The Impact of Exporting on Innovation in the Service industry: Evidence from Korea

Jaeho Lee
POSTECH

Ji-Hwan Lee
KAIST

Baeho Choi
POSTECH

ABSTRACT

Globalization of business environment has made it very important for firms to expand internationally in the pursuit of foreign market opportunities beyond national boundaries so as to gain and sustain competitive advantage. Exporting is a predominant entry mode a firm selects when it expands internationally. In this paper, we examined the impact of exporting on the production, process and organizational innovations of Korean service firms. The features of service industry that differ from manufacturing industry were expected to strengthen the relationship between exporting and innovation. A higher level of knowledge spillover and a greater tendency of knowledge sourcing from external parties may promote innovation in the process of exporting services to a foreign country. Furthermore, market and technology information acquired through exporting is expected to be incorporated into production design and function. The more successful exporting firms are more likely to improve their service-providing processes as well as their product qualities, using information about foreign customers and their needs. In this process, exporting service firms will re-create their organizational structures so that 'learning by exporting' may be facilitated. Based on discussions centering round these points, we hypothesized that the higher the level of export in a service firm is, the more innovation activities would be conducted in each area of innovation. Implementing logistic regressions using the 2006 Korean Innovation Survey data, we found a significantly positive association of Korean service firms' exporting with product innovation and organizational innovation. However, our data did not support our hypothesis on the relationship between exporting and process innovation.

I. INTRODUCTION

Globalization of business environment has made it very important for firms to expand internationally in the pursuit of foreign market opportunities beyond national boundaries so as to gain and sustain competitive advantage (Aulakh, Kotabe et al. 2000). Multinationals around the globe make an attempt to look for new market, investment and sourcing opportunities, and, along with this, firm from emerging markets are also endeavoring to exploit these opportunities in this increasingly integrated global marketplace in recent years. The international expansion of firms begins when firms produce in the home country and export goods to foreign markets. With increased market knowledge and willingness to commit more capital into foreign expansion, exporting evolves into licensing or foreign direct investment (FDI), following the patterns prescribed by internationalization theories (Vernon 1966; Johanson and Vahlne 1977; Vernon-Wortzel and Wortzel 1988). Despite the fact that the exporting is the initial international expansion mode, it is still the predominant form of international expansion. For example, while US firms exported $2.1 trillion of good and services in 2006, its outward FDI amounted to $222 billion, which was about only one-tenth of exporting volume (UNCTAD 2007; US Bereau of Economic Analysis (BEA) 2007; UNCTAD 2008). Especially, given that a majority of firms from emerging markets are still in the early stages of the internationalization process, exporting remains the prevalent mode of their foreign market entry in these countries. For instance, in 2006, the merchandise and service values exported by Chinese firms amounted to 1.3 trillion, while the outward FDI value in China was only $0.22 billion (UNCTAD 2008; World Trade Organization 2008).

It is generally accepted that firms engaging in exporting gain a benefit by improving the whole level of management through “learning by exporting”. Learning by exporting is driven by information exchange from the foreign market, often via export intermediaries or directly from customers (Salomon and Shaver 2005; Salomon and Jin 2008). Grossman and Helpman (1991, 1993) argue that bi-directional exchange of knowledge across firms engaging in trade is promoted, because exporting firms are exposed to knowledge inputs which are not available to firms whose operations are limited to the domestic market. For example, exporters may derive a benefit from the technological expertise of their buyers (Clerides et al., 1998). Moreover, exporting firms may extract valuable information about consumer product preferences and competing products by interacting with foreign agents (Salomon and Share, 2005). The knowledge and information obtained in foreign countries can be used to promote innovation of the exporting firms.

While the potential strategic importance of exporting on innovation can be equally emphasized both in service and manufacturing industries, there are some areas where service industry can obtain greater benefits through exporting. Innovation in service industry is different+ from that in manufacturing industry. Typically, firms engaging in services do not

have R&D departments which require tangible and specific resources and in many cases service innovations are not the direct outcome of *a priori* innovation planning. Innovations often become visible in the process of service provision while dealing with customer needs and feedback and they are recognized as innovations only *a posteriori* (Toivonen and Tuominen, 2008). Furthermore, the resources and capabilities that service firms require for service innovation in the internationalization context tend to be 'intangible' and embedded in human factors rather than in physical R&D elements. A high degree of contact between service provider and host-country client requires the service firm to establish local branches and to relocate key personnel who are able to deal with significant cultural differences (language, customs and formal and informal communication symbols) (Patterson, 2004). While more radical and tangible innovations tend to be seen as the conspicuous types of innovation in manufacturing industry, incremental and less tangible innovations are acknowledged as innovations in service industry. As such, the role of everyday business activities, especially through customer contacts and market agencies, is emphasized as the sources and drivers of innovations (Schienstock and Hamalainen, 2001). Moreover, it is sometimes difficult to classify products, processes and organizational innovations clearly in service industries, as services tend to be embedded in products and processes simultaneously. This 'fuzziness' of service outputs and operations makes it more complicated to spot an innovation in a service than in a manufactured good. (Trovinen and Tuominen, 2008). Along with this, innovation in service industry is more variable and difficult to measure than it is in manufacturing industry, because personnel play a key role in the production of services (e.g. management consulting assignments, project management, live concert management etc.) (Patterson, 2004). In the service industry, where the primary sources of innovation are the implicit knowledge embedded in the workforce, the standardization of service is hard to achieve. It is sometimes difficult to control the quality of service and to assess service innovation in a foreign branch. A firm may need to bear the costs of recruiting and training local personnel to maintain its service quality and may find it difficult to estimate how much service is improved as a result of this endeavor.

In this paper, we analyze what impact learning by exporting has on innovation in service industry using the data from Korean service firms which engage in exporting. In the next two sections, we briefly review the existing research on the general impact of exporting on innovation and kinds of impact that may be more specific to service industry, and we formulate hypotheses. Section IV describes the data and provides the methodology that we employ to test our hypotheses. Section V documents the empirical results and the final section concludes the paper.

II. INNOVATION BY EXPORTING IN SERVICE INDUSTRY

The value and volume of international trade continues to increase. As of 2007, world manufactured-goods exports are about $9.2 trillion and service exports are around $2.1 trillion (WTO, 2008). Trade in services accounts for some 20% of total world trade. While manufactured goods have dominated world trade over time, the importance of trade in services is growing for many nations, especially for the industrialized nations. Services account for around 60% of GNP in industrialized nations. In Singapore, exports comprise 69% of total service production, while most European countries export between 10% and 20% and the USA exports around 5% (Patterson, 2004).

The globalization of business and progress in technology offer a service firm an enhanced opportunity to expand for growth and for value creation in international trade. As a lot of researchers already pointed out, there are several key dimensions of service industry: high levels of intangibility, inseparability, heterogeneity, perishability and regulation, as summarized by Goerzen and Makino (2007). Especially, in terms of internationalization of a service firm, the characteristics of inseparability which requires many services to conduct simultaneous production and consumption has been known to make it necessary for it to have a local facility through FDI (Capar and Kotabe 2003). This indicates that a service firm may not follow a progressive evolution as suggested by internationalization theory but make considerably higher investments through FDI from the very beginning when it makes an initial expansion abroad (Boddewyn, Halbrich et al. 1986). However, as is anecdotally well-known, globalization and progress in information technology over the years have enabled service firms to unbundle the production and consumption of service activities and to undertake each activity in the international market place (Braga 1996). Increasing sourcing activities from a foreign provider in information-intensive or knowledge-based industries (such as professional and technical services, banking and financial services, health care, education) made the ‘separability’ of production and consumption in the service industry a reality and resulted in the growing tradability of services through exporting. However, while a substantial body of research confirms the effect of knowledge spillovers between a parent company and a subsidiary through FDI, does the exporting that does not engage in cross-border investment bring the same kind of effect so that an exporting service firm can gain access to knowledge embedded in a foreign market and spills it back to home country? Compared to abundant research about links between FDI and innovation, relatively less research has been done concerning the relationship between exporting and innovation, but we find that, more recently, several works which attempted to explore the latter relationship argue that the exporting companies leverage technologies acquired abroad to promote their innovation in home countries. Firms that are exposed to diverse knowledge in foreign markets via exporting are influenced by the flow of that knowledge and experience the innovation in any area of firms’ operation (Salomon 2006).

Service firms not only increase their sales and improve their profitability by exporting, but also accumulate a wide range of knowledge and experiences in the process of selling their services (Trofimenko, 2008; Burpitt et al 2000; McGarvie et al 2003). The intense competition with which a service firm is faced in internationalizing its business encourages the firm to learn extensively from exporting by extracting more technical and non-technical knowledge and gaining hands-on experiences dealing with host-country market condition as a whole. The internationalization of firms exposes them to unusual customers and competitors and to diverse sets of cultures, institutional rules, norms and regulations (Eriksson et al, 2000). More successful firms strive to learn from internationalization through exporting by actively seeking knowledge about international markets, potential opportunities and threats from clients and competitors as well as issues of operation management in a new environment (Craig and Douglas, 1996). Differences in the technological and regulatory environment also affect firms' technological learning and strengthen their motivation to learn about and absorb new technology (Nakata and Sivakumar, 1996).

A current debate among international business scholars concerns the extent to which MNCs engaged in the delivery of services are different from those involved in manufacturing. Several scholars have suggested that the international expansion strategies of service MNCs may differ from those of manufacturing MNCs, because of the unique characteristics of service industries (e.g., Habib and Victor, 1991; Li, 1994; Aharoni, 1996; Aung and Heeler, 2001; Capar and Kotabe, 2003). Although current theories of FDI and the MNC may have broad applicability to the service industry, several scholars have cautioned that this must be done with extreme caution (e.g., Boddewyn et al., 1986; Aharoni, 1996).

Sharma and Johansson (1987) provided some evidence of the difference between service and manufacturing MNC internationalization in their examination of the internationalization of two Swedish technical consultancy firms. Their results indicated that manufacturing MNCs are less mobile and versatile, given that their typically large fixed asset investments in a particular location create a significant and specific commitment to the manner of production. In contrast, the market specificity of service MNC investments is relatively low as the production of many services can therefore be moved rapidly, and at comparatively low cost. Similarly, in a study of multinational insurance firms Katrishen and Scordis (1998) suggested that service firms are liable to suffer from diseconomies of scale as multinationality increases. Part of the reason that underpins this finding may be the greater local adaptation that is required of service firms compared with manufacturers (Patterson and Cicic, 1995; Knight, 1999).

While the positive relationship between a firm's exporting and its innovations is expected to be found in any type of industry, we focus our attention on the service sector in this study. We conjecture that a couple of characteristics of service industry (as described below in comparison with manufacturing industry) may strengthen the association between

exporting and innovation and, as a first step, we try to find empirical evidence in service industry in this study.[1] First, the level of knowledge spillover is generally higher in service industry than it is in manufacturing industry (Arvanitis, 2008). Such a fast spillover of knowledge will expedite the speed of learning by services-exporters (relative to goods-exporters) and, thereby, help them to accumulate various sources for subsequent innovation by themselves.

Second, compared to manufacturing firms, service firms rely more on external than on internal sources in their activities for innovation (Sirill and Evangelista, 1998; Tether, 2005; Vega-Jurado, et al, 2008). While most manufacturing firms establish R&D departments and pursue technological innovation based on science and engineering, service firms rarely have such a policy of innovation. Rather, their innovative activities consist largely of accessing, gathering and combining knowledge originally owned by external parties, including customers, suppliers, competitors, universities, research institutes, etc. As a service firm expands geographically through exporting, it tends to rapidly build up a relationship with more individuals and organizations in the global marketplace. Such relationships may well serve the focal service firm as fresh external sources of innovation.

Third, service firms often find it difficult to protect their intellectual rights through legal safeguards such as patents and trademarks. The typical tacitness and stickiness of knowledge in most types of services make it costly for a service provider to standardize and codify its services to secure legal protection (Hipp and Grupp, 2005; Saviotti, 1998). A firm's exporting activities to a remote region will significantly increase its concern of losing its control over its own know-how. For example, when a firm's strategic know-how is largely embedded in people and when legal protective measures are absent, its competitive advantage (especially in the global marketplace) can easily evaporate due to its key employees leaving for a competitor firm. In such circumstances, the firm will have a stronger motivation to form *strategic* (rather than *legal*) barriers to imitation, which often aim to increase the complexity of its services, and ultimately to create new, innovative products and processes.

III. FORMULATION OF HYPOTHESES

As we mentioned in the previous chapters, exporting firms have an opportunity to bring together market and technological information. The local branch can create and disseminate a great deal of information acquired from competing with various competitors and interacting with diverse consumers and intermediaries. The market and technological information collected from these sources are incorporated into the firm's production function. An

[1] In an extended study, the authors are currently conducting an empirical analysis of the differences between manufacturing and service industries in terms of the relationship between exporting and innovation.

exporting manufacturing or service firm has a chance to gather information from the buyers of exports who are generally willing to provide products or service designs and to offer technical assistance freely to improve their operations in the context of their sourcing activities (Evenson and Westphal, 1995). Competing in a foreign market brings firms into contact with the best international practices and this fosters learning (World Bank, 1997). Without participating in export markets, it would not be possible for a service firm to take an overall view of its products, markets and competitors and to see where they stand vis-à-vis them (Salomon and Shaver, 2005). From this discussion, we arrive at the following hypothesis:

Hypothesis 1. The level of exports in a service firm is positively associated with that of activities in product innovation.

While product innovation[2] pertains to taking action to improve the quality and function of a product by responding directly to customer demands, process innovation is related to changes in the logistics chain in both physical and non-physical flows of materials and information. Process innovations tend to be more radical than product innovations because the former is the very first step that is necessary to make in order to transform the whole logistics activity into a more customer-oriented one (Finger, 2007). One of the most plausible ways of improving a service is to have customers participate in process innovation as critical evaluators and informants. Exporting service firms are more likely to transfer product information (such as competing products and customer preferences from export intermediaries, customer feedback and other foreign agents) to the parent company and to assimilate it in the design of a new product/service. However, it may be more challenging to learn about new process technologies, through which the product is circulated, from the same informants and apply them to the transformation of the service. However, it is more likely that the more successful exporting service firms will attempt to enhance process technologies in order to deliver the service more effectively. They will strive to pass very detailed information on foreign customers who do not share identical tastes and to tailor the logistics (such as customer service) to meet the specific needs of the individual customers (Salomon and Shaver, 2005; Vernon, 1979). Therefore:

Hypothesis 2. The level of exports in a service firm is positively associated with that of its activities in process innovation.

It has been observed that service firms do not require large-scale capital investments in physical assets to create a presence in foreign markets in the process of internationalization,

[2] Please refer to the definition of innovation activities in Table 1 of Appendix to find the details of production innovation (appearing in Hypothesis 1), and the following process innovation (in Hypothesis 2) and organizational innovation (in Hypothesis 3).

compared to manufacturing firms (Bouquet et al., 2004). Service firms will be more likely to acquire value-creating assets through human capital rather than through their physical infrastructure (Erramilli and Rao, 1993; Campbell and Verbeke, 1994). Furthermore, service innovations will be less likely to rest on 'hard' sources such as R&D investment, but are more likely to be based on 'soft' traits such as the skills of their workforce (Tether, 2005). Because many services are by nature labor-intensive or people-oriented, one of the key factors for successful foreign market entry through exporting is to have a workforce with a high level of skills, customer-centered minds and specialized know-how in adapting to foreign cultures. Exporting service firms make huge investments in the education and training of employees for this reason. This human capital – the knowledge, skills and talent – is very specific to those firms, and is not easily transferred to different firms. The exporting service firms tend to promote the internationalization of the domestic workforce in this process. They dispatch managers to local branches. As the managers' international market research expertise increases, this experience reduces the potential risk and complexity that is inherent in pursuing foreign markets (Westhead et al., 2001). Managers with international experience can build up and take advantage of international social networks (Coviello and Munro, 1997) to accelerate exports. Furthermore, service firms engaging in exports may need to re-create their organizational structure to the extent that it can absorb new forms of market knowledge and technology conveyed from a foreign market without difficulty. According to the resource-based theory, the internationalization of service firms may require the development of certain organizational skills and capabilities to another level in order to implement more effective technology learning in an international context. From this discussion, we derive:

Hypothesis 3. The level of exports in a service firm is positively associated with that of its activities in organizational innovation.

IV. DATA AND METHODOLOGY

IV.1 Data

To test the hypotheses, we collected data on the exporting and innovation activities of the Korean service firms from STEPI (Science and Technology Policy Institute), a leading government-funded research institute in Korea whose main role is to conduct research on science, technology and innovation in a Korean and international perspective. STEPI undertakes an annual survey of the innovation activities of both manufacturing and service firms, which is called the Korean Innovation Survey (KIS). This survey aims to collect information about technological innovation, including sources and methods of innovation,

innovation expenditures, R&D workforce etc. and general information such as the industry, sales, exports, operating profits, shareholdings of foreign investors etc. of Korean firms which have more than ten employees. A comprehensive range of questionnaires are posted or emailed to the firms to get the information on their innovation activities. The response rate is very high, for example, reaching 60.9% in the 2005 survey.

Our data on the innovation activities (production innovation, process innovation and organizational innovation) and exports of service firms are based on KIS 2006. The definition of each kind of innovation activity and the methodology of the survey rests on the revised edition of the "Oslo Manual" framed by the OECD. When a firm has introduced at least one new or improved product, process and organizational change during the period 2003-2005, by responding positively to the questionnaires, it is considered as having carried out that specific sort of innovation. The definition of innovation activities is presented in Table 1.

[Insert Table 1 here]

Our sample consists of 2,023 service firms which were surveyed by KIS 2006. These firms belong to 20 different service industries, which are classified by the three-digit Korean Standard Industry Classification (KSIC) code.

Table 2 shows the industry distribution of the KIS 2006 service firms. According to the three-digit code used by KSIC, the top five industries occupied almost 50% of whole sample. 'Wholesale trade and commission trade' numbered 315 firms (15.6%), 'Architectural, engineering and technical services' 226 firms (11.2%), 'Supporting and auxiliary transport activities and travel agencies' 192 firms (9.5%), 'Software consultancy and supplies' 177 firms (8.7%) and 'Land transport and transport via pipelines' 175 firms (8.7%). Financial services-related industries ('financial intermediation', 'insurance and pensions' and 'activities auxiliary to financial intermediation') had 207 firms (10.2%) as a whole. The other industries that accounted for more than 5% of the total sample were: legal and accounting services (119 firms, 5.9%), water transport (110 firms, 5.4%), followed by 'other engineering and technical services' (95 firms, 4.7%), 'motion pictures and broadcasting' (92 firms, 4.5%) and 'computer and related activities' (70 firms, 3.5%).

[Insert Table 2 here]

Table 2 also shows that high-technology linked industries tended to engage in more exporting relative to other industries. While 'software consultancy and supply' firms occupied 8.7% out of total sample, 23.7% of the firms in this industry exported services to foreign countries. The firms that belonged to 'research and development' were only 1.5% of the sample firms, but the ratio of exporters in that industry amounted to 32.3%. This high proportion of exporters,

despite the small sample numbers, was also found in ‘science and technology services’ where 17.4% of firms were involved in exporting activities. On the contrary, while the firms that provided financial services made up a considerable proportion of our total sample, their participation in exports was very trivial – only 3 out of 207 firms reported that their businesses were related to international expansion through the exporting of services.

Table 3 exhibits how many firms conducted product, process or organizational innovations in KIS 2006. Out of a total of 2,023 firms, 15.2% (307 firms) introduced one or more significantly improved products on to the market, 11.8% (238 firms) improved methods of supplying services and delivering products and 28.4% (574 firms) introduced new methods or considerably improved extant methods of work organizations to enhance their internal capabilities by adopting new types of divisions and creating external cooperation networks. This observation seems to be relevant to our prediction about the pattern of innovation that service firms might display. They need to transform their organization structures to incorporate new technologies that they obtain in the process of domestic and international business and to convert themselves into “learning organizations”. That’s why firms have engaged in more organizational innovations by comparison with product or process innovations. Furthermore, a relatively smaller number of firms carried out process innovation vis-à-vis product innovation (11.8% vs. 15.2%), which may imply that process innovation, which must truly implant a consumer-oriented mind and type of culture into the whole process of logistics, is more difficult to achieve than product innovation.

[Insert Table 3 here]

In all service industries, more organizational innovations were observed than product and process innovations. Six industries showed that more than 40% of surveyed firms reported their organizational innovations: ‘market research and management consultancy’ (48.1%), ‘research and development’ (45.2%), ‘software consultancy and supply’ (48.0%), ‘posts and telecommunications’ (42.3%), ‘computer and related activities’ (41.4%) and ‘financial intermediation (40.8%). High-technology related service firms showed that they had successfully brought product innovation into the market. 48.0% of ‘software consultancy and supply’ 45.2% of ‘research and development’, 38.6% of ‘computer and related activities’ and 34.8% of ‘science and technology services’ were reported as conducting effective product innovation. The firms in these industries also showed that they were actively upgrading their service process by making an improvement in the quality of their service delivery and in their response to consumer needs. The ratios of process innovation in high-technology based firms were relatively higher than those of other industries.

IV.2 Methodology

IV.2.1 Logistic Regression and Odd Ratio

Since dependent variables (product innovations, process innovations and organizational innovations) are measured as binary values, we employ logistic regression to test our hypotheses 1-3. We estimate the odd ratio to get the coefficients of the logistic regression and to assess how much the binary value 0 or 1 is affected by the small changes of the independent variables. For instance, if the odd ratio estimating the relationship between the level of exports and product innovations was calculated as 1.5, this would indicate that exporting service firms conduct innovations of a kind that are 1.5 times more likely than those of non-exporting firms. The Wald Test is used to test the statistical significance of each odd ratio in the models by calculating the ratio of the estimated coefficients to the difference between estimators and parameters.

IV.2.2 Variables

Level of Exports

We use three different kinds of level of exports in various model specifications. First, we estimate the level of exports as a binary value. 1 is given if a firm exports services, 0 otherwise. Second, we distribute the numbers 3-0 to the level of exports by the order of the relative weight of exports to the sales volume. The level of exports takes the value of 3, if the ratio of exports to the sales volume is higher than 0.66. If the ratio is between 0.33 and 0.66, it takes the value of 2, and 1 if the ratio is less than 0.33. If a service firm did not export at all, the level of exports has the value of 0. Third, we employ the nominal value of export volumes. To reflect the time lag between the exporting and the innovation, we employ the export data in 2003 for comparison with the innovation data during the period 2003-2005.

Service innovation activities

If a service firm carried out product innovations, it took the value 1, and 0 if it did not. In a similar way, the value 1 was assigned to process innovation if a firm successfully introduced an improvement in its service-providing processing, and 0 otherwise. Organizational innovation will also be defined as a dummy variable: 1 if a firm brought about successful organization changes, and 0 if it did not.

Control variables

To capture the industry-effect, we include six dummy variables taking the value of 1: ‘Science, technology and design industry’ for those firms whose three-digit KSIC were 730, 743, 744,

746 and 749; ‘Telecommunications, computer and software industry’ for the KSIC codes 640, 721 and 722; ‘Commercial business industry’ for the KSIC codes 741, 742 and 745; ‘Distribution industry’ for the KSIC code 510; ‘Transportation industry’ for the KSIC codes 601, 610, 620 and 631; ‘Financial services industry for the KSIC codes 650, 660 and 670.

We also attempt to estimate the degree of the role of external and internal stakeholders in the process of innovation. For this, we employ variables such as ‘Shareholdings of foreign investors’ (0 to 100%), ‘R&D workforce ratio' (0 to 100%), ‘Postgraduate workforce ratio’ (0 to 100%).

We also extract other dummy variables that might influence the innovation activities of service firms. If the main customers of a service firm were individual customers rather than business organizations, the B2C takes the value of 1, and 0 otherwise. If the service firm had an experience of enhancing its internal capabilities and acquiring knowledge from the contribution of external partners, such as affiliated companies, competitors in the same industry, clients, suppliers and IT-service organizations, each business partner takes the value of 1, and 0 if the firms did not benefit from interacting with their partners.

Finally, we control for the firms’ innovation-protecting activities. If the firms made use of methods to protect their inventions or innovations which were developed during the period, such as the acquisition of patents, ‘protection of innovation’ has the value of 1, and 0 if the firms did not attempt to protect their innovations.

V. EMPIRICAL RESULTS

We made a test of hypotheses 1-3 using logistic regression in order to examine how the export level of service firms impacted on the product innovation levels.

V.1 Production Innovation

Table 4 exhibits the coefficient (odd ratio) of the levels of product innovations. The table shows that, in Models 1 and 2, each coefficient indicating the exporting activities in 2003 and the ratio of exports to sales volume in 2003, respectively, is found to be greater than 1.00, thus presenting the positive impact of exporting activities on the level of product innovation. Both coefficients are significant at the 1% and 5% levels, respectively. However, we find that the export volume has no relationship with the level of product innovation activities. A chi-square test for the overall model fit shows that the addition of a variety of independent and control variables significantly improves the fit of the model.

[Insert Table 4 here]

The coefficients of the dummy variable indicating the 'telecommunications, computer and software industry' are 2.83, 2.94 and 2.88, respectively, in Models 1, 2 and 3, which are significant at the 5% to 1% levels. This clearly shows that service firms that belong to IT industries tend to strengthen their endeavors to introduce new innovative products on to the market. The high coefficients (larger than 1.00) on the external contribution from clients, suppliers and IT-service organizations (all are significant at the 10% to 1% levels in all models) suggest that service firms are more likely to take part in product innovation activities as they foster strong relationships with these partners and obtain external knowledge from them, which results in the improving of their internal capabilities. The 'protection of innovation' variable estimates the efforts of firms to protect their product innovation and shows coefficients which are greater than 11.00 in all models at the 1% significance level. This result shows the service firms' continuing attempts to safeguard their inventions or innovations strongly contribute to the higher level of product innovation. The results from Table 4 support Hypothesis 1.

V.2 Process Innovation

In Table 5, the coefficients of the levels of process innovation are presented. All the coefficients on the variables estimating whether a firm participated in exporting in 2003 or not, how important the exporting volume in comparison to sales volumes was in the same year, and how much the firm exported, are larger than 1.00 in all model specifications, but they do not show any significance, at least, at the 10% level. These regression results are not consistent with our Hypothesis 2. However, chi-square tests show the the overall fit of all model specifications.

[Insert Table 5 here]

The firms in the transportation industry and financial services industry are found to be less likely to participate in process innovation than those in other industries are. The coefficients representing these two industries are around 0.40, with the former showing significances at the 5% level in all models and the latter at the 5% level in Model 1 and Model 3. The positive relationship between the external networks with partners and the innovation activities is also found in this case. The dummy variables indicating the acquisition of knowledge from clients and IT-service organizations show high coefficients (approximately 1.60 for clients and 2.90 for IT-service organizations), which are significant at the 5% level (clients) and the 1% level (IT-service organizations), respectively. The coefficients of innovation protection decline considerably, ranging from 3.28 to 3.38, compared to those in the case of product innovations.

This may imply that the attempts to protect innovations are more important for stimulating product innovations than for process innovations and that process innovations tend to be transferred to other firms easily through 'inter-firm' spillovers, which are not protected by legal safeguards such as patents and trademarks, so that firms are not strongly motivated to protect these innovations with as much determination as the product innovations. However, the coefficients of this variable are still high in all models and are significant at the 1% level.

V.3 Organizational Innovation

Table 6 displays the coefficients of the levels of organizational innovation. As in the cases of product innovation, the high coefficients (large than 1.00) on the variables of exporting activities in 2003 (1.42) and the ratio of exports to sales volume in 2003 (1.16) are significant at the 10% level.

[Insert Table 6 here]

The result of the industry controls shows that the transportation industry is less likely to introduce organizational changes. The coefficients are around 0.57 and significant at the 10% to 5% levels.

All the dummy variables that aim to capture the effects of external contributions present strong and significant relationships with organizational innovation activities. It is found that firms gaining new knowledge from IT-service organizations are 3.15 times more likely to bring about organizational changes than those who do not benefit from organizations of this kind. The firms who are supported by affiliated companies will introduce more organizational innovations than those who are not (the coefficients are 2.63, 2.65 and 2.67 in each model specification). The external networks, through which knowledge is transmitted and sourced, with clients and suppliers were also found to contribute significantly to organizational learning and improvements. When a firm attempted to learn from its competitors, this had the effect of introducing organizational innovations. Protection of innovations is also found to have a strongly positive relationship with organizational innovations.

The results from the logistic regression in Table 6 are in line with our Hypothesis 3.

VI. CONCLUSION

In this paper, we examined the impact of exporting on the production, process and organizational innovations of Korean service firms. We started off from a conjecture that the

features of service industry may strengthen the relationship between exporting and innovation of service firms relative to the manufacturing sector. A higher level of knowledge spillover and a greater tendency of knowledge sourcing from external parties may promote innovation in the process of exporting services to a foreign country. Furthermore, the market and technology information acquired through exporting is expected to be incorporated into production design and functioning. More successful exporting firms are more likely to improve the service-providing processes, as well as the product qualities, using the information about foreign customers and their needs. In this process, exporting service firms will re-create their organizational structures so that 'learning by exporting' may be facilitated. Based on the discussions centered round these points, we hypothesized that the higher the level of export in a service firms was, the more innovation activities would be conducted in each area of innovation. Implementing logistic regressions using the 2006 Korean Innovation Survey data, we found a significantly positive association of Korean service firms' exporting with product innovation and organizational innovation. However, our data did not support our hypothesis on the relationship between exporting and process innovation.

In this study, we have analyzed the impact of exporting on innovation, focusing on service industry, although our empirical results do not cover a direct comparison between service and manufacturing industries. This current study needs to be elaborated with extended investigations on the possible reverse causality of innovation on exporting as well as on the bi-directional impacts between these two variables considering both manufacturing and service industries. Our ongoing research will integrate more comprehensive theoretical concepts derived from resource-based theories and will attempt to clarify the empirical relationship between exporting and innovation in both manufacturing and service industries, controlling more relevant variables in the international business context.

REFERENCE

Arvanitis, S. 2008. Explaining innovative activity in service industries: Micro data evidence for Switzerland. *Economics of Innovation and New Technology*, 17(3): 209-225.

Aulakh, P. S., Kotabe, M. et al. 2000. Export Strategies and Performance of Firms from Emerging Economies: Evidence from Brazil, Chile, and Mexico. Academy of Management Journal, *Academy of Management*, 43: 342-361.

Bateson, J. E. G. 1992.*Managing services marketing: text and readings*. Orlando, FL: Dryden Press.

Boddewyn, J., Halbrich, M. and Perry, A. 1986. Service multinationals: conceptualization, measurement and theory, *Journal of International Business Studies,* 17(Fall): 41–57.

Bouquet, C., Hebert, L., and Delios, A. 2004. Foreign expansion in service industries: separability and human capital intensity. *Journal of Business Research*, 57: 35-46.

Braga, C. A. P. 1996. The Impact of the Internationalization of Services on Developing Countries. *Finance & Development*, 33(1): 34-37.

Burpitt, W. J., and Rondinelli, D. A. 2000. Small firms' motivations for exporting: to earn and learn?. *Journal of Small Business Management*, 38(4): 1-14.

Campbell, A. J., and Verbeke, A. 1994. The globalization of service multinationals. *Long Range Planning*, 27: 95-102.

Capar, N. and Kotabe, M. 2003. The relationship between international diversification and performance in service firms. Journal of International Business Studies. 34: 345-355.

Clerides, S. K., Lach, S., and Tybout, J. R. 1998. Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico and Morocco. *Quarterly Journal of Economics*, 113(3): 903-948.

Coviello, N. E., and Munro, H. J. 1997. Network relationships and the internationalization process of small software firms. *International Business Review*, 6: 361-386.

Craig, S. C., and Douglas, S. P. 1996. Developing strategies for global markets: an evolutionary perspective. *Columbia Journal of World Business*, 31(1): 70-81.

Eriksson, K., Johanson, J., Majkgard, A., and Sharma D. 2000. Effect of variation on knowledge accumulation in the internationalization process. *International Studies of Management and Organization*, 30(1): 26-44.

Erramilli, M. K., and Rao, C. P. 1993. Service firms' international entry-mode choice: a modified transaction-cost analysis approach. *Journal of Marketing*, 57: 19-38.

Evenson, R., and Westphal, L. 1995. Technological change and technology strategy. In T. N. Srinvasan and J. Berhman (Eds), *Handbook of development economics*, Vol 3. Amsterdam: North-Holland.

Finger, M. 2007. Innovation in the network industries. Network Industries Quarterly, 9(1): http://newsletter.epfl.ch/mir/newspaper-article?np_id=112&np_eid=23&catid=0.

Goerzen, A. and Makino, S. 2007. Multinational corporation internationalization in the service sector: a study of Japanese trading companies, *Journal of International Business Studies,* 38(7): 1149-1169.

Grossman, G. M., and Helpman, E. 1991. *Trade, knowledge spillovers, and growth*. NBER Working Paper, 3485.

Grossman, G. M., and Helpman, E. 1993. *Innovation and growth in the global economy*. Cambridge, MA: MIT Press.

Habib, M. and Victor, B. 1991. Strategy, structure, and performance of US manufacturing and service MNCs: a comparative analysis, *Strategic Management Journal,* 12(8): 589–606.

Hipp, C., and Grupp, H. 2005. Innovation in the service sector: The demand for service-specific innovation measurement concepts and typologies. *Research Policy*, 34: 517-535.

Johanson, J. and Vahlne, J. E. 1977. The internationalization process of the firm - A model of knowledge development and increasing foreign market commitments. *Journal of International Business Studies,* 8(1): 23-32.

Katrishen, F. and Scordis, N. 1998. Economies of scale in services: a study of multinational insurers', *Journal of International Business Studies,* 29(2): 305–324.

Knight, G.. 1999. International services marketing: review of research, 1980–1998, *Journal of Services Marketing,* 13(4–5): 347–361.

Lovelock, C. H., and Writz, J. 2004. *Services marketing: texts, cases and reading*. Englewood Cliffs, NJ: Prentice-Hall.

MacGarvie, M. J. 2003. *Essays on the economics of knowledge spillovers*. Ph.D. dissertation, University of California Berkeley, Berkeley.

Nakata, C., and Sivakumar, K. 1996. National culture and new product development: an integrative review. *Journal of Marketing,* 60(1): 61-72.

Patterson, P. and Cicic, M. 1995. Typology of service firms in international markets: an empirical investigation, *Journal of International Marketing, 3(*4): 57–83.

Patterson, P. G. 2004. A study of perceptions regarding service firms' attitudes towards exporting. *Australian Marketing Journal*, 12(2): 19-38.

Salomon, R. and Jin, B. 2008. Does knowledge spill to leaders or laggards? Exploring industry heterogeneity in learning by exporting. *Journal of International Business Studies*, 39(1): 132-150.

Salomon, R. M. 2006. Spillovers to Foreign market Participants: Assessing the Impact of Export Strategies on Innovative Productivity. *Strategic Organization,* 4(2): 135-164.

Salomon, R. M. and Shaver, J. M. 2005. Learning by Exporting: New Insights from Examining Firm Innovation. *Journal of Economics & Management Strategy,* 14: 431-

460.

Saviotti, P. 1998. On the dynamics of appropriability of tacit and of codified knowledge. *Research Policy*, 26: 843-856.

Schienstock, G., and Hamalainen, T. 2001. *Transformation of the Finnish Innovation System: A Network Approach*. The Finnish National Fund for Research and Development. Report Series No.7.

Sharma, D. and Johansson, J. 1987. Technical consultancy in internationalization, *International Marketing Review,* 4(Winter): 20–29.

Sirill, G., and Evangelista, R. 1998. Technological innovation in services and manufacturing: results from italian surveys. *Research Policy*, 27: 881-899.

STEPI (Science and Technology Policy Institute), *Korean innovation survey 2006*.

Tether, B. S. 2005. Do services innovate (differently)?: Insights from the European Innobarometer Survey. *Industry and Innovation*, 12(2): 153-184.

Toivonen, M., and Tuominen, T. 2006. *Emergence of innovations in services: theoretical discussion and two case studies*. Proceedings of the International ProACT Conference, 15-17 March 2006, Tampere, Finland.

Trofimenko, N. 2008. Learning by exporting: does it matter where one learns? evidence from colombian manufacturing firms. *Economic Development and Cultural Change*, 56(4): 871-885.

UNCTAD.2007. World Investment Report: Transnational Corporations, Extractive Industries and Development

UNCTAD. 2008. World Investment Report: Transnational Corporations, and the Infrastructure Challenge

US Bereau of Economic Analysis (BEA). 2007. US International Transactions: 2006.

Vega-Jurado, J., Gutierrez-Gracia, A., Fernandez-de-Lucio, I., and Manjarres-Henriquez, L. 2008. The effect of external and internal factors on firms' product innovation. *Research Policy*, 37: 616-632.

Vernon-Wortzel, H. and L. H. Wortzel. 1988. "Globalizing strategies for multinationals from developing countries." Columbia Journal of World Business 23(1): 27-35.

Vernon, R. 1966. "International investment and international trade in the product cycle." Quarterly Journal of Economics 80(2): 190-207.

Vernon, R. 1979. The product cycle hypothesis in a new international environment. *Oxford Bulletin of Economics and Statistics*, 41(4): 255-268.

Westhead, P., Wright, M., and Ucbasaran, D. 2001. The internationalization of new and small firms: a resource-based view. *Journal of Business Venturing*, 16(4), 333-358.

World Bank. 1997. *World development report: the state in a changing world*. New York: Oxford University Press.

World Trade Organization. 2008. *International trade statistics.*

Table 1 Definition of Innovation Activities

Product Innovation	Goods or services that are either new or significantly improved in their fundamental characteristics, or their technical specifications, in their incorporated software or other immaterial components, in their intended use, or user friendliness, and which lead to an increase in the firms' turnover (Example of service innovation: an improvement in an internet service or electronic payment system)
Process Innovation	A new or significantly improved production technology, new or significantly improve methods of supplying services and delivering products which importantly contribute to an increase in productivity (Examples: the introduction of new production technology, such as ERP or Just-in-time, automated production facilities, barcode systems for delivery, and software for purchasing, accounting or maintenance
Organizational Innovation	The introduction of new methods or the significant improvement of existing methods, in terms of methods of working, organizing, and creating external cooperation networks. It contributes to the increase in the effectiveness and efficiency of firms' internal capabilities (Examples: significant changes in internal knowledge sharing, the introduction of new organizational hierarchies, the strengthening of external cooperation or the increasing of outsourcing)

Source: Korean Innovation Survey (KIS) 2006, STEPI (Science and Technology Policy Institute)

Table 2 Industry Distribution of KIS 2006 Service Firms

KSIC code	Industry	Total		Exporting Firms	
		No.	(%) [1)]	No.	(%) [2)]
510	Wholesale trade and commission trade	315	(15.6)	64	(20.3)
601	Land transport; Transport via pipelines	175	(8.7)	5	(2.9)
610	Water transport	110	(5.4)	31	(28.2)
620	Air transport	17	(0.8)	7	(41.2)
631	Supporting and auxiliary transport activities; Activities of travel agencies	192	(9.5)	31	(16.1)
640	Posts and telecommunications	52	(2.6)	1	(1.9)
650	Financial intermediation (except for insurance and pensions)	103	(5.1)	3	(2.9)
660	Insurance and pensions	53	(2.6)	0	(0.0)
670	Activities auxiliary to financial intermediation	51	(2.5)	0	(0.0)
721	Computer and related activities	70	(3.5)	8	(11.4)
722	Software consultancy and supply	177	(8.7)	42	(23.7)
730	Research and development	31	(1.5)	10	(32.3)
741	Legal and accounting services	119	(5.9)	10	(8.4)
742	Market research and management consultancy	27	(1.3)	2	(7.4)
743	Architectural, engineering and technical services	226	(11.2)	15	(6.6)
744	Science and technology services	23	(1.1)	4	(17.4)
745	Advertising	77	(3.8)	6	(7.8)
746	Design services	18	(0.9)	1	(5.6)
749	Other engineering and technical services	95	(4.7)	10	(10.5)
871	Motion pictures and broadcasting	92	(4.5)	6	(6.5)
Total		2023	(100.0)	256	(12.7)

1) Proportion of firms in each industry out of total service firms

2) Proportion of exporting firms out of total firms in each industry

Source: Korean Innovation Survey (KIS) 2006, STEPI (Science and Technology Policy Institute)

Table 3 Distribution of Innovation Activities by Industries

Industry	Product Innovation		Process Innovation		Organizational Innovation	
	No. [1]	(%) [1]	No.	(%)	No.	(%)
Wholesale trade and commission trade	32	(10.2)	42	(13.3)	82	(26.0)
Land transport; Transport via pipelines	5	(2.9)	9	(5.1)	19	(10.9)
Water transport	1	(0.9)	2	(1.8)	17	(15.5)
Air transport	3	(17.6)	2	(11.8)	4	(23.5)
Supporting and auxiliary transport activities; Activities of travel agencies	12	(6.3)	13	(6.8)	41	(21.4)
Posts and telecommunications	14	(26.9)	7	(13.5)	22	(42.3)
Financial intermediation (except for insurance and pensions)	17	(16.5)	12	(11.7)	42	(40.8)
Insurance and pensions	2	(3.8)	3	(5.7)	13	(24.5)
Activities auxiliary to financial intermediation	8	(15.7)	4	(7.8)	13	(25.5)
Computer and related activities	27	(38.6)	16	(22.9)	29	(41.4)
Software consultancy and supply	85	(48.0)	39	(22.0)	85	(48.0)
Research and development	14	(45.2)	4	(12.9)	14	(45.2)
Legal and accounting services	5	(4.2)	9	(7.6)	11	(9.2)
Market research and management consultancy	7	(25.9)	3	(11.1)	13	(48.1)
Architectural, engineering and technical services	36	(15.9)	30	(13.3)	67	(29.6)
Science and technology services	8	(34.8)	5	(21.7)	9	(39.1)
Advertising	5	(6.5)	5	(6.5)	18	(23.4)
Design services	2	(11.1)	3	(16.7)	5	(27.8)
Other engineering and technical services	13	(13.7)	12	(12.6)	35	(36.8)
Motion pictures and broadcasting	11	(12.0)	18	(19.6)	35	(38.0)
Total	307	(15.2)	238	(11.8)	574	(28.4)

1) Number and proportion of firms that conducted innovation out of total firms in each industry

Source: Korean Innovation Survey (KIS) 2006, STEPI (Science and Technology Policy Institute)

Table 4 Logistic Regression: Product Innovation Levels

	Model 1		Model 2		Model 3	
Industry controls						
Science, technology and design industry	1.57	(1.17)	1.59	(1.23)	1.55	(1.10)
Telecommunications, computer and software industry	2.83**	(6.51)	2.94***	(6.98)	2.88**	(6.71)
Commercial business industry	1.13	(0.07)	1.15	(0.09)	1.13	(0.07)
Distribution industry	0.96	(0.01)	1.02	(0.00)	1.09	(0.04)
Transportation industry	0.53	(1.89)	0.56	(1.58)	0.59	(1.33)
Financial services industry	1.04	(0.01)	1.04	(0.01)	0.99	(0.00)
External and internal stakeholders controls						
Shareholdings of foreign investors	1.00*	(3.52)	1.00*	(2.91)	1.00	(2.62)
R&D workforce ratio	1.02***	(25.54)	1.02***	(26.46)	1.02***	(28.39)
Postgraduate workforce ratio	1.01**	(4.48)	1.01**	(5.25)	1.01**	(5.78)
Business type control						
B2C business	1.22	(0.98)	1.23	(1.05)	1.20	(0.80)
External contribution from outside partners' controls						
Affiliated companies	1.09	(0.10)	1.09	(0.11)	1.11	(0.17)
Competitors	1.30	(1.76)	1.30	(1.80)	1.28	(1.60)
Clients	2.09***	(12.68)	2.10***	(12.87)	2.15***	(13.67)
Suppliers	1.51*	(3.81)	1.51**	(3.87)	1.51*	(3.86)
IT-service organizations	2.35***	(17.43)	2.37***	(17.88)	2.37***	(17.85)
Protection of innovation control						
Protection of innovation	11.15***	(42.57)	11.23***	(43.04)	12.25***	(46.58)
Independent variables						
Whether firms exported in 2003	2.02***	(9.38)				
Ratio of exports to sales volume in 2003			1.28**	(5.11)		
Export volume in 2003					1.00	(0.10)
Model indices						
Log-likelihood	1102.74		1101.31		1111.6	
Chi-square	452.9 ***		454.42***		444.13***	

Wald statistics in parentheses for logistic regressions

***, **, * denote significance at the 1%, 5%, 10% level, respectively.

Table 5 Logistic Regression: Process Innovation Levels

	Model 1		Model 2		Model 3	
Industry controls						
Science, technology and design industry	0.76	(0.48)	0.77	(0.44)	0.76	(0.49)
Telecommunications, computer and software industry	0.75	(0.54)	0.76	(0.50)	0.76	(0.52)
Commercial business industry	0.58	(1.48)	0.59	(1.42)	0.58	(1.46)
Distribution industry	0.94	(0.02)	0.95	(0.02)	0.98	(0.00)
Transportation industry	0.39**	(5.18)	0.40**	(5.07)	0.40**	(4.88)
Financial services industry	0.40**	(4.39)	0.40	(4.32)	0.4**	(4.52)
External and internal stakeholders controls						
Shareholdings of foreign investors	1.00	(0.19)	1.00	(0.18)	1.00	(0.18)
R&D workforce ratio	1.01	(1.66)	1.01	(1.68)	1.01	(1.93)
Postgraduate workforce ratio	1.01**	(4.48)	1.01**	(4.72)	1.01**	(4.93)
Business type control						
B2C business	0.94	(0.08)	0.95	(0.06)	0.94	(0.10)
External contribution from outside partners' controls						
Affiliated companies	1.22	(0.62)	1.23	(0.64)	1.24	(0.69)
Competitors	1.34	(1.92)	1.34	(1.95)	1.34	(1.90)
Clients	1.59**	(4.26)	1.59**	(4.29)	1.60**	(4.39)
Suppliers	1.32	(1.59)	1.33	(1.63)	1.32	(1.58)
IT-service organizations	2.90***	(24.11)	2.9***	(24.17)	2.91***	(24.20)
Protection of innovation control						
Protection of innovation	3.28***	(14.94)	3.28***	(15.05)	3.38***	(15.91)
Independent variables						
Whether firms exported in 2003	1.25	(0.84)				
Ratio of exports to sales volume in 2003			1.11	(0.94)		
Export volume in 2003					1.00	(0.00)
Model indices						
Log-likelihood	1048.93		1048.84		1049.74	
Chi-square	202.36***		202.44***		201.54***	

Wald statistics in parentheses for logistic regressions

***, **, * denote significance at the 1%, 5%, 10% level, respectively.

Table 6 Logistic Regression: Organizational Innovation Levels

	Model 1		Model 2		Model 3	
Industry controls						
Science, technology and design industry	0.99	(0.00)	1.00	(0.00)	0.98	(0.00)
Telecommunications, computer and software industry	0.98	(0.00)	1.00	(0.00)	0.99	(0.00)
Commercial business industry	0.66	(1.73)	0.67	(1.63)	0.67	(1.67)
Distribution industry	0.87	(0.24)	0.88	(0.19)	0.89	(0.15)
Transportation industry	0.56**	(4.18)	0.57**	(3.94)	0.57*	(3.81)
Financial services industry	0.82	(0.45)	0.82	(0.43)	0.81	(0.50)
External and internal stakeholders controls						
Shareholdings of foreign investors	1.00	(0.58)	1.00	(0.52)	1.00	(1.19)
R&D workforce ratio	1.02***	(18.36)	1.02***	(18.79)	1.02***	(20.46)
Postgraduate workforce ratio	1.01***	(15.70)	1.01***	(15.97)	1.01***	(15.82)
Business type control						
B2C business	1.20	(1.54)	1.20	(1.62)	1.19	(1.40)
External contribution from outside partners' controls						
Affiliated companies	2.63***	(20.93)	2.65***	(21.21)	2.67***	(21.58)
Competitors	1.4**	(5.50)	1.4**	(5.57)	1.39**	(5.26)
Clients	1.38**	(4.78)	1.38**	(4.74)	1.39**	(5.04)
Suppliers	1.49**	(6.26)	1.5**	(6.36)	1.5**	(6.50)
IT-service organizations	3.15***	(56.01)	3.15***	(56.25)	3.15***	(56.18)
Protection of innovation control						
Protection of innovation	4.4***	(11.50)	4.36***	(11.35)	4.49***	(11.79)
Independent variables						
Whether firms exported in 2003	1.42*	(3.81)				
Ratio of exports to sales volume in 2003			1.16*	(2.98)		
Export volume in 2003					1.00	(2.04)
Model indices						
Log likelihood	1923.99		1924.83		1925.49	
Chi-square	489.23***		488.39***		487.73***	

Wald statistics in parentheses for logistic regressions

***, **, * denote significance at the 1%, 5%, 10% level, respectively.