# When And How Does IT Service Matter? An Analytical And Empirical Analysis Of Heterogeneity Of IT Service Dimensions and the Impact of Non-IT Capability On Performance of Science Oriented Firms

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# When and How Does IT Service Matter?

# An Analytical and Empirical Analysis of Heterogeneity of IT Service Dimensions and the Impact of Non-IT Capability on Performance of Service Oriented Firms

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## Abstract

*Strategic use of IT has been the subject of considerable interest among researchers and practitioners, spurred by Carr(2003) and research about 'IT productivity paradox'. The gist of debate is whether IT investment leads to competitive advantage or not. Even though IT is consist of multiple dimensions, previous studies consider the IT as one unit and oversimplify it. We examine how IT is strategically used in different IT dimensions by investigating the optimal IT investment decision of different dimensions in IT service competition. We consider IT conversion process as two steps. IT investment converts to IT service quality and, in order, service quality converts to financial performance. We refer to each step as 'IT build' and 'IT use' in this paper. We investigate the influence of non-IT capability on each step of conversion process. Our study shows that IT is strategic necessary and does not show strategic differences in some dimensions. And, in other dimensions, firms show strategic differences in IT investment and service quality decision. These are determined by trait of the non-IT capability required for generating IT service. This is consistent with 'resource based view'. Also we show that firms have different capability in IT using. That is, firm's capability of IT using moderates the effect of service quality on financial performance. These are investigated by analytical model and empirical test.*

**Keywords:**

IT strategy, IT investment, Service quality, Resource based view.

# 1    Introduction

There has been a considerable interest about strategic use of IT and its validity was strongly challenged by Carr(2003) and researches and practitioners have gathered a relatively rich accumulation of studies on 'IT productivity paradox'(Cron and Sobol 1983;Turner 1985;Bender 1986;Loveman 1994;Strassman 1990;Harris and Katz 1991;Weill 1992;Brynjolfsson and Hitt 1993;Lichtenberg 1993;Brynjolfsson and Hitt 1996). The debate is whether IT investment leads to competitive advantage to firms or if it is only strategic necessities. Previous studies have investigated IT payoff in various contexts and expanded the research field. However, previous studies consider the IT as one unit and generalize strategic use of IT in this perspective.

Recently the focus of research moved from the question of whether IT creates value to how, when and why benefits occur. IT converts to financial performance through an intermediate process(Lucas 1993;Grabowski and Lee 1993;Markus and Soh 1993;Sambamurthy and Zmud 1994; Beath, Goodhue, and Ross 1994). Soh and Markus(1995) referred to this approach as 'process theories' and distinguished it from 'variance theories' focusing on outcome. Performance of IT is determined by not only the amount of IT investment but also non-IT factors (Soh and Markus 1995; Iacovou et al.1995;Brynjolfsson et al.1998; Brynjolfsson et al.200; Brynjolfsson and Yang 1997).

This research also tries to explain how IT strategically contributes to firms. However, we differentiate this research from prior studies in several ways.  First of all, we focus on multi-dimensionality of services that are provided mainly through IT.  In marketing literature, multi-dimensionality of service has been intensively studied. Due to different characteristics of service dimensions, each dimension may have different implications in firm's strategic outcome or firm performance. Likewise, we find that a relatively small number of MIS literature have studied multiple dimensions of IT.  Hence in the service economy, especially where services are heavily provided through IT, we can project those different dimensions of IT based services may have different strategic implications to businesses.  So we examine whether firms recognize such multi-dimensionalities and their differentiated strategic implications, and take them into account into their IT investment decisions. Complementing prior literature, this also may significantly enhance our understanding of the business value of IT, which was mostly estimated by one aggregated measure of IT.

Secondly, IT can be either necessary or sufficient (Soh and Markus 1995) for a superior financial performance. According to Resource Based View, resources should be difficult to imitate in order to qualify as a sustainable competitive asset. Often non-IT capabilities of firms are used to impart immobility to IT resources when such immobile assets are combined with IT resources. In the service industry, IT investment coverts to financial performance through IT service quality. We refer to each step as 'IT build' and 'IT use' to represent the conversion from IT investment into service quality and from service quality into financial performance respectively.  We investigate the strategic role of non-IT firm capabilities in both stages of an integrated model.

With a stylish simple modeling, we analytically investigate the firm's normative decision under the multi-dimensionality of IT services assuming two classes of dimensions in terms of strategic implications: strategic necessity and competitive advantageous ones.  Using data from online security services, this empirical study is an attempt to support our propositions (derived from our analytical modeling) and our hypotheses from theoretical reasoning.  Our empirical results confirm the heterogeneity of IT dimensions. Some service dimensions are strategic necessities and do not show differences in the amount of IT investment and service quality while other dimensions show the difference in IT investment and service quality among firms. Therefore it seems that firms already recognize the strategic implications of diverse traits of IT based service dimensions. The influence of firm's non-IT capability is also validated on both conversion processes.

Although most previous studies considered IT investment decision as an exogenous variable, we considered IT investment as an optimal decision of firms which is determined endogenously. This calls a cautious note about over-simplifying IT. In the financial service industry, it appears that IT converts to service quality. Improved service quality leads to better financial performance through careful investment.

This is achieved through the strategic implications of diverse dimensions of IT based service and by imbedding less movable non-IT capability into IT services. ly.

# 2    Literature review

## 2.1   IT Investment payoff and influence of other factors

The "IT productivity paradox" was treated as one of the traditional issues in the IT research area, and there is no agreement on the consequences and impact of IT investment. Although this issue had been studied by many academic researchers and practitioners, mixed empirical results induced researchers to seek better theories. Attention has been shifted from the question of whether IT creates value to how, when and why IT benefits either occurs or fails to occur (Soh and Markus, 1995). Markus and Soh(1993) argue that "conversion effectiveness" is not a necessary and sufficient relationship between spending on information technology and improved organizational performance. They posit an intermediate outcome that they call "IT asset" between IT investment and organizational performance.

Several studies investigate the influence of other factors that affect the conversion of IT into financial performance. Among many studies, Weill(1992) accounts for the failure of some IT investment to reach the firm's bottom line by using the concept of "IT conversion effectiveness." and show that conversion effectiveness moderates the relationship between IT investment and incremental firm performance. Some researchers investigate the influence of non-IT capability. Large organizations are more likely to adopt innovations and advanced ICT solutions than smaller organizations (Iacovou et al.,1995; Rogers,1995). Also, Brynjolfsson(1998) argue the importance of intangible assets and identifies a candidate for these intangible assets. They argue that one dollar increase in a firm's IT investment is associated with an increase in the firm's stock market valuation of over five dollars.

Ray et al.(2005) focus on the traits of the above factors based on the resource based view. If the firm possesses a resource or capability that is not currently possessed by competing firms, the condition of resource heterogeneity is met and a firm may obtain at least a temporary competitive advantage. When this analysis is applied to competitive advantage through IT investment, five specific attributes of IT have been suggested as possible sources of sustained competitive advantage for a firm. These attributes are switching costs, access to capital, proprietary technology, technical skill, and managerial IT skills. Each factor is differentiated by firm and these differences can create a competitive advantage. Among the above factors, some are relatively easily achievable in the short-term and at low cost, but others are relatively difficult to achieve. Our analytical analysis is based on this perspective.

## 2.2   Online service quality and multiple dimensions

In the past decade, researchers have sought and found evidence for the financial consequences of service quality improvement. The service concern of the highest priority to today's companies is the impact of service quality on profit and other financial outcomes of the firm (Rust et al., 1995). There are many studies which investigate theses relationships. Parasuraman et al.(1988) found a positive and significant relationship between customer perceptions of service quality and (1) their willingness to recommend the company, and (2) their purchase intentions. Reichheld and Sasser(1990) argue that reducing defects leads to greater loyalty, and increased loyalty leads, in turn, to greater productivity via lower costs of making future transactions, favorable word of mouth, and perhaps even a price premium. Also, Koska(1990) and Nelson et al.(1992) found a positive relationship between patient satisfaction and hospital profitability. Consequently, customer satisfaction is related to customer loyalty, which in turn is related to profitability (Heskett et al.1994; Hallowell,1996).

Despite the relative importance of IT based service quality, the empirical studies available are still limited. While there are significant similarities across groups, the impact of loyalty on overall customer satisfaction was higher in the online group (Shankar et al, 2003). With the importance of private investors, the necessity of satisfying their needs in the usage of trading systems has increased greatly (Weinhardt et

al.2000). In the online brokerage service, primary drivers of satisfaction are closely related to traditional service quality dimensions. Key drivers of dissatisfaction are tied to information system quality (Yang and Fang 2004).

Several papers investigated the importance of IT management in online service quality management. Studies conducted in the marketing field have also revealed some important factors that are relevant to the web site as an information system, in determining the success of an online firm(Yang et al, 2003). The quality of online brokerage systems has unequivocally trended upward with significant IT investment (Shim et al. 2008). Technology leadership in financial services firms is a significant variable that enhances organizational knowledge and improves overall service quality in the eyes of the customer (Roth and Jackson 1995). Lucas(1993) discovered that "well designed IT" is a necessary condition for performance although not a sufficient condition. Therefore, for business success, construction of a well-designed IT system through proper IT investment is an important managerial issue.

More IT investment does not always means better system performance (service quality) due to the multi-dimensional characteristic of online services. There were many studies that investigated the characteristics of multi-dimensional quality. An exploratory study by Parasuraman et al. (1985) elicited ten dimensions. Parasuraman et al.(1988) further consolidated these ten dimensions to five. Yang and Xiang(2004) uncovered that the primary service quality dimensions leading to online customer satisfaction, with the exception of ease of use, are closely related to traditional services, while key factors leading to dissatisfaction are tied to information system quality. They established a conceptual framework by integrating two major aspects of online services: customer service quality and information system quality. Yang and Fang (2004) establish a conceptual framework by integrating two major aspects of online services. Cheung and Lee(2005) identify positive and negative asymmetric effects of website attributes performance on customer satisfaction. Falk et al.(2010) argue that functional utilitarian quality attributes lose their capability to delight customers as the customer relationship matures, in contrast, hedonic quality attributes only exhibit an increasing effect on satisfaction for more experienced customers. Hence, the amount of IT investment in each dimension has to be determined with consideration of the above multi-dimensional characteristic of service quality.

# 3    Model

## 3.1    Model Setup

We build an analytical model that IT investment converts to financial performance via service quality and classify service dimensions as two types by characteristic of service dimensions. Several previous papers divided service quality into several dimensions by characteristics. Yang and Fang (2004) and Falk et al(2010) investigate various attribute of online service quality and different influence on customer satisfaction. We classify service dimensions as two types by the characteristic of firm's capability which is required for generating service quality based on the resource based view.

In 'resource based view', resources which has characteristics such as value, rarity, and imitability have been shown to be a source of competitive advantage (Barney, 1991). We refer to these resources as non-IT capability in this paper. Grant(1991) distinguishes between resources and capability. He argue that capability means organization's ability to assemble, integrate, and deploy valued resources. Lucas et al(1993) argue that "structural factors" such as firm size will affect the ability of the organization to convert IT assets into business value. Therefore, in this paper, we do not distinguish the difference between resources and capability due to the similarity between two concepts in terms of effective use IT. Due to the different characteristics of capability required for each service quality dimensions, some service quality dimensions are easy to imitate and others are difficult.

In analytical model, we assume that two firms compete in two service quality dimensions and each firm decides the optimal IT investment amount of each service quality dimension.

The service quality of each type of dimension can be expressed as follows

$$Q_j^i = f(s_j^i, I_j^i) = (I_j^i)^{s_j^i}$$

$I$ means the amount of IT investment. $i$ denotes the competing firm(1 or 2) and subscript $j$ represent service quality dimensions. Therefore, for example, $Q_1^1$ represent the service quality of dimension 1 provided by firm 1 and $I_1^2$ means the amount of IT investment service quality dimension1 of firm2. Also $s_j^i$ represents firm's non-IT capability that can be interpreted as the ability of efficient converting IT investment to service quality. Therefore, as $s_i^j$ increases, investments more efficiently convert to IT service quality. The service quality function is the diminishing marginal return of investment (Roland, 1995), $0 < s_i^j < 1$.

We set that, in service dimension 1, non-IT capability($s_1^i$) is easy to imitate. In online service, service quality such as system speed and stability is determined by performance of system itself. And it mainly depends on the amount of IT investment. It means that firms can easily imitate other firm's capability in this type of dimensions. Therefore we assume that capabilities of both firm in this service quality dimensions are same, $s_1 = s_1^1 = s_1^2$. We refer to this dimension as 'system functional dimension' because service quality of this dimension is determined by quality of IT system itself. In service quality 2, we set that capability required for service quality is not easy to imitate. Then, firms may have different level of capability in this dimension. In this model, for investigating competition between heterogeneous firms, we assume that non-IT capability of firm1 is better than one of firm2, $s_2^1 > s_2^2$. Competing firms may determine the optimal amount of IT investment of each service quality dimensions in this competitive condition.

Customer utility provided by each firm is influenced by service quality of two types of dimensions and price (fee of using service). Customer utility of each firm can be represented as follows

$$U_i = U_0 \frac{Q_1^i \cdot Q_2^i}{P_i}$$

And the probability that a customer will choose firm i's service among firms is determined by relative utility level. In this case, two firms are competing and the probability is determined by relative utility level(Shim et al. 2008).

$$\Pr_i = \frac{U_i}{\sum U_j} = \frac{U_i}{U_1 + U_2}$$

N represents total customer size and the demand of each firm is determined as

$$D_i = \Pr_i \cdot N$$

### 3.2 Profit maximization

Each firm makes IT investment decision for profit maximization. The firm's objective function can be represented as follows

$$\max_{I_1^i, I_2^i} \pi_i = D_i \cdot P_i - (I_1^i + I_2^i)$$

$$= \frac{U_i}{U_1 + U_2} \cdot N \cdot P_i - (I_1^i + I_2^i)$$

$$= \frac{U_0 \frac{Q_1^i \cdot Q_2^i}{P_i}}{U_0 \frac{Q_1^1 \cdot Q_2^1}{P_1} + U_0 \frac{Q_1^2 \cdot Q_2^2}{P_2}} \cdot N \cdot P_i - (I_1^i + I_2^i)$$

where
$$Q_1^i = f(s_1^i, I_1^i) = (I_1^i)^{s_1^i},$$

$$Q_2^i = f(s_2^i, I_2^i) = (I_2^i)^{s_2^i}$$

In competitive market, even though customers are concerned about the price of service in the short term, their concern move from price to service quality in the long term(Shim et al.2008). Therefore, in the long term perspective of competition, price is easily converged to similar level and not a crucial factor that influences customer utility any more. Then, we assume  . Based on the above objective function, two firms decide the optimal IT investments of two types of service dimensions for profit maximization.

### 3.3    Results

We found that firms show differences between IT investment and service quality not in whole service dimensions. That is, some IT dimensions are strategic necessities and do not show a difference of performance. While other dimensions make differences of performance and can be a source of differentiation. And this difference depends on the characteristics of non-IT capability that is required for generating IT service. In service dimension that is easy to imitate, competing firms invest same amounts in IT system and provide same level of service quality

***Proposition 1***
***Competing firms do not show the difference of IT investment and service quality in 'system functional' dimension.***
  Proof) Appendix A

In 'system functional' dimension, non-IT capability that is required for generating service quality in this dimension is easy to imitate. Therefore, firms easily imitate these resources and firm's capabilities converge to quite similar level. In this condition, any firms may not invest more than other firm by optimization,  . Because non-IT capability and amount of IT investment are same in this dimension, service qualities of this dimension that is provided by both firms are the same. That means that firms do not make strategically different decision in this type of dimensions. This is a strategic necessity. Carr(2003) argue that IT has been commoditized and cannot make a competitive advantage. IT service in this dimension is easy to imitate and firms easily imitate other firm's strategy in 'IT build'. Therefore IT, in this dimension, is commoditized(Carr 2003) and cannot make a competitive advantage and so it is consistent with Carr's assertion(2003). The above result is consistent with RBV. In RBV, resources which is easy to imitate cannot be a source of competitive advantage(Barney 1991).  Therefore firms do not have incentive of investing more in this dimension and provide same level of service quality.

In the other dimension, firms cannot easily imitate the non-IT capability that is required for generating service quality. In the analytical model, firms show different amount of IT investment and service quality decisions in this dimension.

***Proposition 2***
***Competing firms show the difference of IT investment and service quality in 'strategic dimension'.***
  Proof) Appendix A

Firms show the difference of IT investment decisions in the 'strategic dimension'. Because IT investment and capability show differences of firms in the 'strategic dimension', service quality, which is determined by the amount of IT investment and capability, also shows differences. So IT is differently used in this dimension by firms and can be a source of competitive advantage. Strategic usefulness of IT is determined by trait of firm's capability. It is also consistent with RBV. Because the capability that is required for IT service in this dimension is not easy to imitate, firms can get competitive advantage in this dimension.

***Corollary 1***
***Firm having high capability invest more than low capability firms in spite of superiority of capability.***
Proof) Appendix A

In terms of firm's non-IT capability, the high capability firm invests more than low capability firm in the strategic dimension, $\frac{s_2^1}{I_2^1{}^*} = \frac{s_2^2}{I_2^2{}^*}$ and $I_2^1{}^* > I_2^2{}^* (\because s_2^1 > s_2^2)$ . IT investment and firm capability are substitutable in producing service quality. The firm can use capability as a kind of input, and the firm having high capability can provide better service quality with the same amount of IT investment due to its advanced capability. Instead of the advantage of capability, as firm has higher capability, it invests more in IT system($\frac{\partial I{}^*{}_2}{\partial s} > 0$). The firm having high capability provides higher service quality of the strategic dimension by more IT investment and better firm capability.

In analytical model, we figure out how IT is differently used in different IT dimensions. As Carr(2003) argued, IT is strategic necessity in some dimensions. And IT in this dimension cannot be a competitive advantage. Therefore, previous studies considering IT as one unit are limited in understanding the strategic use of IT. However, in other dimensions, IT is still strategically used and can be a source of competitive advantage. Difference of service dimensions depends on the trait of non-IT capability that is needed to generate service quality. And firm's non-IT capability influences the IT investment decision in the 'IT build' process. Previous papers which investigate the IT payoff treat the IT as an exogenous variable. However, managers may make IT investment decisions strategically with consideration of firm's traits and IT are considered as endogenous variables. In above model, we analyze the optimal IT investment decision and figure out that IT is endogenous and influenced by non-IT capability.

## 4. Empirical Analysis

In the previous analytical model, we found that IT investment decisions depend on different characteristics of service quality dimensions. From the above analytical model, we figured out that competing firms invest the same level of 'system functional dimension'. Due to the same capability being imitated easily and same level of IT investment, competing firms provide the same level of service quality in this type of dimensions.
Therefore service quality of system functional dimension is not differentiated by firms.

***H1. Service quality of 'system functional dimension' is not related to firm's non-IT capability.***

Service quality of the 'system functional dimension' does not make a difference in customer satisfaction and demand. And the difference in customer satisfaction and demand is determined by the service quality level of the 'strategic dimension'. From the previous analytical model, we found that firms make different IT investment decision in 'strategic dimension'. In this type of dimensions, firms that have higher capability invest more than low capability firms. Due to the superiority of IT investment level and capability, firms with high capability can provide better service quality in this type of dimensions. Therefore, we can hypothesize that the service quality of the 'strategic dimension' has positive relationship with firm's non-IT capability. Therefore following hypothesis can be derived

***H2. The service quality of 'strategic dimension' is positively related to firm's non-IT capability***

We investigate the strategically different IT investment decision about each type of service dimensions. We also empirically test how non-IT capability influences the 'IT use' of IT conversion process. Lucas (1993) argue that "structural factors" such as firm size and industry information intensity will affect the ability of the organization to convert IT assets into business value. Large organizations are more likely to adopt innovations and advanced ICT solutions than smaller organizations (Iacovou et al.,1995; Rogerss,1995). Also, Brynjolfsson et al.(1998) argue the importance of intangible asset in firm's stock value. They assert that a one dollar increase in a firm's IT investment is associated with an increase in the firm's stock market valuation of over five dollars. They also postulate the importance of intangible asset and identify a candidate for these intangible assets: certain organizational characteristics, involving the structure of decision making. Weill(1992) account for the failure of some IT investment to reach the firm's bottom line by using the concept of "IT conversion effectiveness". He shows that conversion effectiveness moderates the relationship between IT investment and incremental firm performance. Previous studies investigate the influence of non-IT factors on converting IT investment to financial performance or firm value. Based on previous studies, we investigate the effect of non-IT capability on 'IT-use' of IT conversion process.

We hypothesize that firms have different capability in utilization of IT asset for financial performance. That means, high capability firms more efficiently convert IT asset into financial performance than low capability firms. We test that firm's non-IT capability moderates the conversion process from service quality to financial performance. That is, the high capability firm can get better financial performance with same level of service quality. Therefore,

***H3. The higher the firm capability, the more significant the effect of high quality on firm profit.***

We construct hypotheses in the case of profit. The high capability firm can make higher profit than the low capability firm because of superior of non-IT capability and the moderating effect of capability, although the high capability firm invests in IT system more than the low capability firm.

## 4.1   Data

Since the deregulation of online trading in 1997, the volume of online trading has increased dramatically in Korea. There are several reasons for choosing the security brokerage industry. The financial service industry, because of the digital nature of its products and service, has historically been among the largest investors on IT. Revenue from HTS is over the half of total revenue. Moreover IT is a critical tool for providing customer service personnel with the information they need to deliver quality service(Elam and Morrison 1993) And, in highly competitive financial industry, customer service is widely seen as being strategically important(Berry 1995;Griffith 1993) Also, there is a high level of variance in the reported ability of firms, suggesting that firms differ in their ability to execute service.

Our data consists of 17 online brokerage firms, spanning seven years from 2001 to 2009, hence the total sample size is 153. In the case of our study, the extremely high penetration of online trading in Korea shows that online brokerage services has reached a mature stage (Shim et al, 2008). We have three data sources for four major variables: profit of online brokerage, the commission charged for the service(price), the quality of services, and firm size. The financial performance, profit, data is from the DART (Data Analysis, Retrieval and Transfer System) database (http://dart.fss.or.kr). DART is an electronic system that allows companies to submit disclosures online. From this public site, we retrieved the financial statements of security firms and found online brokerage related profit. The online brokerage commission data is from the KSDA (Korea Securities Dealers Association) Website (http://www.ksda.or.kr), which publishes up-to-date stock market data (e.g. brokerage commissions) and current economic and financial news on the firms listed in the stock market. We obtained system quality

data from Stockpia.com, a leading rating agency for the finance sector. Similar to Forrester.com or Gomez Advisors, Stockpia.com provides expert ratings of online brokerage services. It has appraised the quality of the online brokerage system in various dimensions, and has released and scored then on a quarterly basis since 2000. The appraisers are composed of academicians in related areas and internal firm experts. This Stockpia data is analyzed in previous research of Shim et al(1998).

Stockpia.com adopts five sub constructs for quality measurement of online brokerage systems: 1) trading functionality, which considers general trading convenience as well as the variety of functions and menus for online stock, option, and futures trading, 2) information provision, which measures the quality of information on the market such as charts, investment guides, and various research reports, 3) communication channels, which evaluates the quality of communities or education tools for advising on customers investment decisions(e.g. financial product selection, stock investment), 4) customer support, which examine the quality of help menus, personalization services and, privacy protection, 5) finally, system speed and stability. System speed is measured by examining the screen loading time for information menus and real transaction time for trading menus, while system stability is measured by the frequency of response delays or failures. Firm size can represent the different capability of firm and, in this test, we use firm size(total assets of the firm) as a proxy of firm capability. Icacovou et al.(1995)and Rogers(1995) argue that large organization are more likely to adopt innovations and advanced ICT solutions smaller organizations. Lucas et al.(1993) argue that "structural factors" such as firm size will affect the ability of the organization to convert IT assets into business value (Markus and Soh,1993).

The data set used in this test is balanced panel and fixed effect test model is used for empirical test the deregulation of online trading in 1997, the volume of online trading has increased dramatically in Korea.

## 4.2 Service quality of the system functional dimension and firm capability

To test hypothesis 1, we construct a regression equation. From the previous model, we found that service quality of the 'system functional dimension' is not related to firm's non-IT capability due to the characteristic of the service dimension.

The regression equation would be

$$(1) Q_{1i} = C + \alpha \cdot P_i + \beta \cdot s_i + \varepsilon$$

Where $p_i$ is the brokerage commission of firm and $s_i$ is the capability of each firm. Among the five dimensions of service quality of Stockpia data, we consider only one dimension (speed and stability) as the proxy dimension of the system functional dimensions. Sub-content of speed and stability are the speed and stability of system itself. Therefore it depends on the IT system quality and gained by improving IT system. The sub categories of the 'speed and stability' dimension are only systematic factors and these are proper characteristics of system functional dimension. Also we use price as control variable.
The results of the test are as follows

| | C | P(Price) | S(Capability) | R^2 | Adj R^2 |
|---|---|---|---|---|---|
| **Speed and Stability** | 1.631045 (2.063306) | 0.072702 (1.085428) | -0.013355 (-0.489249) | 0.966491 | 0.957935 |

\* $p<0.05$

*Table1. Results of regression- the system functional dimension and firm capability*

Table 1 shows that service quality of the system functional dimension is not related to either price or firm capability. This result is in accord with the results of our previous analytical model and supports H1. Only constant is significant and R-square is very high. So firms which are various in non-IT capability provide same level of service quality in this dimension. This happens because the firm cannot make any difference in customer demand through service quality of the system functional dimension due to the easiness of imitability. Based on the 'RBV', resources that are easy to imitate cannot make any difference

of performance and cannot be a source of competitive advantage. The result of analytical model and empirical test is consistent with RBV. Also this IT of this service dimension is a kind of commodity and it is consistent with Carr(2003)..

### 4.3 Service quality of the strategic dimension and firm capability

To test hypothesis, the regression equation is same as above.

$$(2) Q_{2i} = C + \alpha \cdot P_i + \beta \cdot s_i + \varepsilon$$

Among five service dimensions, we classify four service quality dimensions; Trading, Information, Support, Community and Communications, as the strategic dimensions of service quality by sub-content of each dimensions. Service quality of these service dimensions requires not only improvement of system quality but also other capabilities of firm. For example, in information dimension, improvement of service quality requires both advanced IT system via IT investment and ability of research. Other three dimensions also require ability of firm. Therefore four dimensions are investigated to test hypothesis 2.

The results of the regression test are as follows.

| | C | P(Price) | s(Capability) | R^2 | Adj R^2 |
|---|---|---|---|---|---|
| **Trading** | **2.442916***<br>**(7.470618)** | -0.087906<br>(-2.327897) | **0.113523***<br>**(6.561434)** | 0.083580 | 0.060568 |
| **Information** | **2.302186***<br>**(9.130524)** | -0.091312<br>(-3.136025) | **0.116753***<br>**(8.751661)** | 0.656382 | 0.631392 |
| **Supporting** | **1.656756***<br>**(6.219967)** | -0.107803<br>(-3.504750) | **0.124298***<br>**(8.819862)** | 0.604619 | 0.575864 |
| **Community and communication** | 0.051722<br>(0.074140) | -0.234743<br>(-2.913844) | **0.274008***<br>**(7.423472)** | 0.584014 | 0.553760 |

\* p<0.05

*Table2.   Results of regression-strategic dimension and firm capability*

Table 2 shows that all of service qualities of the strategic dimension are positively related to firm capability. In the previous analytical results, we found that the high capability firm provides high service quality level via higher IT investment and superiority of non-IT capability. Therefore the result of empirical test supports our result of analytical model. This result support H2. IT is still strategically important in this dimension. Although high capability firms have superior capability, they invest more in IT system of these dimensions and provide better service quality. In conclusion, higher service quality is induced both by more IT investment and advanced capability.

In service industry, service quality consists of multiple dimensions and firms have to invest into each dimension with consideration of service characteristics. By analytical model and empirical analysis, we figure out that firms make competitive difference not in every dimension but some dimensions based on the trait of capability. Service dimensions requiring resources that are easy to imitate cannot make difference in IT investment decision and service quality. Because IT investment and capability are the same, competing firms do not show the difference of service quality and cannot make a difference in financial performance. And other dimensions that are not easy to imitate make a difference in IT investment and service quality. In this dimension, high capability firm invest more than low capability firm despite superior capability. In conclusion, strategic difference in IT investment decision in service quality dimension is determined by trait of firm's non-IT capability in IT build of IT inversion process. These results fill the lack of explanation about various traits of IT which previous studies cannot provide.

### 4.4 Profit and firm capability

We hypothesize that firm have different conversion efficiency in 'IT use' of IT conversion process. That is, there is the moderating effect of firm's non-IT capability. Firms having higher capability gain better financial performance than low capability firm, in spite of the fact that they provide same level of service quality. In general terms, a moderator is a qualitative or quantitative variable that affects the direction and/or strengthen of the relation between an independent or predictor variable and a dependent or criterion variable. Specifically within a correlational analysis framework, a moderator is a third variable that affects the zero-order correlation between two other variables. In the more familiar analysis of variance(ANOVA)terms, a basic moderator effect can be represented as an interaction between a focal independent variable and a factor that specifies the appropriate condition for its operation(Baron and Kenny 1986)

To test the moderating effect of firm capability on profit, we construct three regression equations.

$$(3) \text{model1} : \text{profit} = c + \beta_1 Q_1 + \beta_2 Q_2 + \varepsilon$$

$$(4) \text{model2} : \text{profit} = c + \beta_1 Q_1 + \beta_2 Q_2 + \beta_3 s + \varepsilon$$

$$(5) \text{model3} : \text{profit} = c + \beta_1 Q_1 + \beta_2 Q_2 + \beta_3 s + \beta_4 \cdot s \cdot Q_1 + \beta_5 \cdot s \cdot Q_2 + \varepsilon$$

Q1 means service quality of system functional dimensions and Q2 means service quality of strategic dimension. Service quality of strategic dimension calculated as an average of service quality of four strategic dimensions. S means firm's non-IT capability.

The results of the above tests are as follows

| | Model1 | Model2 | Model3 |
|---|---|---|---|
| | **Profit** | **Profit** | **Profit** |
| **C** | -26702.88 (-1.290738) | -8236.240 (-0.417885) | 21703.02 (0.962574) |
| **Q1** | -1009.855 (-0.423947) | -1432.201 (-0.046169) | -2700.373 (-1.157030) |
| **Q2** | **2124.611 \*** **(4.622529)** | **1102.404** **(2.251996)** | 1228.1129 (0.407426) |
| **S** | | **0.003764\*** **(4.278066)** | **-0.30044\*** **(-2.5993715)** |
| **S\*Q1** | | | **0.000851\*** **(2.155349)** |
| **S\*Q2** | | | **0.000141\*** **(2.947913)** |
| **R^2** | 0.258059 | 0.364726 | 0.412557 |
| **Adj R^2** | 0.204099 | 0.312272 | 0.352166 |

\* $p < 0.05$

*Table 3. Results of regression model(3),(4) and (5)*

From regression equation (3), only the service quality of the strategic dimensions has a significant effect on a firm's profit without consideration of a firm's capability. When the firm's non-IT capability is added to the equation, the firm capability has a significant effect also. Next, if firm capability interacting with the service quality variable is added to equation, the effect of service quality disappears and firm capability interacting with the service quality variable has significant effect on firm profit. Firm profit is not related to the service quality of the system functional dimension when firm capability is not

considered. But service quality of this dimension effects profit after moderated by firm's non-IT capability.

This means that firm's non-IT capability moderates the influence of service quality on firm profit. High capability firm can get better financial performance than low capability firm with same service quality. This is consistent with research which investigate the importance of firm capability in IT management context in terms of 'IT use'(Iacovou et al.,1995;Rogerss,1995).

From previous analytical model and empirical test, we figure out the effect of non-IT capability on each step of IT conversion process. At the first step of conversion process, called as IT build, firms determine the amount of IT investment with consideration of trait of firm's capability. Firm's strategic decision about IT investment is differentiated by service quality dimension. Firms cannot make a difference in service quality dimension that is easy to imitate. Firms can make a difference in IT investment decision and service quality in service dimension that is not easy to imitate. The high capability firms invest more than low capability firm even with superior capability only in strategic dimension. At the second step of process, called 'IT use', firm's capability moderates the effect of service quality on financial performance. That means high capability firms can get better financial performance with same level of service quality. Because high capability firms provide high level of service quality via superiority of capability and IT investment, high capability firms can dominate the market by moderating higher service quality.

We figure out the amount of IT investment endogenously by optimization. And show that firm's non-IT capability influence on IT conversion process, 'IT build' and 'IT use'. Even though we also test using the branches and staff, neither are significant as a moderator.

## 5    Conclusion

Strategic use of IT has been widely discussed in the IT literature and there is no clear agreement. The point of debate has been whether IT leads to competitive advantage or not. However these previous papers consider IT as one unit and excessively simplify the IT. In this paper we argue that strategic use of IT has to be investigated based on the various traits of IT dimensions. We show that IT is strategic necessary in some dimensions and can be a source of competitive advantage in other dimensions. And this difference depends on the trait of firm's capability required for generating IT service. Specifically we found that IT investment and service quality of 'system functional dimension' which is easy to imitate cannot make a strategic difference.

IT investment and service quality of the 'strategic dimension', which is not easy to imitate, show strategic difference. That is consistent with RBV. And firm's optimal decisions are related to firm's non-IT capability. High capability firms invest more in strategic dimension than the low quality firm despite their superiority of non-IT capability. The high capability firm can provide high quality service by using better capability and more IT investment in strategic dimension. By an empirical test, we got consistent result with analytical model. That is, we figure out how IT is strategically used in different IT dimensions in 'IT build' analytically and empirically.

Also, through an empirical test, we test the moderating effect of firm's non-IT capability on 'IT-use'. We found that firms with high capability can convert the same level of service quality to a larger financial performance than the low capability firm. This is consistent with previous research of Weill(1992), Ivacou et al.(1995) , and s(1995).

Even though previous papers investigate the influence of non-IT factors, these are based on the direct relationship between IT investment and financial performance and firm value. However, because IT investment converts to performance through process or intermediate result, we investigate the impact of non-IT capability on each step of process, 'IT build' and 'IT use'. Additionally, previous papers consider the IT investment decision as given. However, rational firms m ay determine the amount of IT investment with consideration of their own capability. Therefore, amount of IT investment have to be concerned as endogenous variable.

## Appendix A

Two firms compete for profit maximization and each firm determine the optimal amount of IT investment of each service dimension. In our analytical model, firm's optimization is as follows

Firm1 $\quad \max_{I_1^1, I_2^1} \pi_1 = \dfrac{U_1}{U_1 + U_2} \cdot N \cdot P - (I_1^1 + I_2^1)$

Firm 2 $\quad \max_{I_1^2, I_2^2} \pi_2 = \dfrac{U_2}{U_1 + U_2} \cdot N \cdot P - (\dfrac{I_1^2}{s_1} + \dfrac{I_2^2}{s_2})$

F.O.C

Firm1_Dimension 1: $\dfrac{\partial \pi_1}{\partial I_1^1} = \dfrac{(Q_1^1)' Q_2^1 (Q_1^1 Q_2^1 + Q_1^2 Q_2^2) - Q_1^1 Q_2^1 (Q_1^1)' Q_2^1}{(Q_1^1 Q_2^1 + Q_1^2 Q_2^2)^2} NP - 1 = 0$

$\qquad\qquad = \dfrac{(Q_1^1)' Q_2^1 Q_1^2 Q_2^2}{(Q_1^1 Q_2^1 + Q_1^2 Q_2^2)^2} NP - 1 = 0 - - - - - - - - - - - - - - - (1)$

$\quad$ _Dimension 2: $\dfrac{\partial \pi_1}{\partial I_2^1} = \dfrac{Q_1^1 (Q_2^1)' Q_1^2 Q_2^2}{(Q_1^1 Q_2^1 + Q_1^2 Q_2^2)^2} NP - 1 = 0 - - - - - - - - - - - - - (2)$

Firm 2_Dimension 1: $\dfrac{\partial \pi_2}{\partial I_1^2} = \dfrac{Q_1^1 Q_2^1 (Q_1^2)' Q_2^2}{(Q_1^1 Q_2^1 + Q_1^2 Q_2^2)^2} NP - 1 = 0 - - - - - - - - - - - - - (3)$

$\quad$ _Dimension 2: $\dfrac{\partial \pi_2}{\partial I_2^2} = \dfrac{Q_1^1 Q_2^1 Q_1^2 (Q_2^2)'}{(Q_1^1 Q_2^1 + Q_1^2 Q_2^2)^2} NP - 1 = 0 - - - - - - - - - - - - - (4)$

Because each objective functions has unique optimal solution in each dimension(proof. Appendix B), we assume that each firm has optimal IT investment decision, $I_1^1 *, I_2^1 *, I_1^2 *, I_2^2 *$.

To figure out the relative value of two optimal IT investment decision in service dimension 1, we compare equation (1) and (3). By comparison of optimal solution of dimension 1($I_1^1 *, I_2^1 *$),

$$\dfrac{(Q_1^1 *)' Q_2^1 * Q_1^2 * Q_2^2 *}{(Q_1^1 * Q_2^1 * + Q_1^2 * Q_2^2 *)^2} NP = 1 = \dfrac{Q_1^1 * Q_2^1 * (Q_1^2 *)' Q_2^2 *}{(Q_1^1 * Q_2^1 * + Q_1^2 * Q_2^2 *)^2} NP$$

$$(Q_1^1 *)' Q_2^1 * Q_1^2 * Q_2^2 * = Q_1^1 * Q_2^1 * (Q_1^2 *)' Q_2^2 *$$

$$\dfrac{(Q_1^1 *)'}{Q_1^1 *} = \dfrac{(Q_1^2 *)'}{Q_1^2 *}$$

$$\therefore I_1^1 * = I_1^2 *$$

In service dimension 2, we also figure out the relative value of two optimal IT investment decisions. By comparison equation (2) and (4), we can figure out that IT investment of each firm is determined by relative value of firm's capability.

$$\dfrac{Q_1^1 * (Q_2^1 *)' Q_1^2 * Q_2^2 *}{(Q_1^1 * Q_2^1 * + Q_1^2 * Q_2^2 *)^2} NP = \dfrac{Q_1^1 * Q_2^1 * Q_1^2 * (Q_2^2 *)' \cdot s_2^2}{(Q_1^1 * Q_2^1 * + Q_1^2 * Q_2^2 *)^2} NP$$

$$Q_1^1 * (Q_2^1 *)' Q_1^2 * Q_2^2 * = Q_1^1 * Q_2^1 * Q_1^2 * (Q_2^2 *)'$$

$$\dfrac{(Q_2^1 *)'}{Q_2^1 *} = \dfrac{(Q_2^2 *)'}{Q_2^2 *}$$

$$\dfrac{\gamma \cdot s_2^1 (I_2^1 *)^{\gamma \cdot s_2^1 - 1}}{(I_2^1 *)^{\gamma \cdot s_2^1}} = \dfrac{\gamma \cdot s_2^2 (I_2^2 *)^{\gamma \cdot s_2^2 - 1}}{(I_2^2 *)^{\gamma \cdot s_2^2}} \qquad (\because Q_2^i = (I_2^i)^{\gamma \cdot s_2^i}, 0 < \gamma \cdot s_2^2 < \gamma \cdot s_2^1 < 1)$$

$$\frac{s_2^1}{I_2^1 *} = \frac{s_2^2}{I_2^2 *}$$

$$\therefore I_2^{1*} > I_2^{2*} \ (\because s_2^1 > s_2^2)$$

## Appendix B.

We can show the uniqueness of optimal solution(amount of IT investment) in each service dimension of firms. Revenue is marginally decreasing function and cost is linear function of IT investment.

$$\mathrm{Re}\,venue^i = R^i \cdot P$$

$$= \frac{U_i}{U_1 + U_2} \cdot N \cdot P$$

$$= \frac{U_0 \frac{Q_1^i Q_2^i}{P}}{U_0 \frac{Q_1^1 Q_2^1}{P} + U_0 \frac{Q_1^2 Q_2^2}{P}} \cdot N \cdot P$$

$$= \frac{Q_1^i Q_2^i}{Q_1^1 Q_2^1 + Q_1^2 Q_2^2} \cdot N \cdot P$$

$$= \frac{(I_1^i)^{s_1} (I_2^i)^{s_2^i}}{(I_1^1)^{s_1} (I_2^1)^{s_2^1} + (I_1^2)^{s_1} (I_2^2)^{s_2^2}} \cdot N \cdot P$$

For the ease of notification, we show the case of firm 1's optimal IT investment in the service dimension 1. Because others have same functional form, proof of one case can be applied to other cases. First condition of equation is

$$R' = \frac{\partial R}{\partial I_1^1} = \frac{s_1 \cdot (I_1^i)^{s_1-1} \cdot (I_2^i)^{s_2^i} \cdot (I_1^2)^{s_1} \cdot (I_2^2)^{s_2^2}}{\{(I_1^1)^{s_1} (I_2^1)^{s_2^1} + (I_1^2)^{s_1} (I_2^2)^{s_2^2}\}^2} \cdot N \cdot P > 0$$

Denominator is always positive due to the square. Because s, I are positive, whole compositions of numerator are positive and numerator is positive. Then first differentiation of revenue by IT investment is positive.

$$R'' = \frac{\partial^2 R}{\partial I_1^{1^2}}$$

$$= \frac{s_1 \cdot (s_1-1) \cdot (I_1^i)^{s_1-2} \cdot (I_2^i)^{s_2^i} \cdot (I_1^2)^{s_1} \cdot (I_2^2)^{s_2^2} \{(I_1^1)^{s_1} (I_2^1)^{s_2^1} + (I_1^2)^{s_1} (I_2^2)^{s_2^2}\}^2 - \{(I_1^1)^{s_1} (I_2^1)^{s_2^1} + (I_1^2)^{s_1} (I_2^2)^{s_2^2}\}^2}{\{(I_1^1)^{s_1} (I_2^1)^{s_2^1} + (I_1^2)^{s_1} (I_2^2)^{s_2^2}\}^4} \cdot N \cdot P < 0$$

The denominator is always positive because of fourth power of equation in the denominator. We can figure out the sign of numerator. The former part of numerator is always minus because $s_1, I_j^i$ are positive and $s_1 - 1$ is negative $(\because s_1 < 1)$. Also the latter part of numerator is always positive due to the power of equation. Therefore, numerator should be negative and second order of equation is always minus. That means that revenue is marginal decreasing return. Because cost is linear function, profit has unique solution.

References

Anthony Byrd, T., Lewis, B.R., and Bryan, R.W. 2006. "The Leveraging Influence of Strategic Alignment on It Investment: An Empirical Examination," Information & management (43:3), pp. 308-321.

Apte, U.M., Karmarkar, U.S., and Nath, H.K. 2008. "Information Services in the Us Economy: Value, Jobs, and Management Implications," California Management Review (50:3), p. 12.

Balasubramanian, S., Konana, P., and Menon, N.M. 2003. "Customer Satisfaction in Virtual Environments: A Study of Online Investing," Management science), pp. 871-889.

Banker, R.D., Kauffman, R.J., and Mahmood, M.A. 1993. Strategic Information Technology Management: Perspectives on Organizational Growth and Competitive Advantage. IGI Publishing Hershey, PA, USA.

Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage," Journal of management (17:1), p. 99.

Baron, R.M., and Kenny, D.A. 1986. "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations," Journal of personality and social psychology (51:6), p. 1173.

Barua, A., Kriebel, C.H., and Mukhopadhyay, T. 1991. "An Economic Analysis of Strategic Information Technology Investments," MIS quarterly), pp. 313-331.

Barua, A., Kriebel, C.H., and Mukhopadhyay, T. 1995. "Information Technologies and Business Value: An Analytic and Empirical Investigation," Information Systems Research (6:1), p. 3.

Barua, A., and Lee, B. 1997. "The Information Technology Productivity Paradox Revisited: A Theoretical and Empirical Investigation in the Manufacturing Sector," International journal of flexible manufacturing systems (9:2), pp. 145-166.

Beath, C., Goodhue, D., and Ross, J. 1994. "Partnering for Business Value: The Shared Management of the Is Infrastructure,").

Bender, D.H. 1986. "Financial Impact of Information Processing," J. MANAGE. INFO. SYST. (3:2), pp. 22-32.

Berry, R. 1995. "Define Quality Service So You Can Deliver It," Best's Review/Life-Health Insurance Edition (95:11), p. 68.

Bharadwaj, A.S. 2000. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," MIS quarterly), pp. 169-196.

Bharadwaj, A.S., Bharadwaj, S.G., and Konsynski, B.R. 1999. "Information Technology Effects on Firm Performance as Measured by Tobin's Q," Management science), pp. 1008-1024.

Bharadwaj, S.G., Varadarajan, P.R., and Fahy, J. 1993. "Sustainable Competitive Advantage in Service Industries: A Conceptual Model and Research Propositions," The Journal of Marketing (57:4), pp. 83-99.

Broadbent, M., Weill, P., and St. Clair, D. 1999. "The Implications of Information Technology Infrastructure for Business Process Redesign," MIS quarterly), pp. 159-182.

Brynjolfsson, E. 1993. "The Productivity Paradox of Information Technology," Communications of the ACM (36:12), pp. 66-77.

Brynjolfsson, E., and Hitt, L. 1996. "Paradox Lost? Firm-Level Evidence on the Returns to Information Systems Spending," Management science), pp. 541-558.

Brynjolfsson, E., Hitt, L.M., and Yang, S. 1998. "Intangible Assets: How the Interaction of Computers and Organizational Structure Affects Stock Market Valuations," Association for Information Systems, pp. 8-29.

Brynjolfsson, E., Hitt, L.M., and Yang, S. 2002. "Intangible Assets: Computers and Organizational Capital," Brookings papers on economic activity (2002:1), pp. 137-181.

Brynjolfsson, E., and Yang, S. 1997. "The Intangible Benefits and Costs of Investments: Evidence from Financial Markets," Association for Information Systems, p. 147.

Carr, N.G. 2003. "It Doesn't Matter," Educause Review (38), pp. 24-38.

Cheung, C.M.K., and Lee, M.K.O. 2005. "The Asymmetric Effect of Website Attribute Performance on Satisfaction: An Empirical Study,").

Clemons, E.K., and Row, M.C. 1991. "Sustaining It Advantage: The Role of Structural Differences," MIS quarterly), pp. 275-292.

Cron, W.L., and Sobol, M.G. 1983. "The Relationship between Computerization and Performance: A Strategy for Maximizing the Economic Benefits of Computerization," Information & management (6:3), pp. 171-181.

Dedrick, J., Gurbaxani, V., and Kraemer, K.L. 2003. "Information Technology and Economic Performance: A Critical Review of the Empirical Evidence," ACM Computing Surveys (CSUR) (35:1), pp. 1-28.

Devaraj, S., and Kohli, R. 2003. "Performance Impacts of Information Technology: Is Actual Usage the Missing Link?," Management science), pp. 273-289.

Dewan, S., and Riggins, F.J. 2005. "The Digital Divide: Current and Future Research Directions," Journal of the Association for information systems (6:12), pp. 298-337.

Dube, L., and Renaghan, L.M. 1999. "Sustaining Competitive Advantage," Cornell Hotel and Restaurant Administration Quarterly (40), pp. 27-33.

Ennew, C.T., Reed, G.V., and Binks, M.R. 1993. "Importance-Performance Analysis and the Measurement of Service Quality," European Journal of Marketing (27:2), pp. 59-70.

Falk, T., Hammerschmidt, M., and Schepers, J.J.L. "The Service Quality-Satisfaction Link Revisited: Exploring Asymmetries and Dynamics," Journal of the Academy of Marketing Science (38:3), pp. 288-302.

Gilchrist, S., Gurbaxani, V., and Town, R. 2002. "Productivity and the Pc Revolution," Citeseer.

Grabowski, M., and Lee, S. 1995. "Linking Information Systems Application Portfolios and Organizational Strategy," IGI Publishing, pp. 55-82.

Griffith, P. 1993. "Customer Service: Key to the Industry's Future," National Underwriter/Property & Casualty Risk & Benefits (97:34), pp. 15-16.

Hallowell, R. 1996. "The Relationships of Customer Satisfaction, Customer Loyalty, and Profitability: An Empirical Study," International Journal of Service Industry Management (7:4), pp. 27-42.

Harris, S.E., and Katz, J.L. 1991. "Organizational Performance and Information Technology Investment Intensity in the Insurance Industry," Organization Science (2:3), pp. 263-295.

Heskett, J.L., Sasser, W.E., and Schlesinger, L.A. 1997. The Service Profit Chain: How Leading Companies Link Profit and Growth to Loyalty, Satisfaction, and Value. Free Pr.

Hitt, L., and Brynjolfsson, E. 1994. "The Three Faces of It Value: Theory and Evidence,").

Hitt, L.M., and Brynjolfsson, E. 1996. "Productivity, Business Profitability, and Consumer Surplus: Three Different Measures of Information Technology Value," MIS quarterly), pp. 121-142.

Hu, Q., and Quan, J. 2005. "Evaluating the Impact of It Investments on Productivity: A Causal Analysis at Industry Level," International Journal of Information Management (25:1), pp. 39-53.

Iacovou, C.L., Benbasat, I., and Dexter, A.S. 1995. "Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology," MIS quarterly), pp. 465-485.

Johnston, R., and Jones, P. 2004. "Service Productivity: Towards Understanding the Relationship between Operational and Customer Productivity," International Journal of Productivity and Performance Management (53:3), pp. 201-213.

Kang, H., and Bradley, G. 2002. "Measuring the Performance of It Services:: An Assessment of Servqual," International Journal of Accounting Information Systems (3:3), pp. 151-164.

Karmarkar, U.S. "The Industrializationof Information Services," Handbook of Service Science), pp. 419-435.

Kohli, R., and Devaraj, S. 2003. "Measuring Information Technology Payoff: A Meta-Analysis of Structural Variables in Firm-Level Empirical Research," Information Systems Research (14:2), p. 127.

Koska, M.T. 1990. "High-Quality Care and Hospital Profits: Is There a Link?," Hospitals (64:5), pp. 62, 64.

Krishnan, M.S., Ramaswamy, V., Meyer, M.C., and Damien, P. 1999. "Customer Satisfaction for Financial Services: The Role of Products, Services, and Information Technology," Management science), pp. 1194-1209.

Kumar, R.L. 2004. "A Framework for Assessing the Business Value of Information Technology Infrastructures," Journal of Management Information Systems (21:2), pp. 11-32.

Lee, B., and Barua, A. 1999. "An Integrated Assessment of Productivity and Efficiency Impacts of Information Technology Investments: Old Data, New Analysis and Evidence," Journal of Productivity Analysis (12:1), pp. 21-43.

Lichtenberg, F.R. 1996. "The Output Contributions of Computer Equipment and Personnel: A Firm-Level Analysis." National Bureau of Economic Research Cambridge, Mass., USA.

Lucas Jr, H.C. 1993. "The Business Value of Information Technology: A Historical Perspective and Thoughts for Future Research," IGI Publishing, pp. 359-374.

Markus, M.L., and Robey, D. 1988. "Information Technology and Organizational Change: Causal Structure in Theory and Research," Management science (34:5), pp. 583-598.

Markus, M.L., and Soh, C. 1993. "Banking on Information Technology: Converting It Spending into Firm Performance," IGI Publishing, pp. 375-403.

Mata, F.J., Fuerst, W.L., and Barney, J.B. 1995. "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis," MIS quarterly), pp. 487-505.

Melville, N., Kraemer, K., and Gurbaxani, V. 2004. "Review: Information Technology and Organizational Performance: An Integrative Model of It Business Value," MIS quarterly (28:2), pp. 283-322.

Mittal, N., and Nault, B.R. 2009. "Research Note---Investments in Information Technology: Indirect Effects and Information Technology Intensity," Information Systems Research (20:1), pp. 140-154.

Mohr, L.B. 1982. Explaining Organizational Behavior. Jossey-Bass.

Mooney, J.G., Gurbaxani, V., and Kraemer, K.L. 1996. "A Process Oriented Framework for Assessing the Business Value of Information Technology," ACM SIGMIS Database (27:2), pp. 68-81.

Mukhopadhyay, T., Kekre, S., and Kalathur, S. 1995. "Business Value of Information Technology: A Study of Electronic Data Interchange," MIS quarterly), pp. 137-156.

Nelson, E.C., Rust, R.T., Zahorik, A., Rose, R.L., Batalden, P., and Siemanski, B.A. 1992. "Do Patient Perceptions of Quality Relate to Hospital Financial Performance?," Journal of Health Care Marketing (12:4), p. 6.

Oz, E. 2005. "Information Technology Productivity: In Search of a Definite Observation," Information & management (42:6), pp. 789-798.

Parasuraman, A., Berry, L.L., and Zeithaml, V.A. 1993. "More on Improving Service Quality Measurement," Journal of Retailing (69:1), pp. 140-147.

Parasuraman, A., Zeithaml, V.A., and Berry, L.L. 1988. "Servqual: A Multiple-Item Scale for Measuring Consumer Perceptions of Quality," Journal of Retailing (64:1), pp. 12-40.

Pitt, L.F., Watson, R.T., and Kavan, C.B. 1995. "Service Quality: A Measure of Information Systems Effectiveness," MIS quarterly), pp. 173-187.

Rai, A., Patnayakuni, R., and Patnayakuni, N. 1996. "Refocusing Where and How It Value Is Realized: An Empirical Investigation," Omega (24:4), pp. 399-412.

Rajgopal, S., Venkatachalam, M., and Kotha, S. 2001. "Does the Quality of Online Customer Experience Create a Sustainable Competitive Advantage for E-Commerce Firms?," Unpublished thesis, Stanford University, Stanford & University of Washington, Seattle).

Ray, G., Barney, J.B., and Muhanna, W.A. 2004. "Capabilities, Business Processes, and Competitive Advantage: Choosing the Dependent Variable in Empirical Tests of the Resource-Based View," Strategic Management Journal (25:1), pp. 23-37.

Ray, G., Muhanna, W.A., and Barney, J.B. 2005. "Information Technology and the Performance of the Customer Service Process: A Resource-Based Analysis," MIS quarterly (29:4), pp. 625-652.

Reichheld, F.F., and Sasser, W.E. 1990. "Zero Defections: Quality Comes to Services," Harvard business review (68:5), pp. 105-111.

Rogers, E.M. 1995. Diffusion of Innovations. Free Pr.

Roth, A.V., and Jackson III, W.E. 1995. "Strategic Determinants of Service Quality and Performance: Evidence from the Banking Industry," Management science), pp. 1720-1733.

Rust, R.T., and Kannan, P. 2003. "E-Service: A New Paradigm for Business in the Electronic Environment," Communications of the ACM (46:6), pp. 36-42.

Rust, R.T., Zahorik, A.J., and Keiningham, T.L. 1995. "Return on Quality (Roq): Making Service Quality Financially Accountable," The Journal of Marketing (59:2), pp. 58-70.

Sambamurthy, V., Zmud, R.W., and Foundation, F.E.R. 1994. It Management Competency Assessment: A Tool for Creating Business Value through It. Financial Executives Research Foundation.

Santos, J. 2003. "E-Service Quality: A Model of Virtual Service Quality Dimensions," Managing service quality (13:3), pp. 233-246.

Shankar, V., Smith, A.K., and Rangaswamy, A. 2003. "Customer Satisfaction and Loyalty in Online and Offline Environments," International Journal of Research in Marketing (20:2), pp. 153-175.

Shim, S., Lee, B., and Whinston, A.B. 2008. "Does Lower Transaction Price Attract More Customers?: An Empirical Study on the Short and Long Term Impacts of Online Brokerage Services," ICIS 2008 Proceedings), p. 8.

Shu, W., and Strassmann, P.A. 2005. "Does Information Technology Provide Banks with Profit?," Information & management (42:5), pp. 781-787.

Smith, M.D., and Brynjolfsson, E. 2001. "Consumer Decision Making at an Internet Shopbot: Brand Still Matters," The Journal of Industrial Economics (49:4), pp. 541-558.

Soh, C., and Markus, M.L. 1995. "How It Creates Business Value: A Process Theory Synthesis," Citeseer, pp. 29-42.

Strassmann, P.A. 1990. The Business Value of Computers. Information Economics Pr.

Turner, J.A. 1983. Organizational Performance, Size, and the Use of Data Processing Resources. Center for Research on Information Systems, New York Univ.

Van Dyke, T.P., Kappelman, L.A., and Prybutok, V.R. 1997. "Measuring Information Systems Service Quality: Concerns on the Use of the Servqual Questionnaire," MIS quarterly), pp. 195-208.

Vitale, M., Elam, J., and Morrison, J. "United Services Automobile Association (Usaa)." Harvard Business School Case.

Wang, H., Xie, M., and Goh, T. 1999. "Service Quality of Internet Search Engines," Journal of Information Science (25:6), p. 499.

Weill, P. 1992a. "The Relationship between Investment in Information Technology and Firm Performance: A Study of the Valve Manufacturing Sector," Information Systems Research (3:4), p. 307.

Weill, P. 1992b. "The Role and Value of Information Technology Infrastructure: Some Empirical Observations,").

Weinhardt, C., Gomber, P., and Holtmann, C. 1999. Online Brokerage: Transforming Markets from Professional to Retail Trading. Citeseer.

Yang, Z., and Fang, X. 2004. "Online Service Quality Dimensions and Their Relationships with Satisfaction: A Content Analysis of Customer Reviews of Securities Brokerage Services," International Journal of Service Industry Management (15:3), pp. 302-326.

Yang, Z., Peterson, R.T., and Cai, S. 2003. "Services Quality Dimensions of Internet Retailing: An Exploratory Analysis," Journal of services marketing (17:7), pp. 685-700.

Zeithaml, V.A. 2000. "Service Quality, Profitability, and the Economic Worth of Customers: What We Know and What We Need to Learn," Journal of the Academy of Marketing Science (28:1), p. 67.

Zeithaml, V.A., Berry, L.L., and Parasuraman, A. 1996. "The Behavioral Consequences of Service Quality," The Journal of Marketing (60:2), pp. 31-46.

Zhu, K. 2004. "The Complementarity of Information Technology Infrastructure and E-Commerce Capability: A Resource-Based Assessment of Their Business Value," Journal of Management Information Systems (21:1), pp. 167-202.