The Effect of Interactivity between Knowledge Intensive Business service (KIBS) firms and Customers on Innovations in KIBS Firms

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Abstract

It is now well established that innovation and knowledge management can improve firm’s performance. However, questions like what kind of factors affect the innovations and how knowledge is related to innovation remain largely uninvestigated. In this study, we partially examine what is the key factor for facilitating innovations and how this factor is formed in the case of Knowledge Intensive Business Services (KIBS) firms. The innovation in services is often the result from a collaborative process between KIBS firms and client firms. We examine the role of interactivity in shaping innovations in KIBS firms and subsequent impact on firm performance. We collected data from 91 IT Service Management firms through the survey method. The results show that interactivity may be a significant indicator of innovation within KIBS firms. This study provides a blueprint to further investigation of the critical role of service in service science perspectives.

Keywords: Knowledge intensive business service, interactivity, service innovation, process innovation, organization innovation

1. Introduction

Service industries have expanded rapidly in recent decades and now account for more than 70% of total value added in the OECD countries. Among the service industries, information technology (IT) service industry is one of the fastest growing industries where $3.7 trillion was spent worldwide on IT in 2007, with continued growth anticipated through at least 2011 [40]. The sheer amount of investment in information technology plays an important role in changing the economic paradigm from product-based to service-based economy.

In the service-based economy, knowledge and skills are the most important resources for competitive advantage [2][18]. To obtain necessary knowledge or skills, companies invest a lot of resources or rely on knowledge-intensive business service (KIBS) firms that are regarded as the source of knowledge. KIBS firms support customers to solve their problems or facilitate innovation processes. During the process, KIBS firms may acquire specific domain knowledge or skills about the client firms and the industry, accumulate the knowledge within their organization, and modify their existing knowledge to create new knowledge [16]. In the IT service market, KIBS firms such as IT consulting firms and solution providers evolve to provide customers with integrated solutions incorporating a variety of services to meet customer requirements. IT leaders facing huge challenges in terms of IT investment and technological changes want to understand the relationship between IT investment or innovation and productivity [5][22]. Answering the question of the relationship between technological innovation or IT investment and productivity, however, requires in-depth expertise and knowledge in business models as well as information technology, which may be provided by KIBS firms.

In the sense, understanding the core mechanism of knowledge creation in KIBS firms and its impact on innovation is important. In spite of the importance of the role of KIBS firms in IT investment and service innovations, previous studies did not address the questions about the process of how service innovation in KIBS firms affect their performance still remain, or what are the effects of different knowledge on the innovation processes. To investigate this issue of causality, we draw upon the dynamic theory of knowledge creation proposed by Nonaka [30] and hypothesize the positive causal relationship between a dynamic process, i.e., interactivity in this study, and different innovations, and their impacts on firm performance.

The purpose of this study is to investigate the effect of the interactivity that KIBS firms have with their customers on various types of innovations in KIBS firms and firm performance. Interactivity has been touted to be the most important starting point for and the basis of service innovations [27][34]. This study also examines the effect of knowledge types (tacit or explicit) on the relationship between interactivity and service innovation. To this end, this
study identifies the factors forming the construct ‘interactivity’ that KIBS firms develop to have their customers join in their activities.

By coupling our arguments and our empirical findings with extant research into IT business value, we are able to make three contributions to IS literature. First, we help bring clarity to the concept of interactivity by examining three different dimensions. As we investigate a survey-based dataset, we find support for positive impacts from three sources of interactivity. Second, we identify three different types of innovations. We provide another insight how we view innovation in a new service paradigm. Third, we examine the effect of innovation on firms’ performance. Our investigation reveals the positive impacts of innovation on the performance.

The paper proceeds as follows. We begin with a review of literature, where we describe the perspective of service and knowledge. We then hypothesize the relationships among the research variables. The methods section describes the data, variables, and the measurement of those variables. In the results section, we note strong support for our hypotheses. In the discussion section, we highlight that our empirical results. We also note theoretical and practical contributions. The limitations of our study, and potential directions for future research appear in the discussion section as well.

2. Literature Review

The importance of IT as a component of corporate strategy has been of interest to business researchers for decades [19]. Previous studies argue that IT may improve customer service, change distribution channels, help develop new products, create new business models, and change industry dynamics [19]. Some have argued, however, that the growing ubiquity of IT means that its’ strategic importance is diminishing and that IT is, in fact, becoming merely a commodity [7]. This argument reveals that IS scholars investigate the effect of IT on performance in a different angle. We argue that one of importance aspects is service, which couples with IT.

Traditionally, service has been viewed as the production of units of output in terms of an add-on to the core good or as a residual [24]. In a new paradigm of service, service can be defined as the application of specialized competences (knowledge and skills) for the benefit of another entity, rather than the production of units of output [24]. According to this view, KIBS firms provide clients with service using their specialized knowledge and skills. Hence, the critical issue for the success of KIBS firms is how they can obtain or create the necessary knowledge and skills to serve customers. Nonaka [30] explains that knowledge creation is accomplished through four mode of knowledge conversion (socialization, externalization, combination, and internalization). In the core of these four modes of knowledge creation, interactivity lies. Socialization refers to the interaction or exchange between tacit knowledge and tacit knowledge, while externalization and internalization indicate the interaction between tacit knowledge and explicit knowledge. Combination is about the interaction between explicit knowledge and explicit knowledge. Human actors participate in the interactions, learn new knowledge, and sometimes standardize the knowledge necessary to provide services [31]. The knowledge created through the phases leads to service, process, and organization innovations [31][32].

2.1 Knowledge Intensive Business Service

Knowledge intensive business service (KIBS) refers to a wide range of knowledge services to client firms for generating value [16]. Hertog [16] defines KIBS firms as private organizations that rely heavily on professional knowledge related to a specific (technical) discipline or (technical) functional domain to produce intermediate products and services. Many IT services firms fall under this category. KIBS firms, in particular IT service firms and consulting firms, as service providers make a joint effort with client firms to solve problems during the project. This can be viewed as a process of co-production of value. Accordingly, the quality of the service depends on the nature of the interactivity [16]. KIBS firms play three important roles [38]. First, they renew and innovate on the existing knowledge through the interaction between the processes of knowledge creation, application, and preservation so that the renewed knowledge can be applied to the new project. Second, they convert the flow of information into the stock of knowledge. Basically knowledge is not flow but stock [38]. In the interaction, 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. In other words, KIBS firms bridge general knowledge they have and specialized knowledge client firms possess to facilitate innovations in client firms [25]. Third, a KIBS firm becomes a single source of knowledge to its client firms. A KIBS firm has various functions with their own specialized knowledge regarding project management and management tools. It combines the relevant pieces of knowledge for client firms and delivers the
knowledge as a whole to the client firms [38]. The effectiveness of performing the three roles of a KIBS can be determined their own innovations in knowledge that relies on the quality of the interaction between KIBS firms and customers [25].

2.2 Interactivity: Dynamic Process

In recent years, the meaning of the innovation has been evolved to include the non-technological nature of service innovation. According to an OECD report [32], the innovation is not limited to changes in the product’s characteristics. It also includes changes in the service delivery process and client interface. Jong, et al. [20] summarize service innovation as 1) a development of new service products, 2) a new offering through additions to the existing service or changes, and 3) encompassing ideas, practices or objects which are new to the organization. This definition connotes that service innovation embraces all creative activities about service offerings or relevant to service offerings [23]. Hipp, et al. [17] categorize the type of service innovation into service (product) innovation, process innovation, and organization innovation. Service (product) innovation involves the introduction of new concepts and addition of new features to existing services, while process innovation relates to the adoption of new service production, delivery, maintenance, and monitoring processes. Organization innovation concerns the introduction of a new organization structure or a new way of performing work.

Many studies emphasize the importance of customers in innovation process as a key driver. For example, Liu and Chen [23] suggest that the key characteristic of service innovation is the tight interaction between service supplier and customer. Previous studies [16][27][34] also argue that service innovation often emerges as a result of co-production between service providers and their customers. In sum, interactivity is a dynamic learning process.

In this perspective, KIBS firms are benefited from the active interaction with customers to learn new practices and create knowledge that leads to their own innovations. This learning process is facilitated by standardizing knowledge service for customers to easily accept, making mutual learning possible, and having customers participate in the business processes of KIBS firms [16][18][25]. That is, standardizing knowledge service contributes to building common knowledge base. In this sense, Knowledge service standardization is the extent to which the knowledge services KIBS firms provide to customers are standardized [28]. Standardization of knowledge services may result from the frequent interactions between KIBS firms and customers for KIBS firms to make the purpose of the services easily understood and accepted by customers [28]. In its extreme form, the standardized knowledge services can be routinized so that the service can be delivered even without directives or guidance [15][17].

Interactive learning represents how well KIBS firms and customers can exchange their knowledge with each other [25][28]. In this sense, interactive learning represents the two-way learning between KIBS firms and customers that allows both sides to communicate and combine their knowledge and create new knowledge and innovations [16][21][30]. In particular, KIBS firms that possess general knowledge can benefit from the exchange to build domain knowledge and innovate their systems to better support their customers [25].

Innovation participation also constitutes interactivity. Innovation participation represents the degree to which KIBS firms allow customers or client organizations to take part in creating service innovations in KIBS firms [18]. Traditionally, KIBS firms have been the source of the innovations for client organizations and client firms have been passive recipients of the innovations. Recently, however, the participation of client firms in service provisions is regarded as critical for successful knowledge creation and thus service delivery.

2.3 Knowledge Type and Its Effect

Hertog [16] suggests four discriminating dimensions of knowledge: tangible versus intangible knowledge, human embodied versus non-human embodied knowledge, explicit/codified knowledge versus tacit/non-codified knowledge, and contractual versus non-contractual knowledge. Knowledge can be divided by its tangibility. Tangible knowledge includes books, software, and other forms written in document. Intangible knowledge includes expert skill, communication skill, expertise, etc. Human embodied knowledge is the knowledge that is accumulated in human brains through experience so that the transfer of this type of knowledge requires a face-to-face interaction between KIBS firms and client firms. Disembodied knowledge is typically written down or incorporated in capital goods. Both human-embodied knowledge and disembodied knowledge are important for service innovation. Non-human embodied knowledge in cases works in combination with human-embodied knowledge. Explicit or codified knowledge like tangible knowledge is the knowledge in a written form and can be readily transferred, while tacit knowledge is hard to articulate in the written form and difficult to
transfer. The two forms of knowledge interact with each other to create new knowledge in the knowledge creation process that provides the source of innovation [30]. Finally, contractual knowledge means the knowledge provided to client firms by KIBS firms as determined in the contract, while non-contractual knowledge indicates the knowledge transferred through the close relationship between KIBS firms and client firms beyond the contract. Non-contractual knowledge can be easily spilled over to client firms when KIBS firms have a steady relationship with client firms.

Although the above discussed terms of knowledge vary, knowledge can be grouped into tacit and explicit regardless of its representational forms [31]. Accordingly, we categorize the type of knowledge into tacit and explicit knowledge to examine the effect of knowledge type on the relationship between interactivity and service innovation. Each type of knowledge may have a differential effect on the relationship between interactivity and innovations [37]. 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 [16]. This is primarily because each type of innovation may require different levels of communication and knowledge representation. Consider the case of Toyota production system. Many American companies have made visits to Toyota to learn the lean production system. They actually applied the knowledge they learned from the benchmarking process to their own company. Few of them have accomplished the purposed goals. This is the typical failure in applying tacit knowledge to organizational innovation. On the contrary, if a company obtains the knowledge about a product or service, it can easily replicate the product or service through reverse engineering even in the case the knowledge is in the hidden form. The reason is that organization level or process level knowledge is situated in the context so that the knowledge cannot be easily extracted [15].

3. Research Model and Hypotheses

In this study, we develop hypotheses drawing upon the previous sections as shown in Figure 1.

Recent studies emphasize the importance of the interaction with customers as the basis for co-creation of value in service provision [27][33][34]. Payne, et al. [33] suggest that there are three area of value co-creation including innovating customer value creation process, supplier value creation process, and encounter process. Among these areas, they argue that the supplier value creation process can be enhanced through adding technological breakthroughs, utilizing industry logic changes, and supporting the changes in customer preferences. The three ways of innovating services are all related to enhancing the co-value creation processes.

Michel, et al. [28] suggest that the innovation of value creation processes of firms can be done through using smart offerings, integrating value creating processes, and devising value constellation. Each of the innovations can be respectively matched with service (product) innovation, process innovation, and organization innovation we suggest in this paper [17]. Service innovation involves the innovation in service content and/or service products, while process innovation concerns the innovations in service provision processes, i.e., value creation process of KIBS firms. Organization innovation relates to the innovations in organization structure and systems to provide better services to customers. All these innovations are facilitated through the interaction with customers [28]. Accordingly, we argue that the interactivity with customers leads to innovations in KIBS firms because they acquire enhanced knowledge about best practices and accumulate domain knowledge [34].

Interactivity is formed by three components; knowledge service standardization, interactive learning, and innovation participation [17][28]. Knowledge service standardization helps customers understand the purpose and the forms of the service given by KIBS firms. Knowledge service standardization enables customers to readily accept the service and easily interact with KIBS firms when
there is any problem with the service. During the process of the standardization of knowledge service, KIBS firms may incorporate knowledge to build new service products, or devise a set of service processes to help customers with switching from other firms to them. Or KIBS firms may totally change their organization forms to make a single contact point with customers. Similarly, KIBS firms through interactive learning with customers and customer participation in their service innovation may acquire knowledge about customer preferences and changes in the environments. Therefore, we hypothesize that

Hypothesis 1a: Interactivity positively affects service innovation.
Hypothesis 1b: Interactivity positively affects process innovation.
Hypothesis 1c: Interactivity positively affects organizational innovation

3.2 The effect of knowledge types between interactivity and service innovation

We categorize knowledge into tacit and explicit following Nonaka and Takeuchi [31]. Each type of knowledge may have a differential effect on the relationship between interactivity and innovations, because each type of innovation may require different levels of communication and knowledge representation [37]. In general, when the degree of interactivity is same, tacit knowledge is critical for most of innovations [16]. However, there might be some other cases that even in the presence of high interactivity, if the knowledge exchanged is mostly tacit, organizational innovation may be hampered. But in general, tacit knowledge is more difficult to obtain and exerts more influence on innovations [30][31]. Hence, we argue that when KIBS firms rely more on tacit knowledge during the interaction with customers, the effect of interactivity on the innovations becomes stronger than when KIBS firms rely more on explicit knowledge.

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

3.3 Service innovation on firm performance

The positive relationship between innovations and firm performance has been reported in a number of empirical studies [4][12][14]. Although not focusing on service innovation, Schumpeter [36] identifies five areas of innovation (product innovation, process innovation, market innovation, input innovation, and organization innovation) and argues that innovation is the driving force of firm growth. Deshpande, et al. [12] examine the factors affecting the organizational performance among Japanese firms and find that innovativeness is an important factor for the performance. Baldwin and Johnson [4] also show the significant impact of innovation on a wide variety of business performance measures. Also, in the service context, Gadrey et al. [14] find that financial service innovations consisting of product innovation, process innovation, and organization innovation positively affect firm performance. Accordingly, we argue that all three innovations positively influence firm performance.

Hypothesis 3a: Service innovation positively affects firm performance.
Hypothesis 3b: Process innovation positively affects firm performance.
Hypothesis 3c: Organizational innovation positively affects firm performance.

4. Research Methodology

4.1 Sample and Data

To test our research model and hypotheses, we employed the survey method. We developed a survey questionnaire by modifying items from previous studies and creating new items if it is necessary. The company list of 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**

<table>
<thead>
<tr>
<th>Profile Category</th>
<th>Number of Respondents</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>20</td>
<td>22.0</td>
</tr>
<tr>
<td>31-40</td>
<td>39</td>
<td>42.9</td>
</tr>
<tr>
<td>41-50</td>
<td>33</td>
<td>34.1</td>
</tr>
<tr>
<td>51 or greater</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>73</td>
<td>80.2</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>18.7</td>
</tr>
<tr>
<td><strong>Respondent position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEO/ Senior manager</td>
<td>6</td>
<td>6.6</td>
</tr>
<tr>
<td>Mid-level manager</td>
<td>33</td>
<td>38.3</td>
</tr>
<tr>
<td>Professional</td>
<td>16</td>
<td>18.6</td>
</tr>
<tr>
<td>Supervisor</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Clinical</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td>Administrative</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Production</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>etc</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td><strong>Industry type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT Services</td>
<td>45</td>
<td>50.5</td>
</tr>
<tr>
<td>Finance/ Insurance</td>
<td>19</td>
<td>20.9</td>
</tr>
<tr>
<td>Communications</td>
<td>17</td>
<td>18.7</td>
</tr>
<tr>
<td>Banking</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td>Construction</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Education</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Medical Service</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Firm Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>15</td>
<td>16.7</td>
</tr>
<tr>
<td>Medium</td>
<td>37</td>
<td>40.7</td>
</tr>
<tr>
<td>Small</td>
<td>36</td>
<td>39.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>91</td>
<td>100%</td>
</tr>
</tbody>
</table>

### 4.2 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 measure given by Hipp, et al. [17] and Blind [6]. We used the items that were developed and validated by Marius, et al. [26] to measure interactive learning. The items relate to the degree of interactive learning with customers and suppliers. Innovation participation was measured by adapting the scales from Hertog [16] which concern the customers’ participation in innovation.

The items for service innovation, process innovation and organizational innovation were adapted from the previous innovation studies [1][3][10][17][35]. The items for knowledge type were adapted from tacit and explicit knowledge measures proposed by Miles, et al. [29]. We measured tacit and explicit knowledge separately and reverse-coded explicit knowledge to combine both measures together. Finally, the items for firm performance were adapted from Chen and Tsous [10] and Hipp, et al. [17]. For all measurement items, the 5 point Likert scale was used, anchored by “strongly disagree” and “strongly agree.” Table 2 reports the variables and the characteristics of measurement items.

**Table 2. Constructs and items**

<table>
<thead>
<tr>
<th>Constructs</th>
<th># of Item</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge service standardization</td>
<td>6</td>
<td>[6][16][17][26]</td>
</tr>
<tr>
<td>Interactive learning</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Innovation participation</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Service innovation</td>
<td>3</td>
<td>[2][3][10][17]</td>
</tr>
<tr>
<td>Process innovation</td>
<td>3</td>
<td>[35]</td>
</tr>
<tr>
<td>Organizational innovation</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Tacit knowledge</td>
<td>2</td>
<td>[29]</td>
</tr>
<tr>
<td>Explicit knowledge</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Firm performance</td>
<td>4</td>
<td>[2][10][17][39]</td>
</tr>
</tbody>
</table>

### 5. Result

#### 5.1 Data Analysis

Data analysis was performed using the partial least squares (PLS). Unlike covariance-based approaches, the PLS requires minimal demands on measurement scales, sample size, and distributional assumptions [8].

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.

#### 5.2 Measurement model: Reliability and Validity

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 [13]. Furthermore, the square roots of the shared variance between the constructs were higher than the correlations across constructs, thus supporting discriminant validity [13]. 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.

#### 5.3 Structural Model Test

Data analysis examines the significance and
strength of each of our hypothesized effects and the results are shown in Figure 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 3, all path coefficients are over 0.1 satisfying both conservative criteria and the suggested lower limit. They are also statistically significant at p<0.001, 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 R² values for constructs in the structural model show that this

### Table 3. Reliability measures for model constructs and construct correlation

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach’s α</th>
<th>AVE</th>
<th>STN</th>
<th>IL</th>
<th>IP</th>
<th>SI</th>
<th>PI</th>
<th>OI</th>
<th>FP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardization (STN)</td>
<td>.89</td>
<td>.64</td>
<td>(.80)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interactive learning (IL)</td>
<td>.89</td>
<td>.71</td>
<td>.46</td>
<td>(.84)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation participation (IP)</td>
<td>.78</td>
<td>.70</td>
<td>.26</td>
<td>.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service innovation (SI)</td>
<td>.72</td>
<td>.64</td>
<td>.42</td>
<td>.40</td>
<td>.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process innovation (PI)</td>
<td>.76</td>
<td>.68</td>
<td>.55</td>
<td>.45</td>
<td>.34</td>
<td>.55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational innovation (OI)</td>
<td>.87</td>
<td>.66</td>
<td>.52</td>
<td>.61</td>
<td>.44</td>
<td>.40</td>
<td>.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm performance (FP)</td>
<td>.86</td>
<td>.71</td>
<td>.49</td>
<td>.57</td>
<td>.34</td>
<td>.39</td>
<td>.49</td>
<td>.51</td>
<td>(.84)</td>
</tr>
</tbody>
</table>

*Table 3. Reliability measures for model constructs and construct correlation*

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**Figure 2. The estimated model (Main effect)**

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**Figure 3. The estimated model (Moderating Effect)**
model can be used to predict the effect of interactivity on innovations and firm performance.

We also conducted an additional test by considering 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. (A detail result in available upon request)

We further tested the moderating effect of knowledge type on the relationship between interactivity and innovations. We found that knowledge type does have any direct effect on innovations and only in the case of service (product) innovation, it has the interaction effect. 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). (The results for the analysis are available upon request)

6. Discussion and Conclusion

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. We focus our attention on KIBS firms due to their vital role as a new value creator in the service-based economy. Interactivity has been touted to be critical for new knowledge creation by mobilizing tacit knowledge held by individuals and organizations [30]. The results of the research model show that interactivity positively affects on service (product) 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.

Prior to further discussing the implications of the current research, it is worthy of noting some limitations of this study. First, we made use of subject measures for firm performance. This is reasonable when it is very hard to collect data about the performance in the major market and overall performance. However, objective measures of firm performance may reduce method variance and allow more generalizability. Future research is desired to utilize objective measures for firm performance using mixed method. Second, by the nature of this exploratory study, we draw a single subject from each organization and only focus on KIBS firms. Our results are limited by the extent that each respondent can accurately assess his/her organization and can be interpreted from the perspective of KIBS firms. One can argue that all participants despite of their job positions have fully engaged and responsibility in providing services and creating knowledge. We conducted an extended analysis with considering data from senior managers. The evidence shows that there is no significant difference. However, future studies may incorporate measures taken from multiple members of an organization and convert them to organization level, which may provide a better insight. Future studies also need to collect data from customer side so that the results can be compared with the current results. The third 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 study 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 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 moderating effect.

From a theoretical perspective, the proposed model provides readers with several insights into the effect of interactivity on innovations in KIBS firms. Our results indicate that firm performance is determined by organization innovation, process innovation, and service innovation in that order. It is quite an interesting result when considering the fact that a lot of studies on innovation have focused on service or product innovation as the major source of growth [4][12]. Intuitively, we may argue that organization innovation has a wider scope than process and service innovations do so that it can critically affect the firm performance. Or when KIBS firms invite their customers to join their innovation processes, they may already devise new systems for work which readily affect firm performance. Future studies need to investigate why organization innovation exerts more impact on firm performance than other types of innovation and in what conditions interactivity affects innovations more.
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 is the most complicated so that it requires the exchange of tacit knowledge. This may be the reason previous studies on innovation have focused on service or product innovation too. 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 [16]. 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 [18]. Future studies, however, need to investigate this is true when the data are collected from customer firms. In addition, future research needs to identify what other factors may form the concept of interactivity in the context of knowledge service relationship.

From a practical perspective, the proposed model can give rise to the importance of the interaction of KIBS firms with customers to improve their innovation and thus their performance. In particular, KIBS firms need to pay attention to the fact that organization innovation may have more impact on firm performance rather than process and service innovation in the knowledge service context. In addition, interactivity with customers may be conducive to not only organization 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 up interactive learning with customers.

7. References


