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EXPLORING THE LINKAGES BETWEEN FIRM INTERACTIVITY, INNOVATION, AND IMPROVED BUSINESS PERFORMANCE

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Completed Research Paper

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Abstract

In today's dynamic and hypercompetitive business environment, knowledge and innovation have emerged as bases for sustained competitive advantage. This paper addresses two specific research questions. First, we ask, "What is the effect that firm interactivity has on various types of innovation?" As we address this question, we explain that interactivity helps firms create knowledge, which then promotes and enables innovation. Second, we ask, "How do the various types of innovation impact firm performance?" We develop a research model and a set of hypotheses from the basis of organizational knowledge creation theory and the knowledge-based view of the firm. We test this model using survey data, and find that interactivity is positively associated with innovation. We also find that several types of innovation, including service innovation, process innovation, and organizational innovation have a positive impact on firm performance.

Keywords: Innovation, Interactivity, Knowledge creation, Performance

Introduction

The modern business environment evolves and changes rapidly. Globalization, technological innovation, shifting industrial boundaries, and changing government regulations are some of the forces that have given rise to unstable market conditions. In this dynamic and hypercompetitive environment, knowledge, innovation, and firm-specific skills have emerged as bases for sustained competitive advantage (Alavi and Leidner 2001; Grant 1996a; Nonaka 1994). In such an environment, discovering the core mechanisms for knowledge creation and understanding the potential impact of that knowledge on innovation and firm performance is vital.

This paper addresses two specific research questions. First, we ask, "What is the effect that firm interactivity has on various types of innovation?" As we address this question, we explain that interactivity creates knowledge which promotes and enables innovation. These innovations may include service, process, or organizational innovations, each of which is valuable to a firm. It is not enough to simply identify evidence of innovation, however. It must also be shown that this innovation is indeed valuable in the business world. Therefore, our second research question is, "How do the various types of innovation impact firm performance?" And as we address the second question, we explain that innovation is one of the bases for improved firm performance, and we endeavor to show how innovation can lead to competitive advantage.

This research study makes three contributions to IS literature. First, by coupling our arguments and our empirical findings with extant research, we refine and bring clarity to the concept of firm interactivity. Specifically, we describe three different dimensions of interactivity: knowledge service standardization, interactive learning, and innovation participation. Second, we identify three different types of innovations that can emerge from firm interactivity: service innovations, process innovations, and organizational innovations. Third, we examine the effect of innovation on firms' performance, revealing its positive impact.

The paper proceeds as follows. We begin by briefly reviewing the theoretical background for our study, including organizational knowledge creation theory, and the knowledge-based view of the firm. We explain that interactivity fosters the dynamic process of knowledge creation. This knowledge can then be used as a basis for innovation. We then describe our research model as we develop our hypotheses about how the knowledge that is created from interactivity fosters firm innovation. Innovation, then, improves firm performance. As we describe this model, we also discuss how both tacit and explicit knowledge affect innovation. The subsequent method section describes our survey data, which is drawn from knowledge-intensive business service firms (KIBS), a context where the creation of knowledge is highly important and should be clearly observable. We also discuss the operationalization of our research variables, our tests for validity and reliability, and our PLS analysis. In the results section, we note strong support for our hypotheses. In the discussion section, we highlight the theoretical and practical implications of our work. The limitations of our study, and potential directions for future research appear in the discussion section as well.

Theoretical Background

Organizational Knowledge Creation Theory

Nonaka (1994) explains the process of knowledge creation by building upon the distinction between explicit and tacit knowledge. Explicit knowledge can be written or otherwise codified and is easily transmitted from one individual to another. Tacit knowledge is more difficult to transmit between individuals or groups because it is personal or organizational, rooted in action, and is often context-specific (Polanyi 1958; Polanyi 1966). These two types of knowledge then allow Nonaka to describe four modes of knowledge conversion: socialization, combination, internalization, and externalization. Socialization is the sharing of tacit knowledge through interaction between individuals. Combination is the use of social processes to combine different bodies of explicit knowledge. Internalization is the conversion of explicit knowledge into tacit knowledge. And finally, externalization is the conversion of tacit knowledge into explicit knowledge (Nonaka 1994).

The creation of knowledge takes place through both individuals as well as organizations. In the core of each of the four aforementioned modes of knowledge creation, there is interaction. Human actors participate in the interactions, learn from others, create new knowledge, and can also codify and standardize the knowledge. The knowledge created through these modes leads progressively from individual learning to group learning, organizational learning, and then to inter-organizational learning (Nonaka 1994).

This learning process fosters service, process, and organizational innovations (Nonaka and Takeuchi 1995). While Nonaka explains that individuals develop and create knowledge, he also states that organizations such as firms "articulate and amplify" that knowledge (Nonaka 1994, p. 14). Organizations provide a context in which individuals can create knowledge through social interaction. These interactions may be informal and emergent, or they may be structured and routine. In sum, this theory of organizational knowledge creation applies both to individuals as well as to organizations.

Organizational knowledge creation theory has been applied in IS research in several ways. It has been used to explain that several aspects of organizational context influence the suitability of knowledge management processes

(Becerra-Fernandez and Sabherwal 2001), and to develop approaches for the valuation of organizational knowledge creation investments (Chen and Edgington 2005). The theory has also been used to explain ways in which organizations can enhance knowledge management, innovation, and inter-organizational learning (Lee and Choi 2003; Nambisan et al. 1999; Scott 2000). It has also been used to explain how interaction between supply chain partners promotes market knowledge creation (Malhotra et al. 2005).

In sum, organizational knowledge creation theory explains that it is interaction among individuals and organizations that creates knowledge. This new knowledge fosters innovation. If the process for creating knowledge and promoting innovation can be explained, how is this knowledge valuable to the firm? How can a firm capitalize on these key resources? These are precisely the questions that the Knowledge-Based View of the firm addresses, a theory we now describe as an additional theoretical base for our work.

Knowledge-Based View of the Firm

The Knowledge-Based View of the firm (KBV) has emerged from the Resource-Based View of the firm (RBV). The RBV explains that competing firms possess heterogeneous sets of resources and capabilities (Penrose 1959; Wernerfelt 1984; Wernerfelt 1995). Resources and capabilities that are valuable, rare, difficult to imitate, and difficult to substitute are a potential source of competitive advantage (Barney 1991). The KBV extends this understanding by explaining that knowledge is among the most valuable resources of a firm precisely because it is valuable, rare, difficult to imitate, and difficult to substitute (Grant 1996b). Knowledge-based resources have these characteristics because they are socially complex and embedded within firms' organizational culture, business processes, administrative routines, information systems, and also within its employees (Alavi and Leidner 2001; Grant 1996a).

These knowledge-based resources are posited to be a basis from which sustained competitive advantage and improved firm performance can be built (Grant 1996b). This theory is particularly relevant to IS research, because information systems are able to facilitate intra-firm knowledge development and knowledge management (Alavi and Leidner 2001). Common IT infrastructures and management processes across functional divisions and business units enhance a firm's ability to manage knowledge (Tanriverdi 2005). Furthermore, the ability to create and manage knowledge using IT has been shown to improve a firm's performance (Pavlou et al. 2005; Tanriverdi 2005).

We appeal to the KBV because it indicates the importance of knowledge for improved business performance and competitive advantage. Within KBV research, however, the mechanisms and processes by which knowledge creates competitive advantage have not been thoroughly explored. For this reason, we couple the KBV with organizational knowledge creation theory, a theory that explains how knowledge is created by individuals as well as by organizations.

In this paper, we take the position that knowledge is a valuable resource for the firm because it is valuable, rare, not easily imitated, or easily substituted. While researchers have explored how individuals create knowledge within a firm, relatively little work has been done on how organizations interact to create knowledge. We explore the ways in which firms' interactivity enables them to create knowledge. We then argue that this knowledge provides value to the firm because it enables the firm to innovate. Innovation is thus a source of competitive advantage that is closely related to knowledge creation. A detailed explanation of this relationship will be provided as we develop our hypotheses.

Research Model and Hypotheses

In this section, we begin by explaining that interactivity is a second-order construct consisting of knowledge service standardization, interactive learning, and innovation participation. We then go on to explain that interactivity enables firms to innovate in three ways: service innovation, process innovation, and organizational innovation. We also explain how the type of knowledge, either tacit or explicit, moderates the relationships between interactivity and the three types of innovation. Finally, we explain how and why innovation improves firm performance. Our research model is depicted below as Figure 1. A detailed rationale for our model now follows.

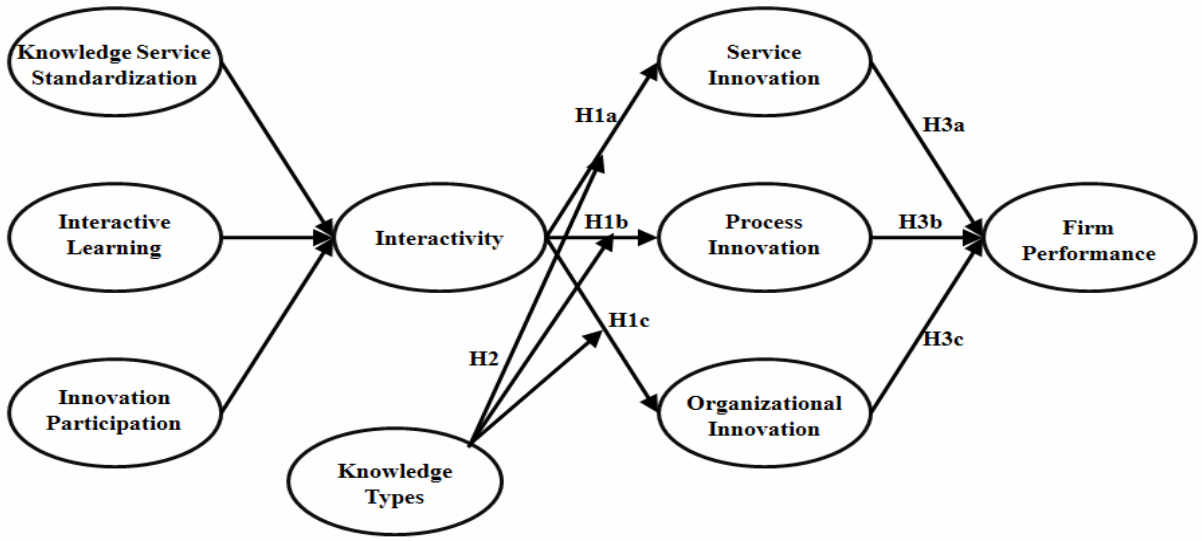

Figure 1. Research Model

Interactivity

By interactivity, we mean more than simply interaction. Interaction is the reciprocal action between two entities, such as the exchange of information between individuals or between firms. Examples would include the sharing of information between supply chain partners, or the sharing of market research between a firm and a marketing consultancy.

Interactivity, on the other hand, is *the extent or the degree to which something is interactive* (Liu and Shrum 2002). The term interactivity is often used to describe consumer technology devices that promote or foster interaction between the user and the device, or between the user and the provider of the content that is being viewed on the device. Here, interactivity is used to describe the degree to which a firm is able to interact with, or promotes interaction with other partner firms. These partners could be suppliers, customers, consulting firms, regulatory agencies, or other similar entities.

We regard the construct of interactivity that has been proposed by previous studies (Miles, 2001; Lundvall, 1997; Howell, 2003) as a formative construct, as it consists of multiple dimensions. We suggest that innovation takes place when there is interaction between a firm and its value chain partners. We further suggest that the construct of interactivity is composed of *knowledge service standardization*, *interactive learning*, and *innovation participation*. These three dimensions indicate the ways in which firms can be interactive.

Knowledge service standardization is the extent to which the knowledge services that firms provide to customers are consistent and formalized (Miles 2001). Standardization of knowledge services results from the frequent interactions between firms and customers, and the need to make products and services easily understood and accepted by customers (Miles 2001). Standardized knowledge services can be routinized so that the service can be delivered even without directives or guidance (Grant 1996b). Knowledge service standardization enables customers to readily accept the services that firms render and easily interact with firms when there is any problem with the services. When the transfer of knowledge can be standardized in format and routinized in business processes, firms find it easier to share knowledge. Thus, *knowledge service standardization* is one dimension of interactivity.

Interactive learning represents how easily firms and customers can exchange their knowledge with each other (Lundvall 1997; Miles 2001). In this sense, interactive learning represents the two-way learning between firms and their partners that allows both sides to communicate and combine their knowledge and create new knowledge and innovations (den Hertog 2000; Ko et al. 2005; Nonaka 1994). In particular, firms that possess general knowledge about markets can benefit from the exchange to build domain knowledge and innovate to better support their customers (Lundvall 1997). When firms are able to learn about technologies, about the competitive environment,

about advances in business processes, about new ways to engineer products and services, and when they share that knowledge, they are being interactive and creating opportunities for knowledge creation and innovation.

Innovation participation also constitutes a dimension of interactivity. Innovation participation represents the degree to which firms allow customers or other business partners to take part in creating service innovations (Howells 2003). Prior research has suggested that frontline innovation participation is critical to successful innovation implementation, especially in service contexts (Susan et al., 2009). Thus, we can regard that the motivation to participate in implementation efforts of innovation, which can be the frontline of interactivity, may lead to the successful implementation of innovation.

Based on the arguments presented above, we model the construct of interactivity as a multidimensional formative construct.

One example of a firm that demonstrates interactivity in several ways is Swedish furniture-maker IKEA. IKEA demonstrates knowledge service standardization by allowing customers to construct and configure their furniture by ordering from catalogs and websites. The flows of information both to and from the company thus are standardized. This same ordering and configuration process also demonstrates frequent interaction between customers and the company. In these ways, IKEA can be seen as demonstrating interactivity.

The Effect of Interactivity on Innovation

Recent studies emphasize the importance of interaction with customers as the basis for co-creation of value in service provision (Michel et al. 2008; Payne et al. 2008; Prahalad 1999). We argue that the interactivity of firms, that is, the degree or extent to which they interact with partners, helps them create knowledge and innovate in both products and services.

If high levels of firm interactivity foster the sharing of information between firms, then this information sharing can lead to the creation of new knowledge and innovation. Indeed, knowledge conversion through socialization, combination, internalization, and externalization leads to knowledge creation (Nonaka 1994). As individuals become aware of knowledge that was once available only to other individuals, groups, or firms, learning takes place. This learning process fosters service, process, and organizational innovations (Nonaka and Takeuchi 1995). Thus, interactivity has the potential to foster innovation.

Existing research indicates the possibility of a link between interactivity and the innovation of specific products or services. Product or service innovation involves the introduction of new concepts and addition of new features to existing products and services (Hipp et al. 2000). Studies suggest that the key characteristic of product and service innovation is the tight interaction between service supplier and customer (Liu and Chen 2007). Others similarly note that service innovation often emerges as a result of co-production between service providers and their customers (den Hertog 2000; Michel et al. 2008; Prahalad and Ramaswamy 2004).

Innovations that arise from interactivity are not, however, limited to product and service innovations. Process innovations have been identified as well (Hipp et al. 2000). Process innovation relates to the adoption of new service production, delivery, maintenance, and monitoring processes. Several of these different process innovations have been described as necessary to improve firm performance. These process innovations often take the form of soliciting customer feedback and co-creating value with them foster the innovation of new processes (Michel et al. 2008). This new perspective on interacting with customers to innovate has even given rise to a new perspective on business strategy and marketing, what is referred to as the service-logic perspective (Michel et al. 2008; Vargo and Lusch 2004). This new perspective is based on the idea that customers and businesses can collaborate to create innovative new ways for customers to service their personal needs and wants. Examples of firms that have developed new, interactive processes with customers include Google, where search "customers" create the rankings that make its search results useful, and Netflix, where a new process for movie rentals is created, one that allows customers to play a larger role in determining what content Netflix provides (Anderson 2006; Michel et al. 2008). In sum, increased interactivity with customers has been identified as a key way to innovate in the area of business processes and create value within modern firms.

Yet another type of innovation is organizational innovation, which is defined as the introduction of a new organization structure or a new way of performing work. Some have discussed the reconfiguration of the "value constellation", or the reconfiguration of the network of suppliers, producers, partners, and customers (Michel et al. 2008). One example of a firm that has been able to make such an organizational innovation is YouTube, which has

permitted and fostered collaboration with customers to create content that is viewed through the site. They have also changed the revenue-generation process by moving from a model where content creators paid a fee to convert and host video, but now do not have to pay because the service of hosting is free and essentially funded by advertisers on the site (Michel et al. 2008). Thus, interactivity with customers can lead to innovation in organizational structure and in the ways that work is performed.

In sum, each of these three types of innovations – product/service, process, and organizational – are facilitated through the interaction with customers (Michel et al. 2008; Miles 2001). We argue that interactivity with customers leads to innovation in firms because firms acquire enhanced knowledge about best practices and accumulate domain knowledge (Prahalad and Ramaswamy 2004). Furthermore, knowledge is accumulated through interactivity and recombined into new forms in the process of organizational learning (Nonaka and Takeuchi 1995). Each of these outcomes support innovation. Therefore, we hypothesize that

Hypothesis 1a: Interactivity positively affects service innovation.

Hypothesis 1b: Interactivity positively affects process innovation.

Hypothesis1c: Interactivity positively affects organizational innovation

The Moderating Effect of Knowledge Types

We categorize the type of knowledge into tacit and explicit knowledge to examine the effect of knowledge type on the relationship between interactivity and the various types of innovation. Each type of knowledge may have a differential effect on the relationship between interactivity and innovation (Song et al. 2007). That is, even with the same degree of interactivity, tacit knowledge is critical for some innovations, while for other innovations explicit knowledge is more valuable than tacit knowledge (den Hertog 2000). This is primarily because each type of innovation may require different levels of communication and knowledge representation.

Consider the case of the Toyota production system. Many American companies have made visits to Toyota to learn the lean production system. These American companies have actually applied the knowledge they learned from the benchmarking process to their own company. Few of them, however, have accomplished their intended goals. This is a typical failure in applying tacit knowledge to organizational innovation. The reason is that organization level or process level knowledge is situated in the context so that the knowledge cannot be easily extracted (Grant 1996b). If the tacit knowledge were able to be effectively exchanged, however, the impact on the receiving firm could be considerable. On the contrary, if a company obtains knowledge about a product or service, it can easily replicate the product or service through reverse engineering. This is the case when explicit knowledge that is gained from interaction is applied to the process of innovation.

Following Nonaka and Takeuchi (1995), we classify knowledge as either tacit or explicit. Tacit knowledge essentially represents "know-how" which is related to subjective knowledge; explicit knowledge represents "knowing-about" and is related to objective knowledge. In general, since explicit knowledge is available in the form of formulas, technical specifications, or embedded in equipment and computer programs, it can be relatively easy to store and transfer. On the other hand, tacit knowledge can be held and deployed on the part of the user (Hales, 1997). It is highly personal and difficult to convert. It cannot easily be codified and can often only be observed through application and acquired through practice and experience.

These two different types of knowledge may have a differential effect on the relationship between interactivity and innovation, because each type of innovation may require different levels of communication and knowledge representation (Song et al. 2007). Tacit knowledge is generally more difficult to obtain than explicit knowledge (Nonaka 1994). In spite of this difficulty, tacit knowledge is critical for most innovations (den Hertog 2000). Tacit knowledge can be the most difficult to extract, recombine with other knowledge, and use to develop innovations.

Therefore, when interactivity is high, if the knowledge that is exchanged between a firm and a partner is mostly tacit, there will be a greater effect on innovation than when the knowledge exchanged is mostly explicit. Because explicit knowledge is codified and easier to access, share, and understand, it promises less of an increase in innovation, and less of a sustainable advantage.

Restated, even when tacit knowledge is shared, it may be difficult to separate from its native context, difficult to decode and interpret, and difficult to apply in a new circumstance. However, when firms and partners have high levels of interactivity, and are able to effectively exchange tacit knowledge, this exchange will provide a greater

degree of benefit than the exchange of explicit knowledge. Hence, we argue that when firms rely more on tacit knowledge during the interaction with customers, the effect of interactivity on innovation is greater than when firms rely more on explicit knowledge. Therefore, we hypothesize:

Hypothesis 2a: When firms rely more on tacit knowledge during the interaction with customers, the effect of interactivity on service innovation becomes stronger than when firms rely more on explicit knowledge.

Hypothesis 2b: When firms rely more on tacit knowledge during the interaction with customers, the effect of interactivity on process innovation becomes stronger than when firms rely more on explicit knowledge.

Hypothesis 2c: When firms rely more on tacit knowledge during the interaction with customers, the effect of interactivity on organization innovation becomes stronger than when firms rely more on explicit knowledge.

The Effect of Innovation on Firm Performance

Innovation has been described as the driving force of firm growth for decades (Schumpeter 1934). While this relationship has been borne out in a host of empirical studies (Baldwin and Johnson 1996; Barua and Mukhopadhyay 2000; Deshpande et al. 1993; Fichman 2000; Han et al. 1998; Ramamurthy et al. 1999; Teece 1986), some have criticized contemporary innovation literature for emphasizing technical innovations over other types of innovations, noting that the original idea of Schumpeterian innovation was much broader than simply technical or technological innovation (Gallouj and Weinstein 1997). To address this limitation, researchers have explained and shown that product/service innovation, process innovation, and organization innovation positively affect firm performance (de Vries 2006; Gadrey et al. 1995).

As we have noted earlier, product or service innovation involves the introduction of new concepts and addition of new features to existing products and services (Hipp et al. 2000); process innovation relates to the adoption of new service production, delivery, maintenance, and monitoring processes; and organizational innovation is defined as the introduction of a new organization structure or a new way of performing work (Michel et al. 2008). The original idea behind Schumpeterian innovation was that larger firms were able to innovate, changing the structure of the market from within to suit themselves. He referred to the process of innovation and the subsequent changes to the market "creative destruction", noting that the firms that flourish are those that are able to grasp discontinuities quickly. Thus, firms that can innovate to change the market, or those that can respond rapidly to innovations, are poised to succeed.

In today's knowledge-based economy, the explanation is similar. Firms seek to innovate in order to steal a march on their competitors. When they are able to develop innovations, be they service, process, or organizational innovations, those firms are poised to see superior performance. The RBV, and its extension, the KBV, both posit that when a resource is valuable, rare, inimitable, and nonsubstitutable, competitive advantage can be built. Knowledge-based resources, in particular, are a basis from which sustained competitive advantage and improved firm performance can be built (Grant 1996b). Innovations are, by definition rare. They are novel and represent creative approaches to developing new services and products, new processes, or new organizational forms. To the degree that these innovations are potentially valuable, and to the degree that they cannot be quickly copied or substituted for, the firm will realize a competitive advantage over their competitors.

Knowledge-based innovations are likely to be a basis on which competitive advantage can be built because knowledge is generally unique to an individual, group, or firm. Such firm-specific resources meet the criteria for being valuable, rare, not easily imitated, or easily substituted. We therefore hypotheisize:

Hypothesis 3a: Service innovation positively affects firm performance.

Hypothesis 3b: Process innovation positively affects firm performance.

Hypothesis 3c: Organizational innovation positively affects firm performance.

Method

Sample and Data

To test our research model and hypotheses, we surveyed knowledge-intensive business service firms (KIBS). KIBS firms are private organizations that rely heavily on professional knowledge related to a specific (technical) discipline or (technical) functional domain to produce intermediate products and services (Hertog 2000). Many IT services firms and consulting firms fall into this category. KIBS firms play three important roles (Starbuck 1992). First, through knowledge creation, application, and preservation, they innovate so that new and renewed knowledge can be applied to new projects. Second, they convert the flow of information into the stock of knowledge. In their interactions with other firms, KIBS firms capture the flow of information from client firms and convert it into their knowledge stock to be subsequently used for further service innovation (Lundvall 1997). Third, a KIBS firm becomes a single source of knowledge to its client firm(s). The effectiveness of performing the three roles of a KIBS firm relies on the quality of the interaction between KIBS firms and customers (Lundvall 1997).

The nature of KIBS firms' business means that interactivity with clients, knowledge creation, and innovation are all highly important for success. In such a context, the phenomena that we seek to observe should be clearly observable. For these reasons, we have chosen KIBS firms as the context for our research study.

We developed a survey questionnaire by modifying items from previous studies and creating new items where necessary. The company list of the IT Service Management Forum (itSMF) was used as the source of sampling. The questionnaire was mailed to a sample of KIBS firms. In addition, we directly contacted KIBS firms to encourage their participation. Of 230 firms that were contacted for the survey, 96 firms completed and returned the questionnaires (response rate of 41.7%). 5 out of 96 returned survey questionnaires were dropped due to incomplete answers and 91 usable responses were included in the data analysis. Table 1 shows the demographic information of the respondents.

Table 1. Demographic information

Profile Category		Number of Respondents	Percentage of Respondents
Age	20-30	20	22.0
	31-40	39	42.9
	41-50	31	34.1
	51 or Greater	1	1.1
Gender	Male	73	80.2
	Female	17	18.7
Respondent Position	CEO/ Senior Manager	6	6.6
	Mid-level Manager	33	36.3
	Professional	36	39.6
	Supervisor	2	2.2
	Clerical	5	5.5
	Administrative	2	2.2
	Production	2	2.2
	Etc.	5	5.5
Industry Type	IT services	46	50.5
	Finance/ Insurance	19	20.9
	Communications	17	18.7
	Banking	5	5.5
	Construction	2	2.2
	Education	1	1.1
	Medical Service	1	1.1
Firm Size	Large	18	19.8
	Medium	37	40.7
	Small	36	39.6
Total		91	100%

Operationalization of Research Variables

We measure interactivity as a second order construct formed by three dimensions of knowledge service standardization, interactive learning and innovation participation. The items for knowledge service standardization were adapted from standardized service measures in earlier research (Blind 2006; Hipp et al. 2000). We used previously developed items to measure interactive learning as well (Meeus et al. 2001). Innovation participation was measured by adapting the scales that concern the customers' participation in innovation (den Hertog 2000).

The items for service innovation, process innovation and organizational innovation were adapted from the previous innovation studies (Armbruster et al. 2008; Avlonitis et al. 2001; Ravichandram 1999). The items for knowledge type were adapted from tacit and explicit knowledge measures (Miles et al. 1995). We measured tacit and explicit knowledge separately and reverse-coded explicit knowledge to combine both measures together. Finally, the items for firm performance were also adapted from previous research (Hipp et al. 2000). For all measurement items, a 5 point Likert scale was used, anchored by "strongly disagree" and "strongly agree." The survey instrument appears in the Appendix.

Validity and Reliability

Data analysis was performed using the partial least squares (PLS). Unlike covariance-based approaches, PLS requires minimal demands on measurement scales, sample size, and distributional assumptions (Chin 1998). We used Smart PLS Version 2.0 for our analysis. Smart PLS is a software application for the design of structural equation models (SEM) on a graphical user interface (GUI). We conducted our analysis in two stages. First, we tested the measurement model to ensure that the constructs had sufficient psychometric validity and then addressed the structural model in which the hypotheses were tested (Please see Appendix A and Appendix B for confirmatory factor analysis, as well as for item loadings and cross-loadings).

Table 3 shows that the composite reliability for all constructs is greater than 0.80 and the average variance extracted (AVE) is greater than 0.50. Also, all item-loadings were greater than 0.70; therefore, the level is generally acceptable (Fornell and Larcker 1981). Furthermore, the square roots of the shared variance between the constructs were higher than the correlations across constructs, thus supporting discriminant validity (Fornell and Larcker 1981). In this study, AVE for each construct is greater than the correlation between that and all other constructs. These statistics for the reliability of our measures and analysis are summarized in Table 3.

Table 3. Reliability Measures for Model Constructs and Construct Correlation

Construct	Cronbach's α	AVE	Construct Correlation[d]						
			STN	IL	IP	SI	PI	OI	FP
Standardization (STN)	.89	.64	**(.80)**						
Interactive learning (IL)	.89	.71	.46	**(.84)**					
Innovation participation (IP)	.78	.70	.26	.51	**(.84)**				
Service innovation (SI)	.72	.64	.42	.40	.35	**(.80)**			
Process innovation (PI)	.76	.68	.55	.45	.34	.55	**(.82)**		
Organizational innovation (OI)	.87	.66	.52	.61	.44	.40	.50	**(.81)**	
Firm performance (FP)	.86	.71	.49	.57	.34	.39	.49	.51	**(.84)**

Structural Model Test

Data analysis examines the significance and strength of each of our hypothesized effects and the results are shown in Figures 2 and 3. We tested two models: one with only main effect of interactivity and innovations (Figure 2), the other with the moderating effect of knowledge type on the relationship between interactivity and innovations (Figure 3).

As shown in Figure 2, all path coefficients are over 0.1 satisfying both conservative criteria and the suggested lower limits for such relationships. They are also statistically significant at the $p<0.001$ level, which indicates that all hypotheses regarding the direct effect of interactivity on innovations (H1a, H1b, H1c, H3a, H3b, H3c) are supported

by the data. Moreover, high R^2 values for constructs in the structural model show that this model can be used to predict the effect of interactivity on innovations and firm performance.

We also conducted an additional test where we considered firm size as a control variable. It was not statistically significant, which means that for KIBS firms, firm size may not be important in terms of performance, because the competitive advantage of these firms may come from knowledge and expertise.

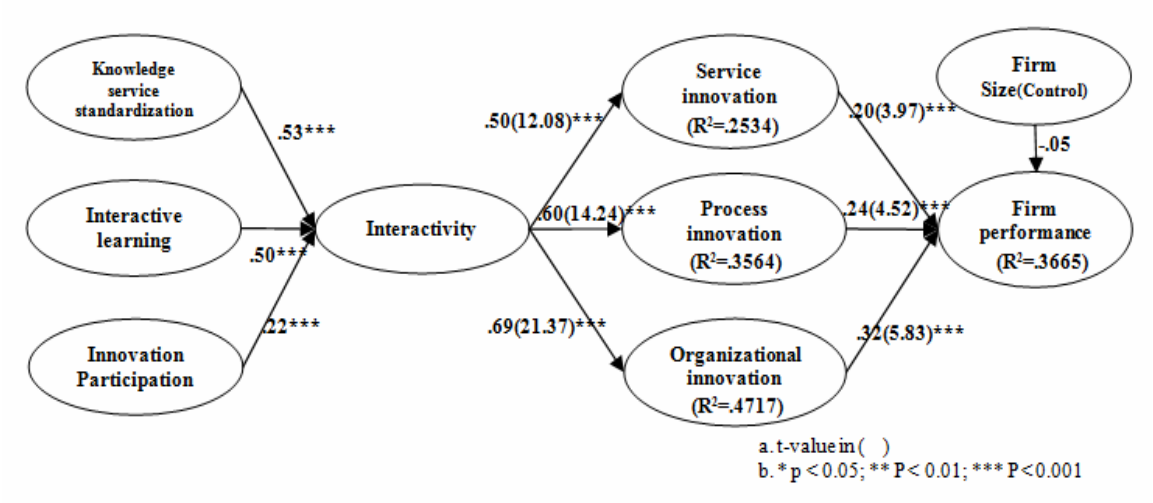

Figure 2. The Estimated Model (Main Effect)

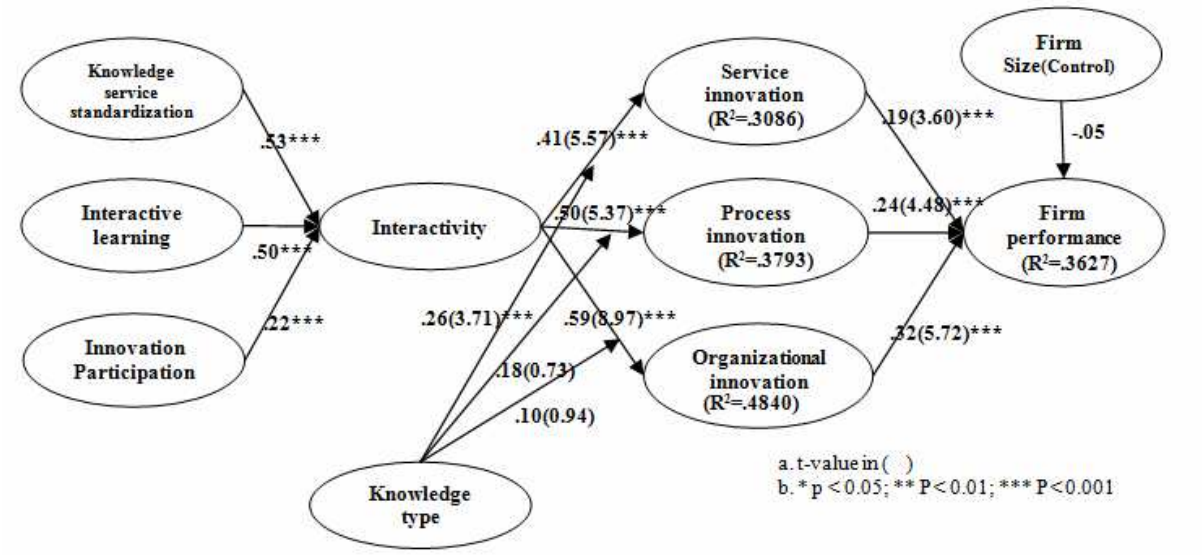

Figure 3. The Estimated Model (Moderating Effect)

We further tested the moderating effect of knowledge type on the relationship between interactivity and innovations. To test moderation of the types of knowledge, we constructed the interaction terms between the types of knowledge and interactivity to test the moderating effect of the relationship between independent variable and innovation variables. We followed the procedure suggested by Goodhue et al.(2007). In our results, we found that knowledge types could partially moderate only the relationship between service innovation and interactivity. In other words, when KIBS firms rely more on tacit knowledge during the interaction with customers, the effect of interactivity on

service innovation becomes stronger than when KIBS firms rely more on explicit knowledge (H2a). In the cases of process innovation and organization innovation, there is no interaction effect observed (H2b and c).

Discussion

In this study, we set out to investigate the effect of the interactivity on three types of innovations and their subsequent effects of innovations on firm performance. Interactivity has been touted to be critical for new knowledge creation by mobilizing tacit knowledge held by individuals and organizations (Nonaka 1994). The results of the research model show that interactivity positively affects service innovation, process innovation, and organization innovation. We also examine the moderating effect of knowledge types (tacit or explicit) on the relationship between interactivity and innovations. According to the test results, the moderating effect of knowledge type on the relationship between interactivity and innovations is effective only in the case of service innovation, not in the cases of process and organization innovation.

Theoretical Implications

From a theoretical perspective, the proposed model provides several insights into the effect of interactivity on innovations. Our results indicate that firm performance is determined by organization innovation, process innovation, and service innovation in that order. Considering the fact that many studies on innovation have focused on service or product innovation as the major source of growth (Baldwin and Johnson 1996; Deshpande et al. 1993), our results are quite interesting. Intuitively, we may argue that organizational innovation has a wider scope than process and service innovations do; organizational innovation can critically affect firm performance. Future studies need to investigate why organization innovation exerts a greater impact on firm performance than other types of innovation, and in what conditions interactivity affects the different types of innovations described here.

The results of the moderating effect test show that knowledge type affects the relationship between interactivity and innovations only in the case of service (product) innovation. People may perceive service or product innovation as the most complicated because it requires the exchange of tacit knowledge. This may be the reason previous studies on innovation have focused on service or product innovation.

Finally, we propose a three-component-based construct of interactivity including knowledge service standardization, interactive learning, and innovation participation. Knowledge service standardization has the highest loading followed by interactive learning and then innovation participation. The evidence clearly shows that the more standardized the knowledge service is, the easier the customers understand the purpose of the service and accept the service. It is also understandable that interactive learning and innovation participation form interactivity (Howells 2003). Future studies, however, need to investigate whether this is true when the data are collected from customer firms. In addition, future research needs to identify what other factors may contribute to interactivity in the context of knowledge service relationships.

Practical Implications

From a practical perspective, the proposed model can help explain the importance of the interaction of firms with customers to improve their innovation and thus their performance. In particular, firms need to pay attention to the fact that organizational innovation may have more impact on firm performance rather than process and service innovation. In addition, interactivity with customers may promote not only organizational innovation, but also process and service innovation. Hence, firms need to improve the interaction with customers by facilitating their service standardization, encouraging customers' participation in their business processes, and boosting interactive learning with customers.

Limitations and Future Research

It is worthwhile to note some of the limitations of this study. First, we made use of perceptual measures for firm performance. Objective measures of firm performance may reduce method variance and allow more generalizability. However, it is difficult to collect data about the performance of private firms, and also about the performance of a firm on service metrics, rather than financial metrics. Future research can be conducted that utilizes objective measures for firm performance.

Second, because of the nature of this exploratory study, we drew only a single subject from each organization and only focus on one type of firm, KIBS firms. Our results are limited by the extent to which each respondent can accurately assess his/her organization. One can argue that all participants despite of their job positions are fully engaged and responsible for providing services and creating knowledge. Future studies may incorporate measures taken from multiple members of an organization and convert them to organization level, which may provide better insights. Future studies also need to collect data from the customer side so that the results can be compared with the current study.

The thrid limitation concerns the scales used to measure the research constructs. We selectively used the measurement items validated by other researchers to measure the research constructs. Although statistically legitimate, this practice may impair content validity by doing away with some facets of each construct. Future studies should incorporate more facets of each construct to extend the research presented here.

The final limitation relates to the type of knowledge and its interaction effect on the innovation. We focus on tacit and explicit knowledge and their moderating effect of knowledge type on the relationship between interactivity and innovation. Future study may include more types of knowledge such as declarative, procedural, semantic, and episodic knowledge and investigate their potential moderating effects.

Conclusion

The contributions of our research are threefold. First, by coupling our arguments and our empirical findings with extant research, we have helped to refine and bring clarity to the concept of firm interactivity. Specifically, we have described three different dimensions of interactivity: knowledge service standardization, interactive learning, and innovation participation. Second, we have identified three different types of innovations that can emerge from firm interactivity: service, process, and organizational innovations. Third and finally, we have explored the effect of innovation on firms' performance, revealing its positive impact. We believe this work provides useful insights for continuing research into firm interactivity and innovation. We anticipate many opportunities to continue to test and practically apply these ideas.

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References

Alavi, M., and Leidner, D.E. 2001. "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly* (25:1), March, pp 107-136.

Anderson, C. 2006. *The Long Tail*. New York: Hyperion.

Armbruster, H., Bikfalvi, A., Steffen, K., and Lay, G. 2008. "Organizational Innovation: The Challenge of Measuring Non-Technical Innovation in Large-Scale Surveys," *Technovation* (28).

Avlonitis, G.J., Papastathopoulou, P.G., and Gounaris, S.P. 2001. "An Empirically-Based Typology of Product Innovativeness for New Financial Services: Success and Failure Scenarios," *The Journal of Product Innovation Management* (18:5), pp 324-342.

Baldwin, J.R., and Johnson, J. 1996. "Business Strategies in More- and Less-Innovative Firms in Canada," *Research Policy* (25:5), pp 785-804.

Barney, J.B. 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), pp 99-120.

Barua, A., and Mukhopadhyay, T. 2000. "Information Technology and Business Performance: Past, Present, and Future," in: *Framing the Domains of It Management,* R.W. Zmud (ed.). Cincinnatti, Ohio: Pinnaflex Education Resources.

Becerra-Fernandez, I., and Sabherwal, R. 2001. "Organizational Knowledge Management: A Contingency Perspective," *Journal of Management Information Systems* (18:1), pp 23 - 55.

Blind, K. 2006. "A Taxonomy of Standards in the Service Sector: Theoretical Discussion and Empirical Test," *The Service Industries Journal* (26:4), pp 397 - 420.

Chen, A.N.K., and Edgington, T.M. 2005. "Assessing Value in Organizational Knowledge Creation: Considerations for Knowledge Workers," *MIS Quarterly* (29:2), pp 279-309.

Chin, W.W. 1998. "The Partial Least Squares Approach to Structural Equation Modeling," in: *Modern Methods for Business Research,* G.A. Marcoulides (ed.). London: pp. 295-336.

de Vries, E.J. 2006. "Innovation in Services in Networks of Organizations and in the Distribution of Services," *Research Policy* (35:7), pp 1037-1051.

den Hertog, P. 2000. "Knowledge-Intensive Business Service as Co-Producers of Innovation," *International Journal of Innovation Management* (4:4), December, pp 491-528.

Deshpande, R., Farley, J.U., and Webster Jr., F.E. 1993. "Corporate Culture, Customer Orientation, and Innovativeness in Japanese Firms: A Quadrad Analysis," *Journal of Marketing* (57:1), pp 23-27.

Fichman, R. 2000. "The Diffusion and Assimilation of Information Technology Investments," in: *Framing the Domains of It Management,* R.W. Zmud (ed.). Cincinnatti, Ohio: Pinnaflex Education Resources, pp. 105-127.

Fornell, C., and Larcker, D. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* (18:1), February, pp 39-50.

Gadrey, J., Gallouj, F., and Weinstein, O. 1995. "New Modes of Innovation: How Services Benefit Industry," *International Journal of Service Industry Management* (6:3), pp 4-16.

Gallouj, F., and Weinstein, O. 1997. "Innovation in Services," *Research Policy* (26:4-5), pp 537-556.

Grant, R.M. 1996a. "Prospering in Dynamically-Competitive Environments: Oranizational Capability as Knowledge Integration," *Organization Science* (7:4), July-August, pp 375-378.

Grant, R.M. 1996b. "Toward a Knowledge-Based Theory of the Firm," *Strategic Management Journal* (17:Winter Special Issue), pp 109-122.

Han, J.K., Namwoon, K., and Srivastava, R.K. 1998. "Market Orientation and Organizational Performance: Is Innovation a Missing Link?," *The Journal of Marketing* (62:4), pp 30-45.

Hertog, P.d. 2000. "Knowledge-Intensive Business Service as Co-Producers of Innovation," *International Journal of Innovation Management* (4:4), December, pp 491-528.

Hipp, C., Tether, B.S., and Miles, I. 2000. "The Incidence and Effects of Innovation in Services: Evidence from Germany," *International Journal of Innovation Management* (4:4), December, pp 417-453.

Howells, J. 2003. "Innovation and Services: The Combinatorial Role of Services in the Knowledge-Based Economy," *Proceedings of the Conference on New Trends and Challenges of Science and Technology Innovation in a Critical Era* (Taipei), October 30-31, pp 16-22.

Ko, D.G., Kirsch, J., and King, W.R. 2005. "Antecedents of Knowledge Transfer from Consultants to Clients in Enterprise System Implementations," *MIS Quarterly* (29:1), March, pp 59-85.

Lee, H., and Choi, B. 2003. "Knowlege Mangement Enablers, Processes, and Organizational Performance: An Integrative View and Empirical Examination," *Journal of Management Information Systems* (20:1), pp 179-228.

Liu, X.L., and Chen, X.G. 2007. "Service Innovation Mechanism Based on Customer-Employee Interaction," *International Conference on Management Science and Engineering*).

Liu, Y., and Shrum, L.J. 2002. "What Is Interactivity and Is It Always Such a Good Thing? Implications of Definition, Person, and Situation for the Influence of Interactivity on Advertising Effectiveness," *Journal of Advertising* (31:4), Winter, pp 53-64.

Lundvall, B.A. 1997. *National Systems of Innovation, Towards a Theory of Innovation and Interactive Learning*. London: Printer Publishers.

Malhotra, A., Gosain, S., and El Sawy, O.A. 2005. "Absorptive Capacity Configurations in Supply Chains: Gearing for Partner-Enabled Market Knowledge Creation," *MIS Quarterly* (29:1), pp 145-187.

Meeus, M.T.H., Oerlemans, L.A.G., and Hage, J. 2001. "Patterns of Interactive Learning in a High-Tech Region," *Organization Studies* (22:1), pp 145-172.

Michel, S., Brown, S.W., and Gallan, A.S. 2008. "Service-Logic Innovations: How to Innovate Customers, Not Products," *California Management Review* (50:3), pp 49-65.

Miles, I. 2001. "Services Innovation: A Reconfiguration of Innovation Studies," *Policy Research in Engineering, Science, and Technology [Discussion Paper]*).

Miles, I., Kastrinos, N., Bilderbeek, R., Hertog, d.P., Flanagan, K., and Huntink, W. 1995. "Knowledge-Intensive Business Services: Their Roles as Users, Carriers, and Sources of Innovation," *Report to the EC DG XIII Luxembour: Sprint EIMS Programme*).

Nambisan, S., Agarwal, R., and Tanniru, M. 1999. "Organizational Mechanisms for Enhancing User Innovation in Information Technology," *MIS Quarterly* (23:3), pp 365-395.

Nonaka, I. 1994. "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science* (5:1), February, pp 14-37.

Nonaka, I., and Takeuchi, H. 1995. *The Knowledge-Creating Company*. New York: Oxford University Press.

Pavlou, P.A., Housel, T.J., Rodgers, W., and Jansen, E. 2005. "Measuring the Return on Information Technology: A Knowledge-Based Approach for Revenue Allocation at the Process and Firm Level," *Journal of the AIS* (6:7), pp 199-226.

Payne, A.F., Storbacka, K., and Frow, P. 2008. "Managing the Co-Creation of Value," *Journal of the Academy of Marketing Science* (36:1), March, pp 83-96.

Penrose, E.T. 1959. *The Theory of the Growth of the Firm*. New York: Wiley.

Polanyi, M. 1958. *Personal Knowledge*. Chicago: University of Chicago Press.

Polanyi, M. 1966. *The Tacit Dimension*. London: Routledge & Kegan Paul.

Prahalad, C.K. 1999. "Changes in the Competitive Battlefield," in: *Financial Times*. London (UK): p. 1.

Prahalad, C.K., and Ramaswamy, V. 2004. *The Future of Competition: Co-Creating Unique Value with Customers*. Boston, MA: Harvard Business School Press.

Ramamurthy, K., Premkumar, G., and Crum, M.R. 1999. "Organizational and Interorganizational Determinants of Edi Diffusion and Organizational Performance," *Journal of Organizational Computing and Electronic Commerce* (9:4), December, pp 253-285.

Ravichandram, T. 1999. "Redefining Organizational Innovation: Towards Theoretical Advancements," *The Journal of high Technology Management Research* (10:2), pp 243-274.

Schumpeter, J.A. 1934. *The Theory of Economic Development: An Inquiry into Pofits, Capital Credit, Interest, and the Business Cycle*. Cambridge, MA: Harvard University Press.

Scott, J.E. 2000. "Facilitating Interorganizational Learning with Information Technology," *Journal of Management Information Systems* (17:2), pp 81-113.

Song, S., Nerur, S., and Teng, J.T.C. 2007. "An Exploratory Study on Teh Roles of Network Structure and Knowledge Processing Orientation in Work Unit Knowledge Management," *The DATABASE for Advances in Information Systems* (38:2), pp 8-26.

Starbuck, W.H. 1992. "Learning by Knowledge-Intensive Firms," *The Journal of Management Studies* (29:6), pp 713-740.

Tanriverdi, H. 2005. "Information Technology Relatedness, Knowledge Management Capability, and Performance of Multibusiness Firms," *MIS Quarterly* (29:2), June pp 311-335.

Teece, D.J. 1986. "Profiting from Technological Guideposts and Innovation: Implications for Integration, Collaboration, Licensing and Public Policy," *Research Policy* (15), pp 285-305.

Vargo, S.L., and Lusch, R.F. 2004. "Evolving to a New Dominant Logic for Marketing," *Journal of Marketing* (68:1), pp 1-17.

Wernerfelt, B. 1984. "A Resource-Based View of the Firm," *Strategic Management Journal* (5:2), April - June, pp 171-180.

Wernerfelt, B. 1995. "The Resource-Based View of the Firm: Ten Years After," *Strategic Management Journal* (16:3), March, pp 171-174.

Appendix A.

Table A.1. Item Loadings and Cross Loadings

	SI	PI	OI	KSS	IL	IP	EK	TK	FTP
SI1	0.588	0.374	0.326	0.246	0.258	0.199	0.015	-0.110	0.265
SI2	0.825	0.578	0.432	0.465	0.495	0.294	0.457	-0.190	0.432
SI3	0.863	0.506	0.560	0.450	0.606	0.534	0.358	-0.205	0.499
PI2	0.586	0.850	0.476	0.526	0.504	0.226	0.357	-0.181	0.517
PI1	0.597	0.820	0.407	0.500	0.544	0.388	0.280	-0.132	0.462
PI3	0.290	0.714	0.442	0.430	0.402	0.404	0.201	-0.077	0.259
OI1	0.335	0.351	0.575	0.374	0.420	0.310	0.293	-0.169	0.470
OI2	0.492	0.490	0.696	0.417	0.598	0.314	0.427	-0.167	0.395
OI3	0.507	0.533	0.870	0.438	0.574	0.482	0.318	-0.092	0.530
OI4	0.432	0.334	0.683	0.218	0.364	0.310	0.067	-0.018	0.366
OI5	0.482	0.438	0.855	0.392	0.480	0.354	0.405	-0.282	0.496
KSS1	0.411	0.521	0.274	0.800	0.419	0.287	0.337	-0.239	0.448
KSS2	0.334	0.469	0.331	0.831	0.346	0.074	0.364	-0.175	0.469
KSS3	0.432	0.495	0.376	0.782	0.392	0.127	0.303	-0.281	0.599
KSS4	0.458	0.504	0.518	0.794	0.604	0.462	0.370	-0.248	0.564
KSS5	0.442	0.420	0.330	0.845	0.438	0.182	0.374	-0.226	0.528
KSS6	0.386	0.473	0.433	0.420	0.669	0.405	0.476	-0.303	0.525
IL1	0.476	0.434	0.464	0.472	0.807	0.568	0.471	-0.230	0.621
IL2	0.530	0.481	0.473	0.533	0.850	0.553	0.455	-0.267	0.576
IL3	0.577	0.355	0.477	0.214	0.781	0.519	0.392	-0.234	0.451
IL4	0.496	0.499	0.495	0.336	0.822	0.555	0.462	-0.138	0.513
IL5	0.506	0.547	0.613	0.451	0.827	0.492	0.415	-0.072	0.517
IP1	0.435	0.343	0.567	0.209	0.579	0.831	0.501	-0.221	0.365
IP2	0.226	0.370	0.211	0.299	0.434	0.776	0.368	-0.260	0.332
IP3	0.448	0.341	0.425	0.532	0.591	0.501	0.882	-0.425	0.626
EK1	0.271	0.290	0.189	0.253	0.405	0.369	0.882	-0.437	0.312
EK2	-0.252	-0.221	-0.182	-0.285	-0.354	-0.284	0.919	-0.338	-0.314
TK1	-0.165	-0.090	-0.134	-0.262	-0.130	-0.157	-0.421	0.884	-0.296
TK2	0.450	0.460	0.442	0.409	0.580	0.435	0.463	0.919	-0.477
FP1	0.483	0.423	0.503	0.474	0.544	0.350	0.400	-0.287	0.842
FP2	0.371	0.396	0.444	0.495	0.536	0.378	0.443	-0.174	0.826
FP3	0.436	0.328	0.388	0.422	0.460	0.426	0.428	-0.264	0.679
FP4	0.469	0.463	0.423	0.391	0.472	0.413	0.478	-0.383	0.591

Notes:

SI: Service Innovation,

PI: Process Innovation,

OI: Organizational Innovation,

KSS: Knowledge Service Standardization

IP: Innovation Participation

EK: Explicit Knowledge

TK: Tactic Knowledge

FTP: Firm Performance.

Appendix B.

Table B.1. Results of Confirmatory Factor Analysis

Constructs		Items	Factor loadings	S.E.	T-statistic	Composite Reliability
Knowledge Service Standardization		KS1	0.744	0.065	11.478	0.914
		KS2	0.800	0.047	16.999	
		KS3	0.832	0.045	18.617	
		KS4	0.782	0.056	14.084	
		KS5	0.794	0.045	17.773	
		KS6	0.845	0.035	24.263	
Interactive Learning		IL1	0.669	0.073	9.157	0.927
		IL2	0.807	0.045	17.907	
		IL3	0.850	0.031	27.348	
		IL4	0.781	0.062	12.660	
		IL5	0.822	0.049	16.932	
Innovation Participation		IP1	0.754	0.067	11.297	0.831
		IP2	0.831	0.043	19.355	
		IP3	0.777	0.067	11.666	
Service Innovation		SI1	0.588	0.127	4.621	0.808
		SI2	0.825	0.035	23.674	
		SI3	0.863	0.029	29.990	
Process Innovation		PI1	0.850	0.031	27.542	0.839
		PI2	0.820	0.047	17.556	
		PI3	0.714	0.087	8.248	
Organizational Innovation		OI1	0.870	0.027	31.874	0.847
		OI2	0.683	0.086	7.964	
		OI3	0.855	0.043	19.759	
Firm Performance		FP1	0.884	0.030	29.653	0.884
		FP2	0.842	0.041	20.469	
		FP3	0.826	0.045	18.213	
		FP4	0.680	0.080	8.500	
Knowledge types	Explicit knowledge	EK1	0.882	0.025	35.108	0.875
		EK2	0.882	0.025	35.108	
	Tactic Knowledge	TK1	0.919	0.020	46.288	0.916
		TK2	0.919	0.020	46.288	

Appendix C.

Table C. Measurement Items for Principal Constructs

Knowledge Service Standardization (KSS) (Blind 2006; den Hertog 2000; Hipp et al. 2000; Meeus et al. 2001)
KSS1: Our firm provides services repeatedly based on customer requirement.
KSS2: Our firm suggests criteria for helping customers when they evaluate the given service.
KSS3: Our firm implements the system to maintain service quality that customers receive.
KSS4: Our firm provides the service through standardized service process.
KSS5: Our firm provides functionalities to customize services.
KSS6: Our firm makes efforts for customer to receive service anywhere.
Interactive Learning (IL) (Blind 2006; den Hertog 2000; Hipp et al. 2000; Meeus et al. 2001)
IL1: Our firm shares our goals with customers.
IL2: Our firm discusses methods improving our services with customers
IL3: Our firm constantly exchanges or transfers knowledge, information and skills to customers
IL4: Our firm shares new ideas with customers for improving service.
IL5: Our firm occasionally contacts customers in order to get their feedback.
Innovation Participation (IP) (Blind 2006; den Hertog 2000; Hipp et al. 2000; Meeus et al. 2001)
IP1: Our firm supports customers to make them suggest innovation methods
IP2: Our firm drives customers to participate in designing service process
IP3: Our firm makes a mechanism that drives for customer to participate in evaluation process
Service Innovation (SP) (Armbruster et al. 2008; Avlonitis et al. 2001; Ravichandram 1999)
SI1: Our firm develops new service based on customer requirement
SI2: Our firm launches the competitive or new service
SI3: Our firm provides new service by combining components in existing services
Process Innovation (PI) (Armbruster et al. 2008; Avlonitis et al. 2001; Ravichandram 1999)
PI1: Our firm always adopts and develops new service delivery process.
PI2: Our firm always introduce new service design process.
PI3: Our firm always changes following-up process for service.
Organizational Innovation (OI) (Armbruster et al. 2008; Avlonitis et al. 2001; Ravichandram 1999)
OI1: Our firm has implemented new or changed organizational structures for providing better services.
OI2: Our firm makes the organizational structure be changed through new technology.
OI3: Our firm changes the organizational structure for effectively exchanging information, knowledge and skills.
OI4: Our firm introduces significant changes in relations to other firms such as alliances, partnerships, outsourcing and sub-contracting
OI5: Our firm changes organizational structure with the introduction of a new service
Tacit Knowledge (TK) (Miles 2001; Nonaka 1994)

TK1: The extent to which our firm has trouble to sufficiently explain or transfer knowledge to customers
TK2: The extent to which it is difficult to apply knowledge as means of writing such as report, manual etc within our firm
Explicit Knowledge (EK) (Miles 2001; Nonaka 1994)
EK1: The extent to which knowledge related to interaction with customers such as task, method, function, is documented in our firm.
EK2: The extent to which our firm changes knowledge into formal form for delivering e-mail, report, manual to customers
Firm Performance (FP) (Armbruster et al. 2008; Hipp et al. 2000)
FP1: Our firm makes profit through service.
FP2: Our firm increases market share through service.
FP3: Our firm obtains higher competitive advantage through service.
FP4:Our firm increases sales through service.