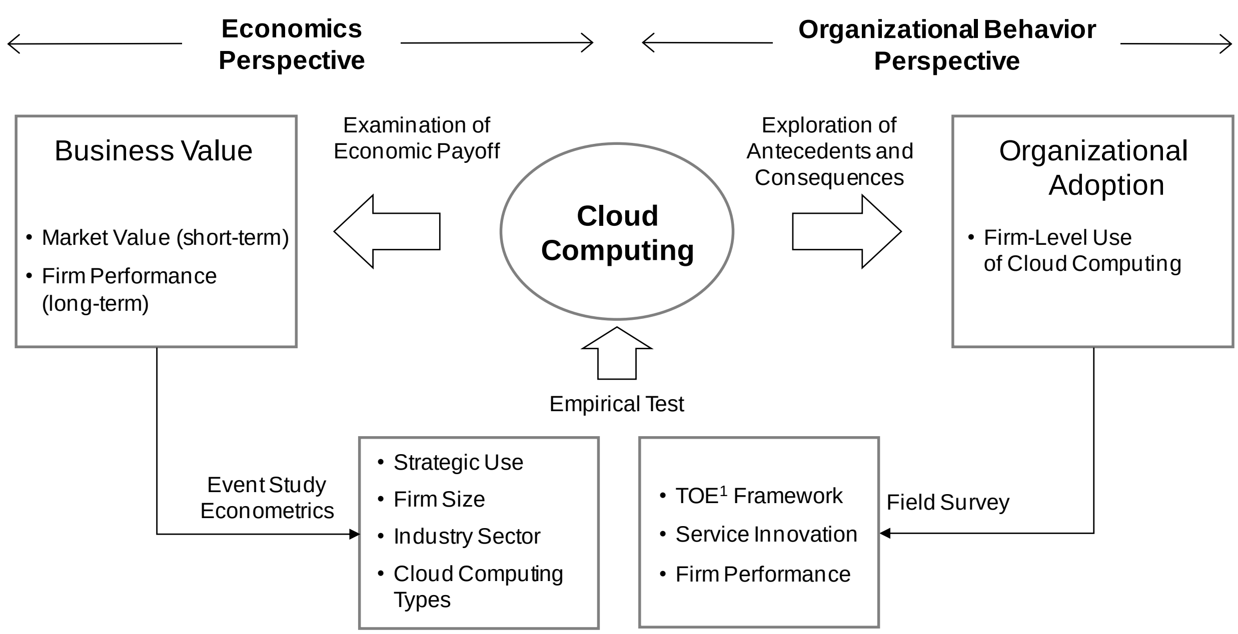
Yet, cloud computing is not just limited to technology or technical infrastructure; rather, it reflects a new way in which IT can be used more strategically in business value creation. When considering the value of cloud computing, one may think IT cost reduction as a primary benefit because the nature of cloud computing is to flexibly provide service-centric IT capabilities without large scale of up-front IT infrastructure investment. However, this is certainly not the only benefit of cloud computing.

Cloud computing also reinforces business agility in an organization by considerably reducing the lead time needed to acquire IT resources for business strategy deployment or operations. Without the cloud service, an organization usually needs to initiate another IS project to establish a dedicated system to enable associated business processes. Due to the key attribute of cloud computing, subscribing computing utility, a firm is able to instantly access required IT resources and immediately enable the planned strategy and business operations. Thus, the firm can market its new products or services faster than its competitors, sustaining its business competence in the market.

The service-oriented features of cloud computing which lead to technology flexibility and business agility may enhance the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments, eventually sustaining competitive advantages (Pavlou and El Sawy 2006; Teece et al. 1997).

Thus, deploying cloud computing encourages practitioners and IT researchers to better understand how its potential benefits could be maximized and to address the problems inherent in implementing and utilizing the new IT innovation in the organization. How can we have a better understanding about the application of cloud computing to business environment? To answer this question, I conduct two distinctive but interrelated studies in the context of cloud computing (see Figure 2): (1) investigating economic payoffs from cloud computing deployment; and (2) exploring the organizational use of cloud computing. The studies collectively aim to understand cloud computing phenomenon across the two different theoretical perspectives of economics and organizational behaviour related with pre- and post-adoption (Karahanna et al. 1999). Since the process of IT adoption and use takes place across a sequence of steps in organizations (Rogers 1983), each stage of the process (e.g., pre- and post-adoption) provides different research settings that can be manipulated for different research implications (Kwon and Zmud 1987). Thus, such a multiple theoretical approach in the study can provide a chance to broaden our knowledge and derive diversified research implications regarding the application of cloud computing for the real business environment.

Figure 2. Framework of Cloud Computing Study



TOE: Technology, Organization, Environment Context

Furthermore, the outcomes of each research stream can be synthetically utilized as guidelines for organizational decision-making of cloud computing deployment. For example, for potential users, empirical assessment of economic payoffs from cloud computing utilization suggests practical benchmark for the firm's decision-making about whether and in what circumstances to utilize cloud computing to enhance business productivity and increase business value. On the other hand, for vendors of cloud computing, indentifying antecedents that affect organizational use of cloud computing provides useful references for refining their service provision capabilities to exploit this new IT service model as market-creating service innovation. The proposed study can make contributions to the IS literature in the way that: the study (1) extends the boundary of the IS literature by reflecting the new trend of the IT industry, (2) continues the debate about business value of IT with the new IT service innovation, and (3) provides theoretical framework for cloud computing adoption that can be applied to further studies on cloud computing.

3. Conceptualization of Cloud Computing

Cloud computing has become one of the most prominent topics in the IT industry (Plummer 2008; Staten 2008). However, the identity of cloud computing remains unclear as the real application of cloud computing has just come into place for enterprise IT services. Thus, I attempt to identify the essential properties of cloud computing covering the definition of cloud computing, its characteristics, and differences from traditional computing.

3.1. Definition and Characteristics of Cloud Computing

Several opinions have been introduced for the definition of cloud computing. They embrace some overlapping notions depicting a universal image of “what cloud computing is.” First of all, cloud computing can be seen as the use of Internet technologies for the provision of IT resources, implying highly adaptable, scalable, and ubiquitous IT services. Another overlapping key notion is that the new IT service practice can be applicable to a wide spectrum of IT resources covering infrastructure, platform and application. Finally, the concept of cloud computing emphasizes the differentiated usage context conceptualized as “pay-by-use billing” and “on-demand service.” Therefore, I define cloud computing with a simplified context as “*An innovative way of providing various on-demand IT services for multiple clients using Internet technologies in pay-per-use manners*.”

The differentiated features of cloud computing can be broadly defined in four ways: (1) service-oriented design, (2) service delivery over the Internet, (3) flexible use of shared service, and (4) pay-per-use-billing. Within each key attribute, more detailed features of cloud computing are defined (See Table 2 for further details). These features as a whole characterize cloud computing as a new innovative IT service model capable of transforming existing IT management practices.

Table 1. Characteristics of Cloud Computing

Perspective	Key Attribute	Details
Resource Design	Service-Orientation	*IT service commoditization*: Standard offerings are defined by service providers as "off-the-shelf" items for external customers. On-demand self-service: Service contents and necessary functions are provided at customers' request. Customers are free to initiate and terminate services without involving the service providers. *Technology abstraction*: Service providers usually (or mostly) hide complex technology implementations behind service interfaces.
Resource Delivery	Delivery over the Internet	*Internet technology engagement*: Internet technologies deal with multiple customer service requests at a time and provide enriched service contents. *Availability*: Internet-mediated services are highly accessible in any computers connected on-line.
Resource Usage	Flexible Use of Shared Service	*Computing utility*: Service providers own computing resources and supply them as utility products for multi-tenancy. Elasticity: More flexible IT capabilities are adjusted to demand fluctuations of IT resources. *Scalability*: Infinite capacity is allowed to scale up resource amount at a desired level.
Resource Payment	Pay-per-Use Billing	*Subscription model*: Billing is based on the amount of service use measured according to CPU hours, data transferred, or data stored. Service providers have usage model to measure the service amount and offer different types of payment plans.

3.2. Cloud Computing from Innovation Perspective

Previous IS literature provides a theoretical background for interpreting the identity of cloud computing from innovation perspective. According to the IS innovation typology (Swanson 1994), cloud computing can be viewed as a Type III innovation in the sense that cloud computing can be applied to integrate various service-oriented IT resources with a firm's core business technology; such application leads to a wide scope of changes in a firm's business operation, IT management, and strategic use of IT. In the technology aspect, cloud computing aggregates modern IT features into a new business computing environment in response to the growing need for greater IT-business integration, flexibility, and agility.

Considering such characteristics, I consider cloud computing as a synthetic innovation (Hage 1980), which involves the combination of existing technologies in ways that create significantly new products or services. Cloud computing refers to a paradigm shift that offers flexible IT resources and services over the Internet. From technical point of view, cloud computing originates from a set of pre-existing technical concepts such as service-oriented architecture (SOA), distributed and grid computing, and virtualization. Although these technology components do not seem to be new, the innovativeness of cloud computing is based on its ability to aggregate existing services and generate the new way of providing computing services to customers. These theoretical perspectives support innovation features pertaining to cloud computing and emphasize its strategic role of business value creation in organizations.

3.3. Comparison of Cloud Computing to Traditional IT Provisions

As discussed in the previous section, from an IT provisioning perspective, cloud computing has the potential to innovate the practice of computing resources deployment, transform traditional IT service value chain, and bring chance for new IT business models. Linked with such potentials, cloud computing presents several differentiated features compared to the traditional model of IT provision.

First, cloud computing shifts the ownership of IT resources from the client side to the service provider side and supplies such resources as service items (Cearly and Smith 2009; Plummer 2008). The change in ownership implies that under the cloud computing environment, prior IT capital expenditure is transformed into operational cost, which should reduce the financial burden associated with the initial IT implementation and its subsequent maintenance (Cearly and Smith 2009).

Second, natures of cloud computing, such as elasticity and scalability, provide users with a more flexible resource management basis on which the amount of IT resources supplied to clients can be adjusted according to fluctuations in customer demand (Armbrust et al. 2009). The feature prevents resource shortages in case of under-provision and resource waste in case of over-provision. Such benefits consequently are self-reinforced by generating slack resources that can be allocated to more business-oriented tasks in organizations.

Third, the service interface of cloud computing and IT commoditization features provide clients with enhanced technology abstraction hiding detailed technology expertise behind cloud computing service items, reducing the burden of on-site system implementation (Staten 2008). Cloud computing offers various types of off-the-shelf IT services that can be instantly deployable to business processes of enterprise customers. The differentiated features enable clients to use on-demand IT and business functions reflecting the latest technology trends. Thus, by exploiting cloud computing, clients are able to follow up-to-date technology features without the burden of on-site system implementation and periodical maintenance and upgrades (Staten 2008).

Finally, cloud computing presents a different shape of IT service value chain. Through an increased service orientation and a continuing technology standardization, the classical IT service value chain has been transformed; the model of single-provider or one-stop provision of IT outsourcing is replaced by a cloud computing service network in which different service providers offer a wide range of cloud computing services at different IT infrastructure levels (e.g., software, hardware and platform). The emerging cloud computing service network allows users to deploy virtual and asset-free IT resources and also allows service providers to reorganize their existing services and offer new combinations of IT capabilities.

4. Study 1: Economic Payoffs from Cloud Computing Deployment

For firms that have already deployed cloud computing practices in their business operations, it is necessary to assess economic returns on cloud computing investments. As the real application of cloud computing in the business environment has recently emerged (Staten 2008), few studies examine this new IT and business phenomenon from the perspective of economic value and productivity of the firm. So, suspicious opinions are raised on the economic validity of cloud computing in the industry and academics (Brynjolfsson et al. 2010). From academic perspective, it is critical to investigate the economic salience of deploying this IT service innovation in a real business environment and specify the complementary conditions under which a firm can realize business values from cloud computing deployment.

Key research questions that motivate the first study are: (1) Does cloud computing investment receive a positive reaction from the market in terms of expected return? (2) How is the market reaction to cloud computing deployment different depending on contextual factors (e.g., firm size, industry, strategic intention, and cloud computing types)? (3) Does cloud computing result in improved firm performance after the years of its deployment?

To understand economic payoffs from cloud computing use with balanced research perspectives, the study specifies the 'payoff' into two ways: (1) measuring market expectations of firms' cloud computing investment based on stock market reaction and (2) examining whether to improve their business productivity. The basic idea of the first approach is based on investigating how the market evaluates firms' cloud computing deployment (McWilliams and Siegel 1997). Employing the event study methodology, I analyze 219 firm-level announcements regarding cloud computing deployment. I also investigate whether cloud computing adoption eventually resulted in improved firm performance such as return on asset (ROA), return on sales (ROS), selling, general, and administrative expense (EXSGA), and growth rate of sales (GR).

4.1. Theoretical Background

Today, most organizations recognize that information technologies play an extremely important role in sustaining their business operations. Some previous IS studies have made plausible claims that investments in IT can have important strategic consequences. This literature suggests that IT investment decisions have the potential either to improve a firm's competitive position or to allow the firm to become more vulnerable to competitive forces (Cash and Konsynski 1985; Ives and Learmonth 1984; Porter and Millar 1985). However, results of other empirical studies on IT investments and firm performance have been equivocal (Hitt and Brynjolfsson 1996; Weill 1992). Given these contradictory results, it has been argued that the intangible benefits of IT, such as improved quality, variety, timeliness, and customization, have not been appropriately measured primarily due to the use of conventional productivity measurement techniques (Brynjolfsson 1993; Brynjolfsson and Hitt 1998). Furthermore, as many factors influence firm performance, it is difficult to establish clear and proprietary causality between IT investments and firm-level performance (Im et al. 2001).

The review of IT productivity literature indicates that the understanding of the relationship between IT and business value is still controversial. While prior studies have focused on the economic impact of IT under the production function framework, exploring business value from IT investments is still limited due to immeasurable benefits that accrue from innovative IT practices such as cloud computing. Accordingly, IS researchers are motivated to apply alternative perspectives to analyze IT's contribution to firm performance.

To provide a different way of measuring business performance, some IS studies have adopted a stock market valuation approach based on the event study methodology, which is an efficient way to capture market's overall assessment of a firm's business activities (McWilliams and Siegel 1997). The event study usually measures the stock market's reaction to unexpected events (e.g., announcements) to estimate how the event impacts the value of the firm. The underlying assumption is that capital markets are sufficient for evaluating new information about the key event (Fama et al. 1969), including IT investment, which can potentially impact the firm's expected future profits. This methodology has been recently used within IS literature. For example, the impact of unexpected announcements has been studied in regard to IT investment in general (Dos Santos et al. 1993), outsourcing (Peak et al. 2002), ERP system (Hayes et al. 2001), and so on.

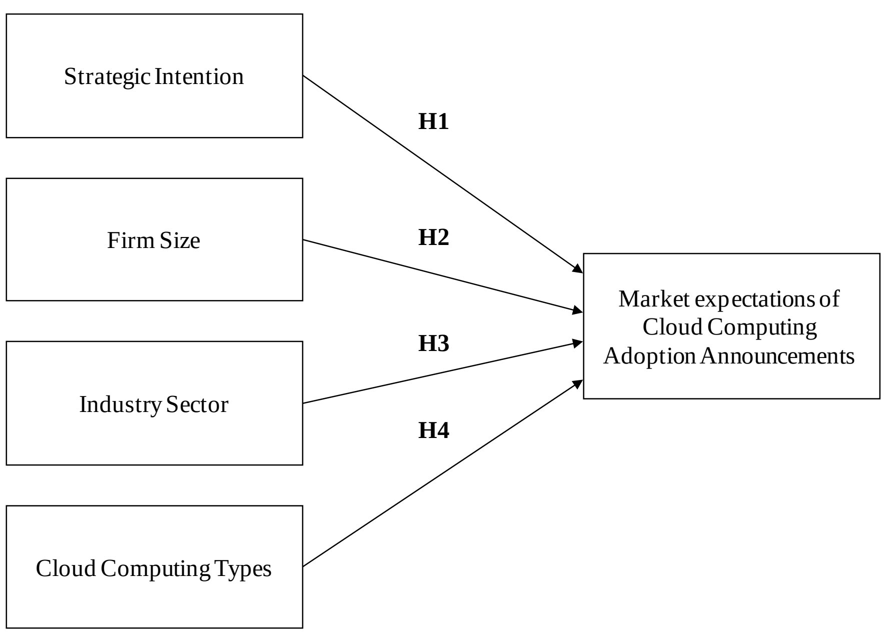
The results of prior event study works provide IS researchers with useful reference to understand the market's assessment of intangible benefits related to IT investment that accounting measurements cannot control for. However, it does not necessarily imply that event study is the one that substitutes traditional IT productivity research. Rather, it is understood that both approaches are complementary for each other to produce more diversified results for IT's contribution to creating business values. The review of IT productivity and event study literature finally provides theoretical background that motivates me to combine these two approaches to evaluate economic payoff from cloud computing deployment in broader perspectives such as market expectations and firm performance.

4.2. Research Model and Hypotheses

As previously discussed, the study seeks to indentify complementary conditions under which firms are likely to achieve significant returns on their cloud computing investment based on market expectation. To this end, I propose several contextual factors that capture the firm's organizational and environmental aspects and technological features of cloud computing. More specifically, strategic use, firm size, industry sector, and cloud computing types are implemented in the research model as contextual factors to investigate their effects on the level of market expectation.

Strategic use refers to the purpose and the way in which a firm utilizes cloud computing from the perspective of strategic IT use. Firm size and industry sector represent organizational and environmental aspects of technology adoption. Finally, cloud computing type reflects a primary technological feature of cloud computing that embraces various on-demand IT capabilities including software, hardware, and platform. Aggregating arguments regarding proposed contextual factors below, I present the research model as follows.

Figure 3. Research Model of Market Reaction to Cloud Computing



Strategic Use. The basic idea of incorporating strategic use as an influencing factor is that market's evaluation of the expected value of the adopting firm can be different depending on business purposes of utilizing cloud computing. IT investments usually play a variety of strategic roles in sustaining and enhancing firms' business competence in the market. These roles are different according to firms' business goals and the context to which IT is applied. Prior literature suggests that strategic use of IT in organizations conceptually includes three categories (Schein 1992; Zuboff 1988): automating business processes for increased efficiency (automotive), facilitating virtual communications to senior management for better decision making (informative), and redefining business practices and industry relationships for creating new market (transformative). These types of strategic IT use are closely related to the firm's business strategies to create sustainable competitive advantages in two ways: operational efficiency, which attempts to improve internal work productivity, and strategic positioning, which aims to enhance business capabilities in the market (Chatterjee et al. 2001; Tallon et al. 2000).

However, previous IS studies argue that even for the new innovative technology like cloud computing, market expectations of such IT investments could be different depending on the purpose and way of utilizing the technology (Dehning et al. 2003; Dos Santos et al. 1993; Im et al. 2001). For instance, Dehning et al. (2003) posit that benefits from efficiency-oriented IT investments (e.g., automotive and informative) are to be short-lived because the practice is easy to be duplicated by competitors. For this reason, market will not positively react to these investments. Reversely, for IT investments focused on strategic positioning (e.g., transformative), market expectations would be higher because such investments can result in new business models and provide unique products and services that are difficult to be imitated by other competitors.

Drawing from such theoretical arguments, I expect that the market will react to firms' cloud computing deployment in different ways based on their strategic intention as shareholders and investors can usually evaluate the future value of the firm through the cloud computing adoption events. Thus, I propose the follow hypothesis:

Hypothesis 1: *Cloud computing adoption announcements produce a significantly different level of abnormal shareholder returns according to strategic intention.*

Firm Size. The study also examines how market expectations of cloud computing deployment are affected by firm size. In IS literature, the relationship between firm size and IT has been widely investigated from different academic aspects such as technology adoption, IT investments, and market reactions to IT practices. In particular, mixed arguments and empirical results have been presented in terms of firm size effect on IT investments. Dewan et al. (1998) find that the level of IT investment is positively related to the degree of firm size including business scope and scale. Harris and Katz (1991) examine the relationship between IT intensity (i.e., the ratio of IT expenses to total expenses) and firm size. They find that small firms present relatively higher IT intensity than large firms do. Richardson and Zmud (2001) posit that small firms are more likely to sustain competitive advantages brought by IT investments compared to large firms because small firms are in less structural inertia and organizationally more agile in censoring, adopting, and internalizing new technologies for commercial purposes.

From information disclosure perspective, some studies consider firm size a proxy for the amount of pre-disclosure information and posit that it is more difficult for the market to be aware of the actions of small firms compared to large firms (Atiase 1985; Bamber 1986; Ziebart 1990). In short, the smaller firms are, the less likely they are to be disclosed as sources of information. Thus, all things being equal, the amount of unexpected information conveyed to the market by IT investment announcements should be inversely related to firm size (Im et al. 2001). Therefore, it would be expected that IT investment announcements of smaller firms marginally have more information content than those of larger firms. Then, the market reaction would be more favourable to IT investment announcements brought by smaller firms.

Other than the arguments suggested by previous literature, cloud computing itself has plausible potentials for small and medium-size enterprises (SMEs) who would like to put their resources more on building their businesses rather than making significant IT investments (Plummer 2008; Staten 2008). For

SMEs struggling to acquire sufficient IT resources, the value proposition of providing various Internet-mediated IT capabilities with less or no up-front capital investment makes cloud computing a viable and affordable IT service model for SMEs. The situation may lead to more favorable market reaction to cloud computing initiatives by SMEs than those by large firms.

Aggregating such advantageous features of cloud computing and theories related to firm size effect on IT investments, I expect that market expectations of firms' cloud computing deployment can be different based on whether the client of cloud computing is a large firm or SME. Thus, I present the following hypothesis:

Hypothesis 2: *Cloud computing adoption announcements produce a significantly different level of abnormal shareholder returns according to firm size.*

Industry Sector. Industry has frequently been considered as a salient influencing factor in several event study works (Dehning et al. 2005; Im et al. 2001; Oh and Richardson 2006; Telang and Wattal 2007). Although IT has been known as a major key factor in changing business practices, its role and impact may vary with industry types (Melville et al. 2004).

Previous studies have examined the relationship between industry sector and IT investments mostly based on information intensity attributed to industry characteristics (Cash et al. 1992, Jarvenpaa and Ives 1991). The most popular academic example is investigating the difference of industry effect on the level of IT investments between service firms (e.g., especially financial firms) and manufacturing firms. In general, service firms have more complex business models and are more broadly connected with customers and partners through direct and indirect business networks (Dewan et al. 1998). Under such business environment, service firms are prone to make broad and intensive IT investment to sustain their competitive advantages in the market.

From the perspective of market expectations, some studies argue that a service firm's IT investment decision can be considered as a major technological event, while a manufacturing firm's IT investment decision may not because IT investments from service industry side are usually expected to provide more impact on business performance than those from manufacturing industry (Cash et al. 1992, Jarvenpaa and Ives 1991, Johnston and Carrico 1988, Porter and Millar 1985). Also, in previous event study works, it has been suggested that the market shows more positive reactions to IT investment announcements brought by service firms than manufacturers although the studies have provided mixed empirical results (Dos Santos et al. 1993; Im et al. 2001; Oh and Richardson 2006).

Based on the theoretical arguments and empirical results, it would be expected that outcomes of IT investments may differ across industry sectors. More specifically, the service industry, which requires more information-intensive capabilities, tends to be affected to a greater degree than the manufacturing sector from cloud computing deployment (Porter and Millar 1985). This leads to:

Hypothesis 3: *Cloud computing adoption announcements produce a significantly different level of abnormal shareholder returns according to industry sector.*

Cloud Computing Types. Cloud computing can be regarded as a new IT provision model that delivers several forms of service-oriented IT capabilities. In other words, cloud computing is based on the concept of using the Internet to allow users to access technology-enabled services in the layers that consist of various types of information systems such as software, hardware, and platform. Categorized into different layers, cloud computing services are described in three types: software-as-a-service (SaaS), platform-as-a-service (PaaS), and hardware-as-a-service (HaaS). SaaS is the cloud application layer and provides Internet-enabled business applications that are instantly applied to end-users' business processes. PaaS is the cloud software environment layer that provides a programming language environment for cloud application developers. HaaS refers to virtual computational resources (e.g., server, storage, and communication network) that serve cloud applications and platforms.

Previous event studies on IT investments have examined various IS contexts covering from hardware infrastructure to applications. The results of those studies have yielded a different set of outcomes depending on investors' business expectations and characteristics of adopted IS (Dos Santos et al. 1993; Hayes et al. 2001; Im et al. 2001; Peak et al. 2002). In particular, Chatterjee et al. (2002) assess several IT investment announcements to examine whether IT infrastructure investments result in positive market expectations. They empirically find that IT infrastructure investments generate greater positive market returns than IT applications investments do. With this finding, they argue that the market more favorably reacts to IT infrastructure investments rather than IT applications investments as IT infrastructure has potentials to bring more innovative changes to a firm's business operations and strategies.

The impact of cloud computing can be different in the similar way that investors are likely to evaluate firms' cloud computing practices based on which cloud computing resources to be deployed for what business purposes. The market would prefer infrastructure-related cloud computing investment due to the expectations of relatively higher returns in the future. Thus, it would be anticipated that investors' and shareholders' reactions to a firm's cloud computing announcements can be different depending on the expectation of cloud computing on firm performance and the features of cloud computing types. This leads to:

Hypothesis 4: *Cloud computing adoption announcements produce a significantly different level of abnormal shareholder returns by cloud computing types.*

4.3. Research Method

To investigate market reaction to firms' cloud computing investment, event study is applied as a primary research methodology. Recently, the event study has emerged as a pervasive mechanism by which researchers can explore the relationship between IT investments and business performance because the method provides the ability to measure investors' perceptions of the intangible costs and benefits associated with IT investments (Chatlcrjee et al. 2002; Dehning et al. 2005; Dos Santos et al. 1993; Im et al. 2001). For this reason, IS researchers have widely used the event study methodology as a relevant tool that can assess the business performance related to IT investments using market-based measures such as stock price or trading volume. The methodology draws upon the efficient market hypothesis (Fama et al. 1969) that capital markets are efficient mechanisms to process available information on firms. The logic underlying the hypothesis is the belief that investors in capital markets process publicly available information on firm activities to assess the impact of such activities; not only on current performance but also on the firm performance in future periods (Subramani and Walden 2001).

The key procedure of event study analysis is calculating abnormal returns responding to firms' cloud computing announcements. To measure the impact of a cloud computing adoption event, I need to estimate the normal return of the stock as it would have been had the event not occurred. The approach produces the following regression:

$$R_{s,t} = \alpha_s + \beta_s R_{m,t} + \epsilon_{s,t} \quad (1)$$

where $R_{s,t}$ is the return of stock s on day t, and $R_{m,t}$ is the market return on day t. α_s and β_s are firm-dependent coefficients to be estimated. The $\varepsilon_{s,t}$ is a random error term for stock s on day t.
Using this equation, I can derive the abnormal return (AR), which indicates the difference between the expected returns based on general market movement and the actual returns shown as following:

$$AR_{s,t} = R_{s,t} - (\alpha_s + \beta_s R_{m,t}) \quad (2)$$

where α_s and β_s are the coefficients of the parameters obtained from ordinary least squares (OLS). In turn, the abnormal returns are simply the prediction errors of the model in equation (1).

The stock's abnormal return provides an estimate of the economic worth of the event (Brown and Warner 1980). Once abnormal returns of sample cloud investment announcements are calculated, a cumulative abnormal return (CAR) can also be calculated by aggregating all sample abnormal returns across the event window, which is defined as plus and minus a certain number of days from the event date (e.g., ±5 days or ±10 days). In order to avoid confounding effects due to the wide range of the event window (McWilliams and Siegel 1997), a narrow event window such as ±1 day from the event is applied in the study. CAR for all sample abnormal returns usually represents the overall effect of cloud computing investment on the firm's market value. Finally, CAR is examined to verify its statistical significance using *t*-test with the null hypothesis that CAR is equal to zero.

Other than the calculation and statistical test of CAR, I specify a regression model to empirically validate the hypotheses argued in the previous section. The model uses CAR as a dependent variable and incorporates four contextual factors corresponding to hypotheses 1 through 4 as independents variables. The model specification used in the study is described as follows:

$$CAR_i = \beta_0 + \beta_1\text{Strategic\_Use}_i + \beta_2\text{Size}_i + \beta_3\text{Industry}_i + \beta_4\text{Type}_i + \varepsilon_i \quad (3)$$

where CAR_i is cumulative abnormal return for firm *i*. Strategic_Use_i indicates firm *i*'s strategic use of cloud computing. In order to identify each sample firm's usage type, I review the context of cloud computing adoption announcements. I use a dummy variable, coded as "0" if there are any announcements that mention a goal of increasing business process efficiency (or cost reduction). I also code as "1" those announcements that mention transformative use of cloud computing such as producing new services or products, customer service improvement, and enhancing partner relationship. Size_i denotes firm size regarding whether firm *i* is a large enterprise ($\text{Size}_i = 0$) or a SME ($\text{Size}_i = 1$). To identify firm size, I apply the criterion of market capitalization used to categorize publicly traded firms into "Large Cap" (larger than 10 billion dollars) and "Mid and Small Cap" (less than 10 billion dollars). Industry_i refers to industry sector to which firm *i* belongs. In this study, SIC code is used to identify each sample firm's industry sector: service industry firm with SIC ≥ 6000 ($\text{Industry}_i = 1$) and non-service industry firm with SIC < 6000 ($\text{Industry}_i = 0$). Type_i indicates cloud computing types that firm *i* adopt. In the study, dummy variables are generated for reflecting three types of cloud computing: SaaS, PaaS, and HaaS.

In the study, the event is defined as a public announcement of a firm's cloud computing initiative in the media. The event study methodology aims to investigate the causal relationship between such an event and market reaction represented as the variance of a firm's market value. Thus, the methodology is based on searching a large range of news reports and rigorously analyzing their contents. I followed a procedure for a sample selection as suggested by McWilliams and Siegel (1997).

The sample data were collected from a full text search of news sources such as PR Newswire and Business Wire within the Lexis-Nexis academic search engine over the period from 2005 to 2010. Search keywords included names of focal technologies (e.g., cloud computing, SaaS, PaaS, and HaaS) and some action verbs such as adopt, implement, initiate, and deploy. More than 1,000 news articles were filtered based on the following sampling criteria: (1) announcements in daily publications; (2) announcements by firms within major security exchanges; (3) announcements containing confounding effects such as dividends, earnings, and mergers and acquisition (Im et al. 2001; Oh and Richardson 2006). In particular, to control for the confounding effect, I eliminated the firms from the sample on the day that they had experienced confounding events (McWilliams and Siegel 1997); this sampling procedure yielded 223 cloud computing announcements. In addition, in the analysis step, I eliminated cloud computing announcements with extremely high or low abnormal returns (i.e., outliers) using Cook's distance analysis. Outlier analysis ultimately yielded 219 corporate cloud computing adoption announcements from 2005 to 2010.

The daily stock returns of the individual firms were retrieved from the Center for Research on Security Prices (CRSP) database. I also used a commercial Web portal like "Yahoo Finance" and a specialized Web search engine like "Lexis-Nexis Company Dossier" to retrieve daily stock returns not offered from CRSP (particularly, stock returns dated after January 2010). I used the list of firms in the S&P 500 index to collect announcements. As a result, the announcements were mostly for firms in the S&P 500. Therefore, I applied the S&P 500 index for the market return regression. Our analytical methods are consistent with prior studies using daily stock returns. For the analysis, I used an estimation period of 120 days and calculated the CARs over one primary event window: a 3-day interval, ranging from 1 day before to 1 day after the event. The length of the estimation period and the event windows used are consistent with prior studies of capital market responses (Subramani and Walden 2001).

4.4. Analysis Results

I conducted a cross-sectional analysis of the abnormal returns by estimating equation (3) to identify the complementary conditions on which different levels of market expectation for cloud computing investment depend. To estimate the model, I used ordinary least squares (OLS) procedures with robust standard errors. In the model, *CARi* is the dependent variable for regression analysis. Table 2 summarizes the results of regression analysis.

Table 2. Results of Regression

Dependent Variable	CAR (±1)
INTENTION (Strategic positioning)	-0.0097* (0.0053)
SIZE (SME)	0.0104** (0.0051)
INDUSTRY (Service)	0.0128** (0.0056)
TYPE (SaaS)	0.0064 (0.0059)
TYPE (HaaS)	0.0042 (0.0067)
N	219
F – Statistics	3.01**
R – squared	0.0532

Note: Standard errors in parenthesis. ***p < 0.01, **p < 0.05, *p < 0.01

As shown in Table 2, strategic intention was found to be significant at 10% level. The direction of coefficient is negative. The result indicates that compared to external focus, internal focus has relatively higher influence level on firm's cumulative abnormal returns, and the result shows that there is different level of abnormal shareholder returns by strategic intention to use cloud computing. Thus, Hypothesis 1 is supported. Firm size was also found to be significant at 5% level, indicating that SMEs report relatively higher influence on firm's cumulative abnormal returns. Hypothesis 2 is supported. Industry sector turned out to be significant at 5% level. The result presents that firms in service industry achieve higher abnormal returns than those in non-service industry, supporting Hypothesis 3. However, cloud computing type was found to be statistically insignificant. The results indicate that there is no difference in the level of influence on firm's cumulative abnormal returns across cloud computing types. More specifically, the results suggest that the impacts of SaaS and Haas are not different from that of PaaS. Thus, Hypothesis 4 is not supported.

As an auxiliary analysis, I also assessed the overall effect of firm's cloud computing deployment on market expectation. Table 3 presents the results of the average cumulative abnormal return (ACAR) for the 219 cloud computing deployment announcements. The table also indicates the test results for the significance of the effect. The main event window used for the study is ±1 day in order to avoid confounding effects. As the result in the table indicates, the overall ACAR over the 3-day (-1 ~ +1) event window of all firms releasing adoption announcements was found to be significant at the 1% level (ACAR = 0.834%, t = 3.590, p < 0.01). This indicates that investors or shareholders favourably evaluate firms' cloud computing adoption initiatives within the short period of event windows.

Table 3. Abnormal Return to Cloud Computing Adoption

	ACAR (±1)	***t*-value**
Overall Effect (n=219)[1]	0.834%	3.590***

Note: ****p* < 0.01, ***p* < 0.05, **p* < 0.01

4.5. Extending the Current Study: Cloud Computing and Firm Performance

So far, in the study, I have examined the influence of cloud computing investment announcements on firm's market value using event study methodology. The approach usually focuses more on reflecting market expectation of future profits of firms upon new IT adoption event. However, market-based abnormal return may not be necessarily related to the realized firm's benefit. To complement the analysis of stock market data and investigate whether the use of cloud computing actually results in higher business performance, I conducted a different type of analysis based on performance-oriented indicators.

Based on the arguments previously raised for explaining the business value of cloud computing, I expect that proper adoption of cloud computing will lead to improved performance of firms in terms of revenue growth, cost reduction, and enhanced productivity (Brown et al. 1995; Smith et al. 1998). Previous IS studies regarding firms' financial performance related with IT adoption have utilized several profit and cost ratios as performance indicators (Aral et al. 2006; Bharadwaj 2000; Hitt et al. 2002). Considering the potential benefits and examined positive market reaction to cloud computing adoption, I need to investigate financial performance realized by adopting firms after their implementation.

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[1] In this study, we also calculated ACAR for ±5 and ±10 days of event windows. ACAR for the ±5 day event window was significant at the 1% level (ACAR = 1.284%, t = 2.76, p < 0.01). Similarly, ACAR for the ±10 day event windows turned out to be positive and significant at the 5% level (ACAR = 1.293%, t = 2.05, p < 0.05).

In this study, the measurements of firm performance are return on asset (ROA) and return on sales (ROS). Also, I use selling, general, and administrative expense (EXSGA) for testing productivity and growth rate of sales (GR) for profitability (Lim et al. 2007). All performance variables are transformed into change variables that present performance difference after 3 years from cloud computing adoption. The model specification utilized in investigating firm performance after cloud computing adoption:

$$Performance_i = \beta_0 + \beta_1 \text{Strategic\_USe}_i + \beta_2 \text{Size}_i + \beta_3 \text{Industry}_i + \beta_4 \text{Type}_i + \beta_5 \text{CAR}_i + \varepsilon_i \quad (4)$$

$Performance_i$ denotes the dependent variable that represents firm i's financial performance including ROA, ROS, EXSGA, and GR. In order to test whether a firm's financial performance affected by cloud computing can be different according to contexts, I incorporate the contextual factors utilized for investigating market expectations (e.g., strategic intention, firm size, industry sector, and cloud computing types). Furthermore, I employ firms' abnormal returns as an explanatory variable. In the model, CAR_i is defined as firm i's cumulative abnormal return with the event window from -1day to +1 day for the announcement. The results of the firm performance analysis are described in Table 4.

Table 4. Cloud Computing Adoption and Firm Performance

Dependent Variable	ΔROA_{Y3}	ΔROS_{Y3}	$\Delta EXSAG_{Y3}$	ΔGR_{Y3}
INTENTION (Strategic Positioning)	-0.1042 (0.2376)	-0.7564 (0.1927)	0.0815 (0.0525)	0.0577 (0.0585)
SIZE (SME)	-0.4971** (0.2273)	-0.3653** (0.1813)	-0.1312*** (0.04906)	-0.0835 (0.0550)
INDUSTRY (Service)	-0.0504 (0.2753)	-0.2086 (0.2118)	0.0752 (0.0592)	0.0557 (0.086)
TYPE (SaaS)	1.2522** (0.4897)	1.0015** (0.3981)	-0.0402 (0.1057)	0.0103 (0.1209)
TYPE (PaaS)	1.4635*** (0.5579)	1.1958*** (0.4484)	-0.0551 (0.1185)	0.0363 (0.1361)
CAR (±1)	8.9890** (3.9083)	6.9265** (3.1443)	0.4055 (0.8383)	2.0517** (0.9548)
N	94	99	93	99
F – Statistics	2.81**	2.81**	2.21**	1.32
R^2	0.1624	0.1550	0.1337	0.0795

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.01$

As shown in Table 4, SMEs were found to be negative and significant at 5% level for both ROA and ROS, which means that small and medium-sized firms have smaller change in ROA and ROS. It is contrast to my expectation that SMEs show larger change in ROA and ROS than large firms do because it is recognized that cloud computing is usually more favourable option to SMEs due to cloud computing' value proposition of various Internet-mediated IT capabilities with less or no up-front capital investment. However, SMEs turned out to be negative and significant at 1% level for EXSGA. The predicted sign for ΔEXSAGY3 is negative because SMEs are expected to appreciate cost-effective benefits from their cloud computing deployment. Thus, the result indicates that SMEs can derive relatively higher cost-reduction effects while using cloud computing than large firms. Service firms turned out to be insignificant. The result did not satisfy the expectation that cloud computing provide significant greater impact on service firms' performance because service firms usually depend more on information processing for their business operations and thus receive more benefits from cloud computing adoption. Both SaaS and PaaS were found to be positive and significant at 1% and 5%% levels respectively in ROA and ROS. The results indicate that cloud computing deployment targeted to business applications and platform could result in greater positive effect on firm performance. CAR (±1) was found to be positive and significant at 5% level for ROA, ROS, and growth rate. The results suggest that there is positive relationship between investors' expectation for cloud computing adoption (measured by market returns) and adopting firms' financial performance in terms of business productivity and revenue growth. However, insignificant result between CAR (±1) and EXSGA implies that cloud computing does not necessarily lead to cost reduction benefits as the market expects when deployed in business operations.

4.6. Discussion

The research findings in the study provide some implications for research and practice. First, the advantages of cloud computing still seem to be controversial (Brynjolfsson et al. 2010). But our results suggest that, the sample of cloud computing deployment announcements in the study is significantly associated with positive market expectations. The positive overall ACAR indirectly implies market's growing interest in firms' attempt to utilize up-to-date information technologies for higher operational efficiency and better market competence.

Second, a number of previous IS studies have empathized the role of IT as a tool for saving operational costs. One of the results in the study shows favorable reaction of investors to operation-oriented use of cloud (i.e., internal focus). The result implies that due to the recent mergence of cloud computing, investors' expectation relatively focus on cost-saving role of cloud computing. Yet, as cloud computing gets more diffused across business environment, the new IT service model can provide sustainable benefits when utilized for market-oriented purpose such as value-added service to customers and better collaboration with suppliers and partners.

Third, the result of investors' favorable reaction to adoption of cloud computing for SMEs implies that cloud computing is a plausible choice to small and medium firms that do not possess sufficient slack resources to cover the large amount of initial investments for IS.

Fourth, some results of the current study indicate that there is a significant industry difference in abnormal returns to cloud computing adoption announcement especially between manufacturing and non manufacturing. The result implies that benefits of cloud computing can be different depending on the nature of each industry. From the study, it can be recognized that return to cloud computing adoption can be rapidly realized in more customer-interactive and competition-intensive industry, which are constituents of non manufacturing industry sector. Thus, mangers who are thinking about the introduction of cloud computing to their organization need to consider the firm and industry-specific characteristics that can affect the success of cloud computing adoption and decide the appropriate timing to introduce.

5. Study 2: Organizational Use of Cloud Computing – Antecedents and Consequences

For firms with potential to implement cloud computing, it is more relevant to identify the factors that affect firms' decision-making of using cloud computing. Since the real application of cloud computing in business has recently emerged, many firms still face a series of obstacles in identifying relevant criteria for decision-making related to cloud computing adoption and use. Thus, in this line of research, the focus is on: (1) establishing a theoretical framework specific to cloud computing adoption and use; (2) conceptualizing factors affecting cloud computing adoption and deployment; and (3) performing empirical assessment based on data from the real business world.

Other than indentifying influencing factors and examining their effects on cloud computing use, this post-adoption study seeks to investigate whether cloud computing use facilitates firms' service innovation practices and contributes to firm business value via cloud computing-mediated service innovation activities. The idea is based on the understanding that in many cases, the underlying reason for firms to deploy cloud computing is to leverage this new technology innovation to change current business operations and eventually refine competitive edges for market competence.

Actually, the importance of service innovation for contemporary firms has been growing. It is obvious that when products or services become more homogeneous or an original competitive advantage cannot be sustained any longer, service innovation becomes an effective way for a firm to accelerate its growth rate and profitability (Berry et al. 2006). Accordingly, researchers and practitioners have been increasingly interested in exploring and predicting key antecedents of and outcomes associated with service innovation.

In recent years, firms are making a large scale of investments in IT to align business strategies, enable innovative business operations and establish extended enterprise networks. These firms have adopted IT to foster changes in their business activities and enhance competitive capabilities (Agarwal and Sambamurthy 2002). A number of IS researchers hold that IT is an important ingredient of conducting innovation in organizations (e.g., Sambamurthy 2003). Firms implement IT to improve the quality and scope their products and services such as adding new services, expanding existing ones, and improving service delivery processes. Thus, the success of a firm in the market broadly depends on how well it implements service innovation by manipulating IT (Berry et al. 2006).

Although the importance of IT to facilitate firms' service innovation is conceptually understood, there are few studies on empirically investigating nomological relationships among IT, service innovation, and firm performance as a whole. So, it is worth filling these gaps by examining role of technology innovation in coordinating service innovation practices and firms' business performance in the context of cloud computing.

Key research questions that motivate the second part of the study are: (1) What theoretical perspectives can we use to identify precursors of organizational use of cloud computing? (2) What conceptual framework can be established for studying cloud computing use? (3) Does the use of cloud computing facilitate firms' business practices of service innovation? (4) Does cloud computing use eventually contribute to firms' increased business value and competitive advantages through service innovation practices?

5.1. Theoretical Background

TOE Framework. A number of prior researches have focused on examining the use of technological innovations in firms. Due to the need to examine innovation use in a wide variety of theoretically interesting contexts, several theories have been used in the prior work, resulting in a large set of antecedents that can impact innovation use. A theoretical model for cloud computing adoption and use needs to take into account factors that affect a firm's decision-making of adopting and using cloud computing, which is rooted in the specific technological, organizational, and environmental circumstances of an organization (Zhu and Kraemer 2005). A review of the technology adoption literature indicates that Tornatzky and Fleischer's (1990) work provides a useful starting point to investigate the organizational Adoption of cloud computing. Tornatzky and Fleischer (1990) developed the technology – organization – environment (TOE) framework, which identified three aspects of a firm's context that influence the process of adopting and implementing technological innovations. The framework posits that in addition to the qualities of an innovation, there exist broader contexts that significantly impact innovation adoption and use.

The technological context focuses on how features of technologies can influence both adoption and implementation processes. The context thereby embraces technologies within the firm and the pool of technologies externally available in the market. The organizational context is related to a variety of descriptive characteristics of an organization. These characteristics include firm size, complexity of its managerial structure, the quality of its human resources, and the amount of slack resources available internally. The environmental context refers to an area in which a firm retains its business. Examples include the industry sector, competitors, and partnerships with external suppliers. The TOE framework implies that the process of innovation adoption and use depends on the combined effects of technology features, organizational properties, and business environment (Chau and Tam 1997; Zhu et al. 2003).

Previous studies have empirically supported the relevance of the framework across various IS domains such as electronic data exchange (EDI), open systems, and e-business. Iacovou et al. (1995) developed a model incorporating three antecedents (i.e., technological factors, organizational factors, and environmental factors) as the main drivers for EDI adoption, and examined the model using seven case studies. Kuan and Chau (2001) further tested the usefulness of TOE framework in the context of EDI using larger samples. As an exploratory study, Chau and Tam (1997) proposed a TOE-based model formulating some antecedents of open system adoption and empirically examined their impact on the firm's behavioural intention to initiate open system. In particular, TOE frame work has been intensively used in studies of e-Business adoption and use. Zhu et al. (2003) drew upon the TOE framework to identify facilitators and inhibitors for e-business adoption decisions by European firms. Zhu and Kraemer (2005) examined the role of the TOE factors to influence e-business usage in the retail industry. Focused on the financial services sector, Zhu et al. (2005) studied how TOE factors may influence e-business impacts on firm performance.

The TOE framework is also consistent with Rogers' (1983) innovation diffusion theory, which emphasizes the influence of technological characteristics (innovation attributes) and both internal and external organizational characteristics on potential adopters. In this sense, as a generic theory of technology diffusion, the TOE framework can be used to study the organizational adoption and use of IT innovation like cloud computing. However, the TOE framework itself does not incorporate a well-developed theory, and furthermore the framework does not provide the theoretical rationale to establish causal relationships among TOE-related constructs. In contrast, individual theories sometimes do not provide diversified variables that explain an organization's technology adoption and use bahaviors. To hurdle these shortcomings, the recent literature in IS has attempted to combine the attributes of the TOE framework with other theories (Zhu and Kraemer 2005; Mishra 2007).

Service Dominant Logic and IT. The fundamental feature of traditional business is making and shipping: manufacturing products, packaging, and delivering them through a distribution system. From this product-oriented perspective, Customers are seen as the recipients of goods that can be acted on in terms of segmentation, promotion and distribution. However, due to increasing complexity and competitiveness of today's business environment, the focus is shifting from products and manufacturers to services and customers.

In recent years, management discipline (e.g., especially marketing) has evolved toward a service dominant (SD) logic (Vargo and Lusch 2004) through which we can re-examine primary mechanism of sustaining competitive advantages and creating business value. Compared to traditional goods dominant (GD) logic, which focuses on the distribution and exchange of commodities and manufactured products, SD logic posits that doing business is a continuous social and economic process in which service provision rather than goods is fundamental to economic exchange (Vargo and Lusch 2008). Thus, SD logic focuses rather on intangible and dynamic resources, which are operant resources (e.g., human knowledge, skills, technologies, core competencies, organizational processes) than on static stuff, which are operand resources. To this end, operant resources have been viewed as the primary source of a firm's increased market competence such as a better service provision to customers and customer value cocreation.

This change in perspective (i.e., shifting the primacy of resources from operand to operant) has fundamental implications for how IT is recognized and evolved. From SD logic perspective, IT is considered technological knowledge asset and an operant resource. The role of IT is the foundation of providing competitive advantage with deploying firms. This view is consistent with current economic thought that the change in a firm's productivity is primarily dependent on knowledge or technology (Capon and Glazer 1987). Capon and Glazer (1987) broadly define technology as know-how, and they identify three components of technology: (1) product technology (i.e., ideas embodied in the product), (2) process technology (i.e., ideas involved in the manufacturing process), and (3) management technology (i.e., management procedures associated with business administration and sales).

Aligned with the above argument, the new dominant logic also has been reflected into the evolution of IT. In order to correspond to the increasingly competitive business environment, Firms want IT be transformed into more effective form of IT services. They are looking for the agile, flexible, and cost-effective technology-enabled services that help them get their business enabled. IT is traditionally organized around the various technology domains taking in new work through project requests and moving it through a Plan-Build-Run life cycle. This delivery-oriented, technology-centric approach to IT has inherent latency built into the model, which has in turn created increasing tension with the business it serves. However, the broad paradigm shift from closed, hierarchical and static system to open, networked and dynamic systems implies a move from centralized, siloed, proprietary and monolithic enterprise information systems to peer-to-peer, service-oriented, standards-based and modular inter-enterprise IT resources provision. Thus, new service-centric IT provision, such as cloud computing, enables business users to source services that meet their needs quickly at relatively advantageous expenses and flexile service level. Taken together, SD logic described in the section provides relevant theoretical basis on which business needs of IT evolution and the emergence of cloud computing can be explained.

Dynamic Capabilities. The dynamic capabilities view has been increasingly applied within the management literature in recent years. Such a widespread use of the theory is eventually attributed to longstanding interest in the relationship between firm's strategic choices and sustaining competitive advantages in today's turbulent business environment. A recent research presents that the average period for which firms are able to hold their market competences has decreased over time (Wiggins and Ruefli 2005). The result suggests that in highly competitive and fast-moving business environments, firms recognize that it gets harder for them to sustain their long-term competitive advantages in the market.

The situation implies that firms should manage themselves in such a way that they can build temporary advantages by effectively responding to successive environmental shocks (Eisenhardt and Martin, 2000). How can firms successfully address such a challenging task? The "dynamic capabilities" approach provides one important response to this crucial question for both managers and researchers. Dynamic capabilities suggest that firms need to build their abilities to integrate bundle, and reconfigure internal and external competences to effectively address rapidly changing environment (Teece et al. 1997).

Dynamic capabilities theory is originally extended from the resource based view (RBV) of the firm (Barney 1986; 1991). The RBV intends to explain the conditions under which firms may achieve a sustained competitive advantage based on their bundles of resources and capabilities. In RBV, resources are stocks of available factors that are owned or controlled by the firm, whereas capabilities refer to a firm's capacity to deploy resources. These two concepts are collectively applied to a firm's business processes and lead to desired commercial results (Amit and Schoemaker, 1993).

Although dynamic capabilities originate from RBV and share some similarities on the importance of firm-level resources to competitive advantages, the theory also retains differentiated perspectives on how to configure and prepare necessary capabilities of a firm to dynamically respond to rapidly changing external environments. The RBV assumes that resources and capabilities are heterogeneously distributed across firms and that such heterogeneity may persist over time. Firms' bundles of resources and capabilities provide a competitive advantage as long as they are valuable and rare, and for such advantage to be sustainable over time, they must also be costly to imitate and non-substitutable (Barney, 1991). However, the RBV is considered to be essentially static in its nature and inadequate to explain firms' competitive advantage in changing environments (Priem & Butler, 2001). To fill this gap, dynamic capabilities adhere to the idea that firms should systematically develop their ability or potential to sense business opportunities or threats, make timely and market-oriented decisions, and reconfigure its resource base (Teece et al. 1997; Teece 2007)

In the aspect of technology adoption and use in organizational level, dynamic capabilities provides theoretical perspective that relevantly explains a firm's migration across different generations of technologies. The idea is based on the Teece (2007)'s extended definition of dynamic capabilities, which insists that the capabilities can be grouped into the capacity (a) to sense and shape opportunities and threats, (b) to seize opportunities, and (c) to maintain competitiveness through enhancing, combining, protecting, and reconfiguring the business enterprise's intangible and tangible assets. These three capacities are closely related with a firm's practices of adopting and assimilating technologies: monitoring new technologies externally available in the market; understand the potential value for its business; and effectively integrating these technologies with the firm's business strategies and processes.

Cohen and Levinthal (1990) argue that the ability of a firm to recognize the value of new and external information (e.g., technologies and business practices), assimilate it, and apply it to commercial ends is critical to its innovative capabilities. They define this capability as a firm's absorptive capacity and suggest that it is largely a function of the firm's level of learning capability. From innovation diffusion perspective, a firm's accumulated knowledge and experience usually plays a pivotal role in formulating organizational propensity to actively innovating business practices using potential technological innovations. In short, dynamic capabilities view provides theoretical background to define useful antecedents of organizations' decision-making of adopting and using emerging technologies to enhance their competitive advantages.

Contagion effects. The theory of contagion effects refers to "the spread of a particular type of behavior through time and space as a result of a prototype or model performing the behavior and either facilitating that behavior in the observer or reducing the observer's inhibitions against performing that same behaviour (Midlarsky 1978, p. 1006)." Contagion effects theory proposes sequential events of technology adoption connected to other entities' decision makings over time, and presents a refined shape of innovation diffusion theory (Kauffman and Techatassanasoontorn 2009). Contagion effects usually arise through spillovers in the market because there are interdependencies among market players who share aligned management interests and business activities associated with similar industry characteristics and business operations (Mann et al. 2011).

Another perspective applied for examining organizational behavior in technology adoption and use is social contagion. It occurs when organizations recognize social pressure to adopt a technological innovation that widely spreads in proportion to the extent of prior adoption (Greve 1995; Mann et al. 2011; Teo et al. 2003). The perspective is based on social learning theory (Bandura 1977) and neo-institutional theory (DiMaggio and Powell 1985). Social learning theory postulates that people engage in learning processes by examining what other people (or similar peers) are doing. This is because people communicate with each other and observe the actions of others as well as the consequences of their predecessors' actions. Individuals and organizations also make adoption decisions through rational processes by combining their own information and information gained from observing their peers (Bikhchandani 1992). Neo-institutional theory seeks to explain the forces that lead to institutional isomorphism – a social phenomenon in which institutions gradually or radically take homogeneous organizational structure and features in terms of business processes, market strategies, and resource configuration (DiMaggio and Powell 1985). In the prior literature, researchers propose three forces that cause such phenomenon: coercive forces arising from societal expectations, normative forces arising from professionalization, and mimetic forces arising from the tendency to imitate peers perceived to be successful under conditions of uncertainty (DiMaggio and Powell 1985; Fichman 2004; Mann et al. 2011).

When social contagion arises, a firm's technology adoption decision usually depends on its own assessment of the technology's merits or risks, the characteristics of prior adopters, the level of competition in a specific industry, and market participants' overall expectation of the technology's dominant position in the market (Fichman 2004). Thus, a technology adopted by large prominent firms would be more prone to be diffused among other smaller firms, and firms in competitive industry sectors are more likely to adopt up-to-date technologies for their business to neutralize other competitors' competitive advantages. As discussed so far, social contagion theory presents useful theoretical perspective for identifying appropriate precursors that explain organizations' adoption and usage behaviour corresponding to successive technology from external environment perspective.

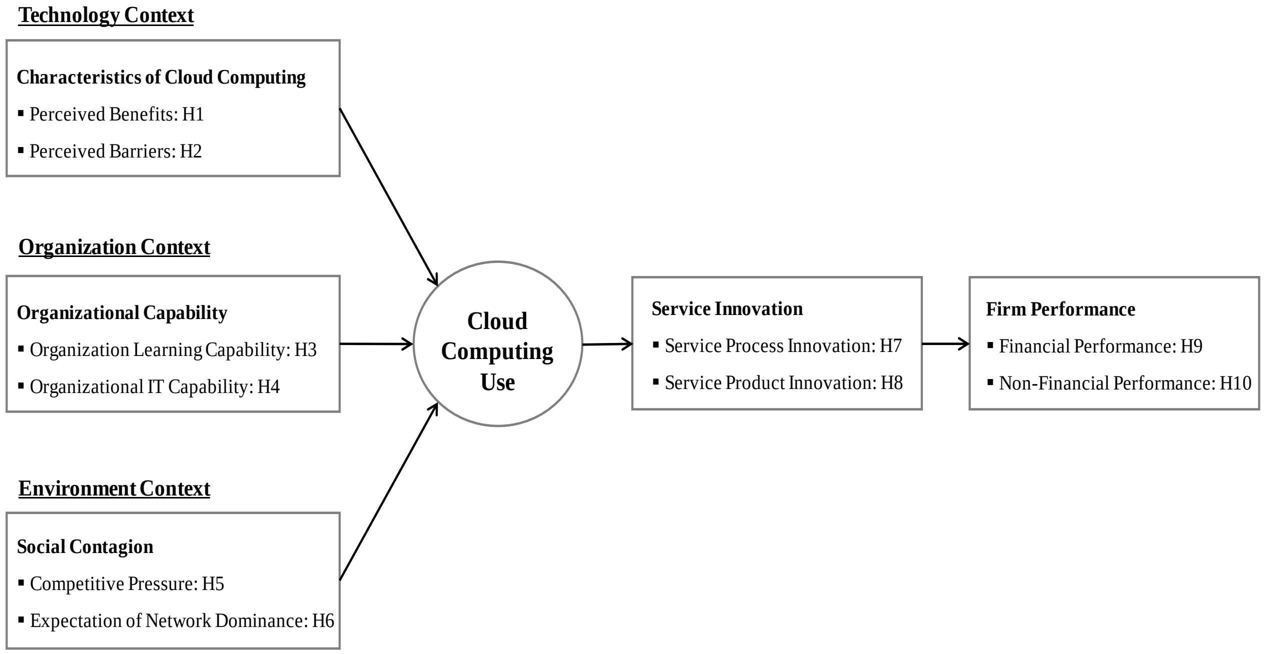
5.2. Research Model and Hypotheses

The conceptual model of cloud computing adoption, in this study, takes into account factors that affect organizational decision making of adopting and using cloud computing with integrative perspectives such as technological and environmental circumstances of organizations. To identify antecedents of cloud computing use at firm level, several influencing factors are derived based on the literature review of TOE framework and the focal theories (e.g., SD logic, dynamic capabilities, and social contagion), which are described in the previous section. The proposed model includes three groups of precursors of organizational use of cloud computing: (1) characteristics of cloud computing (technology context), (2) organizational capabilities (organization context), and (3) social contagion (environment context).

To develop a research model specific to cloud computing adoption, differentiated characteristics of cloud computing should be reflected within the model. In this sense, I conceptualize model constructs that can be used to examine the causal relationship between unique attributes of cloud computing and the organization's decision making of adopting cloud computing. For organization capabilities, the model seeks to measure a firm's organizational learning capacity to absorb external new knowledge and internalize it for commercial end. The conceptual model also explains the effect of social contagion on firm level cloud computing use. In the study, social contagion incorporates competitive pressure among market participants and their expectations of the market position of cloud computing in near future. These two constructs are used to quantify social contagion effect on cloud computing use.

Because the model intends to investigate both antecedents and consequences of cloud computing use, several measurements linked to outcomes of deploying cloud computing in organizations need to be defined from post-adoption perspective. Thus, the conceptual model incorporates some constructs that reflect cloud computing effects on a firm's business operations and outcomes such as cloud computing use, service innovation practice, and firm performance. Cloud computing use intends to measure the extent of organizational deployment of cloud computing in terms of cloud computing types, scope of deployment, and years of cloud computing experience. Service innovation practice specifies and quantifies organizational efforts to innovate a firm's service system including service process improvement and new service product design. Firm performance seeks to measure the outcomes of cloud computing deployment in business operations and incorporates both financial performance and non-financial performance. Figure 4 illustrates the proposed model.

Figure 4. Research Model of Organizational Cloud Computing Use



Characteristics of Cloud Computing (Technology Context). The adoption and use of new technology innovation requires concrete analysis for reliable decision-making references based on the relative amount of total expected benefits earned from and total costs paid for adopting and using a new technology (Fichman 2004). In this sense, the use of cloud computing usually depends on the relative size of estimated benefits and costs. Expected benefits and costs regarding a specific technology innovation are usually attributed to its original characteristics (Chau and Tam 1997). Thus, perceived benefits and barriers represent the technology context of the research model.

Perceived benefits hereby refer to the operational and strategic benefits a firm anticipates from the adoption of cloud computing. In innovation diffusion theory, perceived benefits (i.e., relative advantages) play a central role in facilitating new technology adoption (Rogers 1983). Since cloud computing is an innovative way of providing various on-demand IT capabilities, it proposes such potential benefits as cost reduction, IT management flexibility, and technology agility in a broad sense (Plummer 2008). These kinds of values can generate firms' plausible expectation, possibly resulting in the real adoption of cloud computing. Thus, the argument leads to the following hypothesis:

Hypothesis 1*: Increased perceived benefits of cloud computing lead to a higher level of firms' expectations, thereby more likely to use cloud computing.*

While premising the expected benefits, cloud computing has negative effects recognized as costs or barriers. Exemplified perceived barriers are unverified service quality due to recent commercialization, unclear data storage location, security issues, vulnerability to system crashes or natural disaster, and the reliability of service providers (Nelson 2009; Robertson 2008). Such perceived barriers can be inhibiting factors associated with the transition of current information systems to cloud computing environment if not properly fixed in the near future. This leads to:

Hypothesis 2*: The increased level of potential barriers attributed to risk factors negatively affects cloud computing use.*

Organizational Capability (Organization Context). Organizational capability refers to embracing the ability of an organization to accept new technological innovations and utilize them to build its business competence. Such a capability can be achieved based on the organization's skill, knowledge, experience, etc. Organizational capability perspective consists of two parts: organizational learning capability (Kogut and Zander 1992) and organizational IT capability (Bharadwaj 2000).

Organizational learning capability refers to the ability of an organization to identify the value of new technology, internalize it, and apply it for commercial purposes. The capability originates from a firm's level of prior related knowledge and experience (Cohen and Levinthal 1990). If a firm has a previous successful IT practice, it acquires comprehensive and concrete knowledge of how to manipulate the technology to achieve its business goals and tends to actively consider another technology innovation like cloud computing. Based on this argument, the following hypothesis is derived:

Hypothesis 3*: Higher organizational learning capacity leads to an organization's active attitude toward new technology and thereby more likely to use cloud computing.*

In the IS literature, organizational IT capability is recognized as having three subsets: infrastructure, IT personnel, and IT-related knowledge (Mata et al. 1995). Thus, capability is an integrative concept that reflects a firm's knowledge as well as physical assets. In manipulating organizational IT capability, a firm is able to monitor the current use of IT to enable business operations, identify IT- related issues to be resolved, and finally apply a new technology innovation for better performance. Thus, a firm with a high level of organizational IT capability tends to enjoy greater readiness to use cloud computing in its business processes (Zhu and Kraemer 2005). This argument leads to:

Hypothesis 4*: Firms with higher IT capability are more likely to use cloud computing.*

External Environment (Environment Context). The external environment also plays a salient role in affecting a firm's decision-making regarding adopting technology innovations available in the market (Tornatzky and Fleischer 1990). Since cloud computing is characterized as a strategic IT alternative in achieving a firm's business competence by enhancing its IT agility, business IT alignment, and IT cost-effectiveness, competitive pressure can be a relevant factor for predicting the variance of organizational intention to adopt cloud computing. Another factor that can be applicable to the cloud computing use model is expectation of network dominance, which originates from bandwagon effect (Fichman 2004) and herding behavior (Bikhchandani et al. 1992).

Competitive pressure refers to the level of pressure that a firm perceives from competition within the market (Zhu et al. 2003). Competitive pressure is analyzed as an innovation diffusion driver in the business strategy literature. The literature suggests that, by utilizing a new technology innovation, the firm can change the rules of competition, affect the industry structure, and find a new way to outperform rivals (Porter and Millar 1985). Thus, firms in a highly competitive industry more often tend to pursue a new technology innovation to enhance their competitive advantages. This leads to:

Hypothesis 5*: Firms with higher competitive pressure are more likely to use cloud computing with the purpose of enhancing their business competence in the market.*

The expectation for network dominance of a technology is defined as the extent to which a specific technology innovation is likely to achieve a dominant position in the market relative to other competing technologies (Fichman 2004). The argument is based on theoretical backgrounds like bandwagon effect and herding behavior. Bandwagon effect arises when an organization's preference for a certain product is positively affected by the fact that others are also purchasing the same product (Leibenstein 1950).

Similarly herding behaviour refers to the situation in which a certain kind of decision-making is predominantly affected by observing or learning about other organizations' decisions (Banerjee 1992). Since, cloud computing services have recently become commercialized, most firms do not possess sufficient information on cloud computing. Given this situation, if a leading company in an industry adopts cloud computing, potential users are more likely to follow the predecessor's decision. Thus:

Hypothesis 6*: Increased expectation for dominance of cloud computing increases the expected value of potential returns, thereby more likely to use cloud computing.*

Cloud Computing Use and Service Innovation Practices. Innovation is commonly defined as the initiation, adoption and implementation of ideas or activity that are new to the adopting organization (Daft 1978; Fichman 2001) and entails identifying and using opportunities to create new products, services, or work practices (Tushman and Nadler 1986). When faced with keen competition, one of a firm's predominant problems is whether to pursue an aggressive growth strategy through service innovation practices.

Two commonly raised categories of service innovation are process innovation and product innovation (e.g., Avlonitis et al. 2001; Lyytinen & Rose 2003). For example, Gadrey et al. (1995) categorized four types of service innovation according to service context, namely innovations in service products, architectural innovations that bundle or un-bundle existing service products, innovations that result from the modification of an existing service product and innovations in processes and organization for an existing service product. Further, Lyytinen & Rose (2003) identified service process innovations as services that (1) support the administrative core (administrative process innovation), (2) support functional processes (technological processes innovation), (3) expand and support customer interfacing processes (technological service innovation) and (4) support inter-organizational processes and operations (technological integration innovation).

In this study, I divide service innovation practices into two categories. One is service process innovation, which refers to changes in service delivery and development processes in terms of method, functionality, administration, or other features, and the other is service product innovation, which refers to changes in service products and service features of manufacturing products.

From Schumpeterian perspective, process innovation originally refers to the introduction of a new production method and a novel way of commercially handling a commodity (Schumpeter 1934). The perspective has been extended and can be applied to the entire value chain process, including manufacturing, data processing, distribution and service (Zaltman et al. 1973). The use of cloud computing may have positive impacts on internal operational processes as well as external cross-enterprise processes linked with other organizational processes and external supply chain networks. In the aspect of customer service, cloud computing can enhance a firm's capability of responding to customer demands with more agile and flexible manners without large amount of IT capital investment.

Externally, firms also take advantage of cloud computing in designing or modifying new service processes (Avlonitis et al. 2001). Internally, cloud computing may enhance service development capabilities and administration efficiency to shorten product design time, reduce the number of prototypes that must be built, cut costs, improve quality and foster better collaboration, communication and coordination among project members (Ozer 2000). Thus, it would be expected that cloud computing use has positive and significant effects on firms' service process innovation.

Hypothesis 7*: The use of cloud computing has positive and significant effects on firms' extent of service process innovation.*

Service/product innovation refers to the introduction of a new good or service and adding a new quality of an existing good and service, and it involves the development, production and dissemination of new consumer and capital goods and services (Zaltman et al. 1973). Compared to physical products, service products are easier to imitate and more difficult to protect under commercial patents. In spite of the fact, innovating service products is still an important task for both service firms and manufacturing firms to sustain competitive advantages in the market.

Previous studies support that IT has been playing a significant role in conducting service and product innovation in the firm side. Adopting information technology provides a means for production and marketing staff to create numerous opportunities to innovate new services (Vermeulen & Dankbaar 2002). Using IT applications (e.g., information management and business intelligence) enables employees to access past service innovation projects, allows them to learn from previous experiences, and eventually innovates their current market strategy. In doing so, firms are able develop new services and products that are better suited to market demand (Preissl 1999).

As an evolutionary form of IT, cloud computing shows several potentials for innovating firm's existing service and product lines, introducing new services and products, and finally satisfying customer needs and market expectations. Actually, some use cases have recently realized such potentials for commercial ends. One typical example is "iCloud" service by Apple introduced in June 2011 and commercially released in October 2011. iCloud is cloud computing-based content and information hub for customers who own Apple's smart phone (iPhone), tablet PC (iPad), MP3 player (iPod), or PC (Mac). The core feature of iCloud is to automatically backup what customers bought in iTune, which is Apple's online content market of music, movies, ebooks, and Apps, into personal cloud storage at Apple's data center. Using iCloud, customers do not have to periodically synchronize content within the devices with PCs and are able to access their information goods in anywhere, at anytime, across different kinds of Apple devices. This cloud-based service intends to enhance accessibility of customers to their information and improve the ease of use for their devices, thereby increasing the value of Apple products and customer royalty through IT-enabled service innovation. Considering arguments raised by previous literature and contemporary business case of cloud computing, it would be suggested that firms that utilize cloud computing will do better in differentiating their products and providing superior services. Thus, this leads to:

Hypothesis 8*: The use of cloud computing has positive and significant effects on firms' extent of service/product innovation*

Service Innovation Practices and Firm Performance. Prior researches have examined business performance from different perspectives including financial performance, business unit performance, or organizational performance (Venkatraman and Ramanujam 1986). To measure innovation performance, one general and popular way is to consider both financial and non-financial performances of a firm (Avlonitis et al. 2001). Financial performance hereby refers to how well a firm generate plausible outcomes in terms of revenues and profits through effective service innovation practices. Service innovation eventually intends to increase a firm's service level linked with the qualities of service products and manufacturing products and eventually contributes to generating business benefits regarding profits, cost savings, and market share (Thompson 1985). In other word, service innovation should be justified only by creating better profits and sales performance.

Based on resource advantage theory, a firm is able to obtain competitive market position and achieve superior financial performance through innovating their products and services and transforming business operations and processes although other competitor follow the similar innovations to neutralize the firm's advantages (Chen et al 2009). Therefore, it would be suggested that if firms are able to implement service innovation practices in more differentiated ways to produce competitive products and services, they will achieve superior financial performance (e.g., higher gross and operations margins, increased revenue and profit, lower cost of sales and compliance). Form this argument, I propose the following hypothsis:

Hypothesis 9*: A firm's service innovation practices have a positive impact on the firm's financial performance.*

Non-financial performance hereby refers to long-term and non-monetary business capabilities that a firm should acquire to sustain its competitive advantages in the market, such as increasing customer loyalty, attracting new customers, and enhancing the image and reputation of a firm (Blazevic and

Lievens 2004). It is widely known that innovative new services and products make the strongest contribution to non-financial performance (Avlonitis et al. 2001). Accordingly, service innovation is proposed to enhance a firm's ability to improve customer loyalty through an easier buying process, clearer communication of deliverables and outcomes, and increase the firm's capability to meet customer needs that results in competitive market position in an industry (Chen et al. 2009). Such service innovation practices eventually lead to additional customer utilities and strengthen the firm's corporate images and reputation among customers, which are social capital factors important for building long-term value co-creation relationship with customers.

To this end, I would expect that firms that implement service innovation practices will achieve better non-financial performance. This leads to:

Hypothesis 10*: A firm's service innovation practices have a positive impact on the firm's non-financial performance.*

5.3. Research Method: Field Survey

In order to test the organizational cloud computing use model, a field survey method will be adopted using random samples. The unit of analysis in this study is the organization that is now considering the introduction of cloud computing solution to its business practice.

Survey instruments are designed to measure several key factors that possibly affect firms' decision-making of cloud computing use (See Table 5). Combining the focal theories in the study, the study develops a questionnaire to empirically test the proposed model. Perceptual measures are employed for all variables. When developing the measurement, multiple-item measures are used for all variables to improve the reliability and validity of the measures (Churchill 1979). In addition, each variable is measured based on a seven-point Likert scale.

This study plans to conduct two pilot tests. First, to check the face validity of the developed measures, I will have interviews with several academics and practitioners who have significant expertise in the area of cloud computing. Second, to investigate the questionnaire's internal validity, this study will conduct preliminary test for around 10 organizations that show willingness to participate in the test. Once the instrument is finalized based on the results of the two pre-tests, a main survey will be conducted. The primary source of the sampling frame for the main survey will be firms which are currently using cloud computing in their business. The survey questionnaire will be mailed to target companies' corporate-level IS managers as they are expected to be knowledgeable about the status of internal IT management.

The organizational cloud computing use model presented in Figure 3 will be analyzed by PLS method because the study is still at an early stage and the proposed model has not been tested in the literature. Also, PLS is appropriate for handling both reflective and formative constructs and constructs with mixed scales (Chin 1998). Before conducting PLS analysis of the proposed model, it is necessary to determine if key statistical assumptions such as the linearity of the relationships and the normal distribution of the data are to be met (Hair et al. 1995). In this study, the research model will be statistically examined using the following criteria: (1) overall fit measures of the model-implied correlation matrix to the sample correlation matrix; (2) percentage of the model's hypothesized paths that are statistically significant; (3) ability to explain the variance in the outcomes of interest; and (4) model power, the ability to detect and reject a poor model.

Table 5. Measurement Items

Constructs	Measurement	Sources
Perceived Benefits	Your firm expects the follwing benefits of using cloud computing	Zhue et al. 2004; Chau and Tam 1997
	- Reduced costs (1~7)	
	- IT management flexibility (1~7)	
	- Technology implementation agility (1~7)	
	- Improved efficiency of business process (1~7)	
	- Expanding market for new product / service (1~7)	
Perceived Barriers	Your firm considers the following risks as cloud computing adoption barriers	Chau and Tam 1997
	- Unverified service quality (1~7)	
	- Undiversified service lines (1~7)	
	- Security issues (1~7)	
	- Unclear customer data location (1~7)	
	- Losing the company's core IT competence due to relying on service providers (1~7)	
Organizational Learning Capacity	Your firm possess sufficient prior knowkledge and experience of the follwoing IT practices, which are salient ingridents for cloud computing utilization	Cohen and Levinthal 1990; Thong 1999; Zhu et al. 2003
	- IT Outsourcing (1~7)	
	- e-Business (1~7)	
	- The Executives in your firm possess proactive attitude to innovative changes (1~7)	
Organizational IT Capability	- IT infrastructure in your firm sufficiently support the most of business processes (1~7)	Kuan and Chau 2001; Zhu and
	- Percentage of business processes supported from information systems (#)	
	- Your firm possesses sufficient IT professionals who have technological skills for IT	

	development and management (1~7)	Kraemer 2005
	- Percentage of IT professionals to total employees (#)	
	The executives in your firm possess sufficient IT-related knowledge for the followings	
	- Implementing information systems (1~7)	
	- Utilizing information systems for business performance (1~7)	
Competitive Pressure	Business environment of your firm is highly competitive in the following markets	Iacovou et al. 1995
	- Domestic Market (1~7)	
	- International Market (1~7)	
Expectation of Network Dominance	- As of now, your firm perceives that cloud computing has potential to become a competing alternative to existing information technologies (1~7)	Kuan and Chau 2001; Zhu and Kraemer 2005
	- As of now, your firm expects that cloud computing take a dominant position in IT industry in near future (1~7)	
Service Process Innovation	After adoption, your firm has efficiently utilized cloud computing for the following service process innovation practices.	Zaltman et al. 1973; Davenport and Short 1990
	- Customer service (1~7)	
	- Customer information inquiry and consultation (1~7)	
	- Selling products/services (1~7)	
	- Providing after-sales services (1~7)	
	- Promoting new products/services (1~7)	
	- Internal administration and operations (1~7)	
Service Product Innovation	After adoption, your firm has efficiently utilized cloud computing for the following service product innovation practices	Avlonitis et al. 2001
	- Revised and improved existing products/services (1~7)	
	- Extended products/services (1~7)	
	- Created and established new lines of products/services (1~7)	
Financial Performance	After deploying cloud computing, your firm has experienced the following financial performance.	Chen et al. 2009
	- Enhanced sales revenue (#, 1~7)	
	- Enhanced profits (#, 1~7)	
	- Enhanced market share (#, 1~7)	
	- Achieving sales revenue objectives (1~7)	
	- Achieving profitability objectives (1~7)	
	- Achieving market share objectives (1~7)	
Non-Financial Performance	After deploying cloud computing, your firm has experienced the following non-financial performance.	Chen et al. 2009
	- Improved the loyalty of existing customers (1~7)	
	- Attracting a significant number of new customers (1~7)	
	- Getting important competitive advantage (1~7)	
	- Building well perceived image (1~7)	
	- Receiving good reputation (1~7)	

Note: #: continuous value, 1~7: 7 point Likert scale.

6. Study 3: Channel Disruption and Smart Device Effects on Info Goods Consumption

6.1. Introduction

In the past few decades, we have witnessed the rapid development of information technology (IT) and its tremendous impact on every facet of our life. The trajectory of IT evolution has introduced various types of devices, applications, and services to improve task performance in business organizations and satisfy individual needs for fast communications, easy information access, and digital entertainment.

Especially, technological advances in mobile communication have brought out a new generation of smart devices (e.g., smart phone and Tablet PC) to the consumer electronics marketplace. Equipped with attractive multi-touch user interface, superior mobility, and vast choice of applications (e.g., Apple App Store and Android market), smart devices are attracting more and more loyal users. The consequences lead to big hit in smart devices sales and bright expectation of future growth. For instance, Apple sold about 14.7 million iPad in 2010, and its sales is expected to reach 46.7 million in 2011, and 148.7 million in 2014 (Arthur 2011).

Compared to traditional media devices (e.g., TV sets or PCs), smart devices provide ubiquitous content access without temporal and spatial limits and various digital convergent functions (e.g., compound capabilities of MP3 and video player, photo and document viewer, and mobile phone and Internet). Such differentiated features eventually enable smart devices users to consume information goods in different ways from traditional entertainment service model mainly associated with fixed locations. Thus, the currently successful diffusion of smart devices among people may reinforce its magnitude as a prospective paradigm shift in contemporary IT businesses including computers, telecommunications, and digital audio and video streaming industries.

6.2. The Emergence of Smart Devices and Channel Disruption

For telecom businesses, the emergence of smart devices implies a great deal of changes in consumer behavior. Smart devices provide chance to improve telecom firms' profitability due to increasing demand for information goods and entertainment services among people. However, the use of smart device possibly causes switch-off of demand for information goods between fixed-viewing device (e.g., CATV) and smart device. The phenomenon will occur when customers who own smart device reduce their demand for fixed-location entertainment viewing and spend more time for entertainment based on smart device computing. The situation eventually provides telecom firms with undesirable situation where negative network effect arises because of network traffic congestion while overall revenue remains either unchanged or gradually incremental.

The mixed situations implies that new technologies may fundamentally change consumer behavior, demand for specific products and services, and the operation of different delivery medium in a firm's business, which is collectively referred to as channel disruption (Kim et al. 2010). To address such technology-creating impacts, telecom firms, who have relied on fixed and wireless voice for major revenue sources, are seeking to transform their current business models by redeveloping business operations such as product development, product bundling and pricing, service distribution, and customer promotion and retention.

Although smart device seems to contain its own pros and cons as mentioned from business perspective, one obvious thing is that smart device computing is now widely recognized as a game-changer because it presents significant potential to generate channel disruption (especially for wireless internet channel) in the telecom business. Leveraging smart device for commercial purpose can transform customers' overall propensity to consume information goods including buying, viewing, evaluating and communicating. These behavioral changes from customer side provide great impetus to investigate antecedents and consequences of technology-driven channel disruption to understand IT contribution to business value and return on investment for telecom business.

6.3. Research Objectives

In order to properly respond to the turbulent environment intrigued by smart devices, telecom businesses are required to investigate dynamically changed consumer behaviors upon the new technology use. The discovered customer insights in turn should be reflected to the industry's business and marketing strategies and finally specify new marketing promotions and product bundles. In the telecom industry, where the market is highly competitive and saturated, it is one of critical success factors to gain comprehensive real-time business intelligence about customer requirements and behavior (e.g., choice, action, usage, and consumption) and achieve high return on marketing investment.

Based on this environmental background, the study mainly aims to figure out the extent to which new smart device technology change channel-based consumption of information goods and entertainment services within the context of retail telecom business. In particular, the study seeks to understand consumer behavior on information goods consumption combined with today's online social network. This is because consumers' decision making for information goods nowadays is more likely to be affected by real-time communications under social network environment. The research questions specifying the study objective are described as follows:

- How can we identify channel disruption in the telecom industry? With what evidence can we measure the extent of channel disruption? How will telecom customers shift their service demand and what makes them to change and why? How do we quantify the effects of smart devices on changing channel-based consumption of information goods and entertainment services?
- What can we learn from analysis of data harvested from online social network sites? How individual's consumption behavior can be affected by his/her neighbor in social network? How consumer behaviors will evolve over time? Related with social networks, Can we find some evidences that reflect the impact of technological changes on consumer behavior?
- What are the antecedents and consequences of channel disruption by technology innovations? What business values are provided from the investigation of consumer behavior in the presence of channel disruption? What can we present for managerial implications as guideline for achieving better marketing ROI upon the emergence of smart devices computing?

The study is expected to contribute to the advancement of knowledge in IS and marketing literature by providing reality-based solid empirical reference of consumer behavior insights. Also the outcomes will have immediate practical applications in real business because they can be utilized as benchmark of conducting future consumer researches and formulating a new CRM and marketing strategies.

6.4. Research Method

As described in the previous section, the purpose of the study is to increase our understanding of consumer insights in telecom business area by investigating consumer behavior pattern of using information goods affected from upcoming smart devices computing environment. From socio-technological perspective, the objective is also interpreted as an effort to explore how human networks and society are interactively respond to new technologies and how technology developments result in new social phenomena that affect human life.

The Study will be conducted under academic and industry collaboration. Under such environment, the research setting of the study is differentiated in the way that the study deals with large scale telecom transaction data. Considering these specific research surroundings, the study requires experimental or quasi-experimental approach to handle societal scale real world data and unveil both expected and unexpected consumer behavior patterns on when, where, how, and how much to use information goods and entertainment services over smart device platform. Thus, the underlying premise of conducting the study is to enhance our consumer and social insights from analyzing large scale of socio-technological data with the framework of experimental analytics. Here are proposed work items that will be undertaken throughout the Study:

(a) Defining use cases: In order to specify the research objective, the study needs to select and refine the usage scenarios that explain customers' interaction with telecom businesses in case of consuming information goods. The use case in this study refers to a description of steps or actions between user (or consumer) and telecom business procedures. As the first step of conducting the study, use cases play a significant role in designing the details of data analysis because the selection of variables and methods and research hypotheses usually depends on the choice of use cases among telecom business operations. The focal use cases for the study will be drawn based on study objectives, context, and industry and academic interests. Also discussion with telecom industry experts will be held to check the chosen use cases in terms of relevance.

(b) Establishing analytic framework: In this step, overall analytic framework for the study will be examined and adjusted to make the framework more specific to the research context. The analytic framework for the study consists of four components: (1) Human Action, (2) Observe, (3) Experiment, and (4) Analyze and Predict. Individuals and groups in the social system tend to respond to external environment (e.g., new technologies) and leave their actions, and these actions nowadays can be traced and massively stored in digital format using contemporary IT. The accumulated traits of human actions then are extracted and utilized for experiments (or quasi-experiments) to explore empirical regularities that are theoretically hypothesized as behavioral patterns. Finally, one can figure out the antecedents of the experimental results and theorize the effect of the explanatory factors on specific social phenomenon generalized from the experiments. Brief descriptions of the four components are as follows:

- Human action: individual or group and network response to external environment
- Observe: collect real time stream and other data sources, the digital traces of behavior and living
- Experiment: changes to attributes of products, services, and experience, individual and group level interaction and information
- Analyze and predict: analyze traces, understand behavioral patterns over time and context, predict behavior

(c) Data collection and manipulation: The study goes under academic and industry collaboration. The data available for the study comes from the real world business of telecommunications. The data contains various categories of attributes that represent consumer-telecom interactions such as customer profile, products/services, usage, billings, customer claims, and so on. Furthermore, since all the data regarding telecom transactions is generated on the daily basis, the volume of the data is large scale. Therefore, the study needs to deal with large amount of societal scale data that embrace a variety of features of consumer behavior related with telecom business. They are behavioral data from societal-scale consumer settings that deal with vast numbers of people through multiple types of digital channels and sophisticated technology infrastructure. The short descriptions of expected data categories for the study are as follows:

- Customers: Segmented customers, with information on extent of service penetration, timing of adoption, consumption profile
- Services: Entertainment goods consumed, by channel, with information about prices, attributes, cross-prices, preferences; bundles and packages, by subscription group
- Channels: Measurement of changes in channel participation, with timeline of different service and bundles offered
- Devices: Information on smart devices used for consuming information goods and entertainment service over the mobile Internet channel
- Metrics: Measures need to be designed to capture information about customer by themselves, in groups, and at the network level

(d) Exploring empirical regularities: The study faces massive scale of data sets to analyze. The analytic environment with huge data observations and diversified attributes occasionally cause difficulties to configuring significant empirical findings that provide academic and practical implications. In dealing with societal scale telecom transactions data, the study needs to apply experiment-oriented approaches that could be more suitable for the current data set other than traditional regression-based empirical approaches. One viable approach for the study is massive quasi-experiment (MQE) method. The method is a way of conducting quantitative research aimed to explore empirical regularities from large scale of transaction data and explain the reasons of specific patterns happening (Campbell 1988; Meyer 1995; Kauffman and Wood 2003). The study employs MQE method to takes advantage of natural experiment environment where day-to-day consumer transaction data are generated from real telecom business and unveil both expected and unexpected consumer behavioral patterns on when, where, how, and how much to use entertainment goods over smart device platform.

(F) Identifying implications: After exploring empirical regularities representing consumers' behavioral patterns on information goods consumption, the next step seeks to develop empirical model to theorize influential factors that explain observed regularities and variations (Bergen et al. 2005). Especially, for unexpected newly-observed phenomena, the empirical model needs to be tested in terms of coefficient levels. In this step, the study adopts econometric models that have been widely utilized for previous IS economics literature. The empirically tested relationship between explanatory variables and newly-found telecom consumers' insights then can be applied to developing new theory and also exploited as significant ingredients for formulating telecom industry's new marketing and business strategies.

7. Acknowledgement

I would like to acknowledge that part of this study has been carried out at the Living Analytic Research Centre (LARC) sponsored and supported by the Singapore National Research Foundation & Interactive & Digital Media Program Office, Media Development Authority.

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