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Impact of Service-Dominant Orientation on the Innovative Performance of Technology Firms: Roles of Knowledge Sharing and Relationship Learning

ABSTRACT

Although the adoption of service-dominant logic contributes to the innovativeness of organizations, the relationship between service-dominant logic and innovative performance has seldom been empirically investigated. To fill this literature gap, this study used relationship learning theory to examine the effects of service-dominant orientation (SDO), knowledge sharing, and external network on innovative performance through the mediation of relationship learning in technology firms. The proposed model was tested through a field study conducted in Hong Kong Science and Technology Parks Corporation (HKSTP). Data from 82 technology firms were used to test the research model.

The results showed that relationship learning mediates the relationships of SDO to innovative performance, knowledge sharing to innovative performance and external network to innovative performance. The mediation effect confirms that service-dominant orientated firms have high innovative performance because of the learning from their partner relationships. This research explains that managing the learning from providing services positively influencing innovation of the firm.

Keywords: Innovative Performance; Service Dominant Orientation; Knowledge Sharing, External Network; Relationship Learning; Technology firms

INTRODUCTION

Service has become increasingly important. The service sector contributes considerably to the gross domestic product (GDP) of developing countries (*The World Factbook 2017, 2018*). Service also provides competitive advantages for organizations (Jiang and Li, 2009; Karnoe, 1995). Therefore, service is eliciting much attention from practitioners and scholars (Lusch, Vargo, and O'Brien, 2007). Extensive studies have been conducted to understand the role and contribution of service in organizations (e.g., Cheng and Krumwiede, 2017; Gebauer, 2009; Karmarkar, 2004).

However, extensive investigation of the role of services in marketing and organizations has revealed the limitations of the traditional and currently dominant view of services, namely, good-dominant logic, which emphasizes the difference between services and goods. This logic assumes that goods and services are at the two ends of a continuum (Ackroyd, Hughes, and Soothill, 1989; Murray and Schlacter, 1990; Rathmell, 1966).

The first main limitation of such a view is the vague boundary between services and goods (Vargo and Lusch, 2004). The traditional criteria for distinguishing services from goods are intangibility, heterogeneity, inseparability, and perishability (Gummesson, Lusch, and Vargo, 2010). However, many exceptional cases violate the defined differences between services and goods. For example, according to traditional logic, services are intangible, and the consumption and production of services occur simultaneously (Grönroos, 2016; Vargo and Lusch, 2008a). An e-book purchased and downloaded from Amazon.com is intangible, but consumption and production of the e-book do not occur simultaneously. In this case, we cannot determine if an e-book is a good or service according

to the distinctions between services and goods. The second main limitation of this view is that the majority of marketing studies focused on the marketing of goods instead of services because of the good-dominant logic (Vargo and Lusch, 2004). Thus, the applicability of marketing strategies and research findings on goods to services is questionable.

To overcome the limitations of the good-dominant logic, Vargo and Lusch (2004) proposed the service-dominant (S-D) logic. Instead of distinguishing services from goods, S-D logic regards everything as a service (Lusch and Nambisan, 2015; Lusch et al., 2007; Lusch, Vargo, and Tanniru, 2010). This logic considers services the fundamental basis of exchange, and entities that are considered products and goods in the good-dominant logic are only an appliance and distribution mechanism of services (Vargo and Lusch, 2008b). The values are derived during the process of the consumption of products and goods. When consumers use products and goods, services are provided to them through such products and goods.

Apart from the claim that S-D logic can help overcome the limitations of the traditional good-dominant logic, the extent of an organization's adoption of S-D logic, namely, the level of service-dominant orientation (SDO) of an organization, is also argued to contribute to an organization's innovative capability (Lusch and Nambisan, 2015; Lusch et al., 2007; Vargo and Lusch, 2008b). Nevertheless, studies on S-D logic seldom performed empirical investigations of the relationship between SDO level and innovative capability. Given that the current dominant metrics for determining the innovative performance of organizations are developed in reference to good-dominant logic, the innovative performance of organizations is usually measured based on patent counts, patent citations, and new product announcement or introduction, which are tangible in nature (Hagedoorn and Cloudt, 2003). Thus, whether SDO adoption improves the innovative performance of organizations according to current measurement standards is questionable.

This issue motivated us to empirically study the contributions of SDO to organizational performance. Apart from the internal capability of organizations (i.e., SDO in the context of this study), the innovative performance of organizations is also determined by external factors (Bergenholtz, 2011; Jantunen, 2005). In particular, we investigated the effects of SDO on an organization's innovative performance beyond external factors. To realize a parsimonious research model, we included only two environmental factors that are frequently mentioned in literature as the main antecedents of an organization's innovative performance; these two factors are knowledge sharing and external network (e.g., Jiang and Li, 2009; Spencer, 2003). Specifically, we addressed the following research questions.

(1) Is SDO behavior positively related to innovative performance?

(2) How do SDO behavior, knowledge sharing, and the external network of a firm influence firm innovative performance?

Guided by relationship learning theory, we propose that relationship learning is the mechanism of SDO, knowledge sharing, and external network that affects an organization's innovative performance through mediation. Detailed discussions are provided in the subsequent sections.

<Insert Figure 1 Here>

LITERATURE REVIEW

Service Dominant Orientation

SDO refers to a set of behaviors of a firm in transition from G-D logic to S-D logic (Lusch et al., 2010). S-D logic focuses on the shift from operand resources proposed in the traditional goods dominant (G-D) logic to operant resources, which are intangible, continuous and dynamic. Under the S-D logic, the unit of exchange becomes competencies, or specialized knowledge and skills for the

benefit of the receiver (customer), and the value-in-use, instead of value-in-exchange is focused (Lusch et al., 2007). In other words, under the S-D logic, goods are regarded as the appliances for service, which is a process of using ones resources for the benefit of and in conjunction with another party (Vargo and Lusch, 2004).

There is a growing paradigm shift in marketing toward S-D logic from G-D logic (Lusch, 2014), i.e., organizations started to focus on the constant interaction with customers to sense their needs, collaborate with customers to produce a solution, and bundle service to products to increase its use-value (Vargo and Lusch, 2004). S-D is not limited to the service industry. A number of manufacturing firms are shifting from a product-only orientation to a service-oriented strategy (Gebauer, 2009). Yet, there are substantial hurdles exist in the path of shifting from the G-D logic to the S-D logic, i.e., a broad range of success factors including organizational structure, culture, processes, and measurement systems are needed for a firm to implement a successful service orientation in the business strategy.

Innovative Performance

Innovation relates to a firm's ability to "*exploit its knowledge of the unexplored potential of technology*" and "*generate new combinations of existing knowledge*" (Kogut and Zander, 1992, p. 391). It is defined as "*the application of knowledge to produce new knowledge*" (Drucker, 1994, p. 173). Innovation is important because it enable companies to create and deploy their capabilities in order to support long term business performance (Teece, 2007).

Innovative performance is the outcome of the increase in an organization's knowledge base or the recombination of existing and new knowledge, which is also known as knowledge synthesis (Jiang and Li, 2009; Nonaka and Takeuchi, 1995). Theoretically, innovative performance can be reflected by the (1) introduction of new goods or new quality of goods, (2) introduction of a new method of

production, (3) opening of a new market, (4) conquest of a new source of supply of raw materials, and (5) design of a new organization in any industry (Rogers, 2010).

Considering that we are interested in determining if SDO can contribute to an organization's innovative performance in the traditional sense, innovative performance is defined as the degree to which organizations introduce new inventions, such as new products, process systems, and devices, to the market (Hagedoorn and Cloudt, 2003).

Knowledge Sharing with Partners and External Network

The literature shows that knowledge sharing and external network are the two key antecedents of innovative performance. First, a number of research studies have found that knowledge sharing is a critical factor of a high level of innovative performance. Spencer (2003) confirmed that firms earned higher innovative performance if they shared knowledge with their innovation system. Yu (2008) found that R&D alliances with suppliers have a positive impact on the firm's performance through knowledge sharing. Song and Di Benedetto (2008) found that when a new venture is seeking to develop a radical innovation, supplier involvement is essential so that product requirement knowledge can be shared. Kotabe, Martin, and Domoto (2003) suggested that knowledge sharing involves technological exchanges and transfer; the more exchange, the better the dyadic relationship performance. Luo, Liu, and Xue (2009) confirmed that knowledge sharing is a mediator between supplier-customer relationship investment and supplier-customer dyadic performance.

There are also some research studies suggesting that external network of an organization play a critical role in an organization's innovative performance. For example, Jiang and Li (2009) argued that alliance characteristics (i.e., alliance scope and governance) affect inter-firm knowledge sharing, creation, and innovative performance. Parties in an alliance or network in which the firm participates may contribute to innovative performance. Håkansson (1987) viewed innovation as a series of

interactions among members in the network. Tsai (2001) suggested that continuous interaction among the interacting units is important for organizational learning and resource sharing. The interactions between network actors can help firms to acquire new knowledge, discover new opportunities, and experience sharing, including sharing of resources. Lee, Lee, and Pennings (2001) found that the within the external network (partners and sponsors), the effect of sponsorship linkage, particularly venture capital (VC) makes a significant contribution to the start-up business performance. In particular, VC brings a network of resources to the start up. A network can also bring the firm choices of collaboration partners in R&D innovations (Belderbos, Carree, and Lokshin, 2004). Moreover, different sources of knowledge can positively affect the firm's innovative performance (Frenz and Ietto-Gillies, 2009). Therefore, the external network of a firm does contribute to its innovative performance.

Relationship Learning Theory and Relationship Learning

Relationship learning theory posits that an organization can achieve effective organizational learning and competitive advantages by developing its relationship learning capability (Chen, Lin, and Chang, 2009b; Li, 2006; Selnes and Sallis, 2003). Relationship learning was conceptualized and operationalized by Selnes and Sallis (2003). Relationship learning was initially defined as a set of ongoing information sharing, sense making, and integration activities between organizations and their customers that aims to create shared relationship-domain-specific memory. Subsequently, researchers found that relationship learning does not occur between customers and organizations only but also includes the entire network of an organization, including suppliers, customers, universities, the government, and competitors (Chen et al., 2009b).

Several studies that adopted relationship learning theory have shown that relationship learning is a key factor in an organization's innovative performance (e.g., Chen et al., 2009b). For example, Baba,

Shichijo, and Sedita (2009) discovered that the relationship learning occurring between organizations and universities improves the innovative performance of organizations. Table 1 presents the definitions of research constructs.

<Insert Table 1 Here>

HYPOTHESES DEVELOPMENT

Relationship Learning and Innovative Performance

We expect that relationship learning would lead to innovative performance for the following reasons. First, according to relationship learning theory, an organization's effectiveness in organizational learning is determined by relationship learning (Selnes and Sallis, 2003). An organization's innovative capability depends on how well the organization acquires technical capabilities, learns the business, and markets outside of the firm (Autio, Kanninen, and Gustafsson, 2008). An example is regular interactions and collaboration with customers (Flint, 2016; Weterings and Boschma, 2009). Relationship learning can provide organizations additional innovative ideas. Customers and service providers can co-create innovative solutions, which propel them to patronize refined product and service concepts and service delivery innovation (Chen, Tsou, and Huang, 2009a).

Second, relationship learning enables organizations to learn from their partners' failure. Organizations that learn from others' failure are likely to engage in active search and interpretation of their observations. Consequently, they achieve enhanced innovative performance (Bledow, Carette, Kühnel, and Bister, 2017; Kim and Miner, 2007). Therefore, the following hypothesis is proposed.

H1 – Relationship learning positively influences innovative performance.

SDO and Relationship Learning

SDO is expected to improve an organization's relationship learning. If a firm adopts SDO, it should shift from transactional to relational relationship management with its partners (Lusch et al., 2010), which emphasizes the co-creation of value, interactivity, and collaboration (Vargo and Lusch, 2008b). S-D logic also drives a firm toward active, collaborative problem solving, not just internally with various business functions but also externally with customers, value-network partners, and other stakeholders (Lusch et al., 2010). Firms with high SDO have many relationship learning opportunities. Relationship learning refers to the sharing of management information and development of relationship-specific memories of targeted customer–supplier relationships (Li, 2006). It occurs when a supplier and a customer improve their joint learning activities by facilitating information exchange, developing common learning arenas, and updating their behavior accordingly (Selnes and Sallis, 2003). Hence, SDO should lead to relationship learning, and the following hypothesis is proposed.

H2 – SDO positively influences relationship learning.

Knowledge Sharing and Relationship Learning

Relationship learning theory posits that the cultivation of relationship learning does not depend solely on the capability of the focal organization but also on the interaction between the organization and its partners (Selnes and Sallis, 2003). Therefore, in the present study, we also predict that knowledge sharing and external network, factors that indicate the interaction between organizations and their partners, cultivate relationship learning in organizations.

We expect that knowledge sharing would lead to relationship learning. The mutual sharing of knowledge among organizations should improve their capability to learn from their relationship

(Lee, 2001). The firms in this relationship share knowledge by exchanging technical information through a mutual learning process. Information exchange naturally facilitates effective learning in the supplier–customer dyad. Thus, knowledge sharing and exchange contribute to the relationship learning process (Selnes and Sallis, 2003). Learning among organizations can only occur if they are willing to share knowledge among themselves (Panteli and Sockalingam, 2005). Therefore the following hypothesis is proposed.

H3 – Knowledge sharing positively influences relationship learning.

External Network and Relationship Learning

Partnership with good network resources brings good learning opportunities (Collins and Clark, 2003; Ordanini and Maglio, 2009). For an organization in its network, learning through network relationships can increase substantially as the density of information increases. That is, organizations with deep involvement in their network have high information density (Lusch et al., 2010). An increase in information availability influences an organization’s learning through its relationship with its network. The external networks of firms provide important information exchange sources (Ordanini and Maglio, 2009). Therefore, firms that involve many external parties in product and project development acquire numerous opportunities to learn from their partners. Hence, the following hypothesis is proposed.

H4 – The external network positively influences relationship learning.

Mediating Role of Relationship Learning

We believe that SDO improves an organization’s innovative performance by mediating relationship learning for two reasons. First, SDO represents activities of interactions with partners in the network. An increase in interactions with partners in the network exposes the firm to a high density of technical knowledge and market information for learning (Vargo and Lusch, 2004). Innovative

performance or innovation can result from a firm's collaboration with its partners (Baba et al., 2009; Blazevic and Lievens, 2008; Frenz and Ietto-Gillies, 2009; Tsai, 2009).

Second, bundling services to physical products using technology can increase the overall innovativeness of the offerings to customers because integrated product-related service innovations require a high level of internal coordination involving employees, information sharing, multifunctional teams, IT, training, external contacts, and customers (Gebauer, Krempf, Fleisch, and Friedli, 2008). This coordination enhances innovative performance.

We believe that knowledge sharing affects an organization's innovative performance by mediating relationship learning. Prior research has demonstrated that knowledge sharing plays a key role in firm innovation (Coombs and Hull, 1998; Damanpour, 1991; Englund, 2002; Sherman, Berkowitz, and Souder, 2005). Knowledge sharing in a firm indicates that the firm is willing to share valuable resources with its relevant partners. This willingness to share builds relationship commitment, which leads to cooperation and reciprocal learning (Morgan and Hunt, 1994), thereby improving innovative performance.

We expect that external network would affect an organization's innovative performance by mediating relationship learning. Previous studies have demonstrated that external network plays an important role in improving an organization's innovative performance (Freel, 2003; Ordanini and Maglio, 2009; Roy, Sivakumar, and Wilkinson, 2004). External network or network alliance is a useful resource for firms (Lavie, 2006). The interactions between firms' internal knowledge and external sources can increase the innovative potential of enterprises because activities related to relationship learning are implemented (Frenz and Ietto-Gillies, 2009). A relationship network is established through the firm's engagement with different entities in its external network. Learning opportunities increase as the number of engaged parties increases. Even the relationship network can bring substantial, valuable information to the firm to innovate. Hence, the firm must have a process

to learn, absorb, and make decisions and must combine this process with its own knowledge to produce new ideas. Therefore, the following hypothesis is proposed.

H5 – Relationship learning mediates the relationships of SDO to innovative performance, knowledge sharing to innovative performance, and external network to innovative performance.

Data Collection and Sample

This research is primarily interested in the impact of SDO on innovative performance. Hence, companies in Hong Kong that focus on innovation were selected over general companies. Data were collected in 2011. Invitation letters and questionnaires were sent to 358 companies in Hong Kong Science and Technology Park (HKSTP), which serves for the purpose of nurturing technology and innovative companies in Hong Kong. The survey period lasted for one and a half months, and two rounds of reminders and follow-up telephone calls were conducted. 118 questionnaires were returned (the return rate was 32.96%). Incomplete and problematic cases were excluded from the analysis. A total of 82 samples were retained for analysis. The responding companies in the park are mostly young and small technology companies with 76.8% are less than 10 years of age, 88.9% have a total staff of less than 50, and 76.8% have revenue less than HK\$50M. Among these companies, 88% have less than 25 R&D staff. The proportions of the business to business (B2B) business model and business to consumer (B2C) business model are close with 17% of respondents serving both institutional and consumer customers. The respondents are mostly from top management; 82.9% are owner, top-level management or senior management. Since many of the respondents that returned the questionnaire are from small companies, the R&D investment amount is relatively small. About 70.7% of the firms invest less than HK\$5M in 2010. Half the respondents are with companies that neither filed nor had patents issued in 2009 and 2010. In terms of new product introductions (NPI), a significant number of respondents who did not have new products introduced in 2009 due to the

financial tsunami. The change in terms of percentage is used as the outcome, such as R&D investment growth, patent filing growth, new product introduction growth, and so on.

Before data collection, we conducted a statistical power analysis to determine the minimum sample size required to perform a statistical estimation with the proposed model (Cohen, 1988; Rueda, Benitez, and Braojos, 2017). With a desired statistical power level of 0.8 and seven predictors (number of links received by the construct innovative performance) and by assuming an anticipated effect size of 0.25, we determined that the minimum sample size required is 65. Our sample size was 82, which can provide sufficient statistical power to detect the effects of interests.

Measurements

Service Dominant Orientation. A scale for SDO is adopted from the study of Yiu and Ngai (2012). SDO was operationalized as a third-order construct with three formative second-order dimensions, six formative first-order dimensions, and 24 items. Table 2 shows the items and structure of SDO.

<Insert Table 2 Here>

External Network. External network is defined as the number of external parties in the value chain involved in the firm's innovation process (Ordanini and Maglio, 2009). The network can be measured by the extent to which external parties, such as suppliers, customers, competitors, and research institutions, are involved in innovation processes. A sample item is "the level of involvement with external parties in innovation in terms of supplier." Following the practice of Ordanini and Maglio (2009), external network was regarded in this work as a reflective construct.

Innovative Performance. Innovative performance is the ability to create innovative products or services for customers (Deshpande, Farley, and Webster, 1993). It was measured in this study by adopting the item in the study of Deshpande et al. (1993) that uses a seven-point Likert scale ("strongly agree" to "strongly disagree"). A sample item is "in terms of a new product or service

introduction, how often is your company the first to market new products or services?” According to the guideline provided by Hagedoorn and Cloudt (2003), using any single indicator to measure the innovative performance of technology firms is acceptable because the indicators of innovative performance are statistically overlapping and potentially wasteful in the case of technology firms. Therefore, because the sample of the study comprises technology firms, we used one item from the five-item measurement scale to measure innovative performance.

Knowledge Sharing. Knowledge sharing is defined as technical exchanges between the staff of two collaborating firms. It is assessed by examining the level, quality, timing, and type of technical communication between development engineers of the buyer firm and the firm’s key supplier (Kotabe et al., 2003; Lawson, Petersen, Cousins, and Handfield, 2009). Knowledge sharing (four items) measurement in this study was based on Kotabe et al. (2003) and Lawson et al. (2009) and used a seven-point Likert scale (“strongly agree” to “strongly disagree”). A sample item of knowledge sharing is “our engineers and sales staff have a close relationship with our partner’s staff.” Following common practices in literature, knowledge sharing was regarded as a reflective construct in this work.

Relationship Learning. Relationship learning is “*an ongoing joint activity between the customer and the supplier organizations directed at sharing information, making sense of information, and integrating acquired information into a shared relationship-domain-specific memory to improve the range or likelihood of potential relationship domain-specific behavior*” (Selnes and Sallis, 2003, p. 86). Relationship learning (five items) measurement was performed based on Chen et al. (2009a) and Selnes and Sallis (2003) and used a seven-point Likert scale (from “strongly agree” to “strongly disagree”). A sample item is “we exchange information related to changes in the technology of products with our relevant partner.” Following common practices in literature, relationship learning was regarded as a reflective construct in this work.

Control Variables. We propose to have control for the effects of firm size, firm age and firm revenue: (1) Firm size may influence the result of firm performance and competitive advantage; the value of relationship learning probably may not be as significant as in a decent size operation, and there may be many other factors that affect the performance results in a small firm. (2) The age of the firm may affect the innovative performance and competitive advantage, particularly while they start up, because the number of patents and amount of R&D investment may not be as high as in older firms. (3) The revenue level may reflect the firm's competitive advantage and the resource availability in its ability to innovate.

Measurement Model Evaluation

Before conducting further analysis, the external validity of our composite constructs was examined via confirmatory composite analysis (Benitez, Henseler, and Castillo, 2017; Benitez, Llorens, and Braojos, 2018). Model misspecification can be detected by the analysis. The goodness of fit indices of the saturate model, standardized root mean squared residual (SRMR), unweighted least squares (ULS) discrepancy (d_{ULS}), and geodesic discrepancy (d_G) were evaluated during the analysis (Benitez, Castillo, Llorens, and Braojos, 2018; Benitez et al., 2017)). According to the rule of thumb, the lower the indices are, the better the model fit is. Table 3 shows that all fit indices are relatively low. They are lower than the the 95% quantile of the bootstrap discrepancies (HI_{95}). This result supports the structure of our measurement model.

<Insert Table 3 Here>

As par the practices of Boudreau, Gefen, and Straub (2001), Cronbach (1971) and Straub (1989), we struck to improve the content validity of the constructs by taking the following measures. (1) A pilot test was carried out using data of 10 part-time students who are at management level in their organizations and items were slightly modified to increase clarity. (2) The other construct measuring

instruments were drawn directly from the prior literature. Therefore, we strongly believe that content validity is unlikely to be a problem in this research.

The internal consistence of each construct satisfied Cronbach's alpha assessment criteria of > 0.7 with value ranging from 0.7933 to 0.9122 (Fornell and Larcker, 1981). The AVE value of each construct is also greater than 0.5. Therefore, we can conclude that the convergent validity of relationship learning and knowledge sharing are supported.

The discriminant validity of construct was assessed by examining the interconstruct correlations, the comparison of the square root of the constructs' AVE and interconstruct correlations. Table 4 shows that all of the interconstruct correlations are below 0.9 (Bagozzi, Yi, and Phillips, 1991). The square root of the construct's AVE value, which is in the the diagonal of the matrix as shown in Table 4, are greater than all the interconstruct correlations (Chin, 1998). This results provide supports for the convergent and discriminant validity of the constructs.

The validity of external network is assessed by examining its VIF, as it is a formative construct that records different aspects of the firm's connection to other parties in innovative product development. All VIFs do not exceeding 3.3 per the recommendation from the study by Diamantopoulos and Sigauw (2006). Table 5 shows the VIFs of the formative constructs.

<Insert Table 4 Here>

<Insert Table 5 Here>

Non-response Bias

We examined the potential non-responses bias using independent t-tests (Armstrong and Overton, 1977), whereby we compared the early samples ($n = 59$) and late samples ($n = 59$) of randomly selected items of the questionnaire. We found that there were no significant differences between the means of the two groups. Therefore, non-response bias is less likely to affect the results.

Common Method Bias

Common method variance (CMV) may exist when a survey is filled out by the same person (Campbell and Fiske, 1959; Podsakoff and Organ, 1986). Although a composite model is unlikely to suffer from CMV (Rueda et al., 2017), we implemented a partial least squares (PLS) marker variable approach to test if our data are contaminated with CMV (Ronkko and Ylitalo, 2011). The marker variable is the education level of the respondents, which is supposed to be unrelated to the research constructs. We conclude that CMV is unlikely to be a serious concern because the imposition of the marker variable did not change the significance of the paths among constructs.

RESULTS

The research model was validated through PLS-based structural equation modeling (SEM). Advanced Analysis for Composites (ADANCO) 2.0.1 was selected as the software package for the implementation of PLS-based SEM. This method is considered appropriate for two primary reasons. First, PLS is a full-fledged SEM approach that can provide fit indices for confirmatory research (Benitez et al., 2017; Henseler, Hubona, and Ray, 2016). Second, PLS can handle composite and factor measurement models (Henseler et al., 2016; Rueda et al., 2017). Third, compared with covariance-based (CB) SEM, PLS-SEM provides better estimations of relatively complex models, namely, models with multidimensional constructs (Hair, Sarstedt, Ringle, and Mena, 2012; Henseler et al., 2016). Lastly, PLS-SEM is preferable when newly developed measurement scales are used (Rueda et al., 2017).

All control variables, namely, firm size ($\beta = 0.033$; $p > 0.05$), firm age ($\beta = -0.125$; $p > 0.05$), and revenue ($\beta = -0.044$, $p > 0.05$), were not significantly related to innovative performance. SDO, knowledge sharing, external network, and relationship learning explained 36.9% of the variation in innovative performance. SDO, knowledge sharing, and external network explained 63.0% of the variation in relationship learning. Relationship learning was positively and significantly related to innovation performance ($\beta = 0.431$; $p < 0.01$). Therefore, H1 is supported. SDO ($\beta = 0.419$; $p < 0.001$), knowledge sharing ($\beta = 0.296$; $p < 0.01$), and external network ($\beta = 0.247$; $p < 0.001$) were positively and significantly related to relationship learning. Thus, H2, H3, and H4 are supported. All hypotheses about direct relationships are therefore supported.

A mediation analysis was performed to determine if SDO, knowledge sharing, and external network affect innovative performance by mediating relationship learning. To do so, we added the direct effects of SDO, knowledge sharing, and external network on innovative performance. We also performed a bootstrapping analysis of 5,000 subsamples to test the significance of the direct effects proposed in H5. All direct effects were determined to be not significant. The indirect effects of SDO ($\beta = 0.18$, $p\text{-value} < 0.01$), knowledge sharing ($\beta = 0.127$, $p\text{-value} < 0.05$), and external network ($\beta = 0.107$, $p\text{-value} < 0.05$) on innovative performance exerted through the mediation of relationship learning were significant. Hence, the mediation effects proposed in H5 are supported.

<Insert Figure 2 Here>

DISCUSSIONS

We identified the relationship between innovative performance and SDO. The relationships of our proposed model of innovative performance and relationship learning with antecedents (SDO, knowledge sharing, and external network) were empirically tested through a survey of technological

companies in Hong Kong. The results showed that SDO, knowledge sharing, and external network indirectly affect an organization's innovative performance by mediating relationship learning.

The results of the test on the mediation of relationship learning showed that the positive effects of SDO, external network, and knowledge sharing on innovative performance are due to relationship learning with partners. This result indicates that learning in a relationship with relevant partners can explain the innovative process of technological firms. External network, knowledge sharing, and learning with partners are also important for the innovative performance of the technology companies we selected for the study. The mediation effect provides sufficient evidence on the importance of relationship-based learning in the innovation process. However, during the interviews for the construct development phase, several informants said they could not understand why offering good customer service leads to increased innovation. According to Prahalad and Ramaswamy (2004), innovation nowadays is transforming to experience innovation. Service, as defined by Vargo and Lusch (2004), would have a much boarder sense if we use the experience paradigm, in which parties (supplier, customers, and partners) co-create experience when consuming products or services (or consumption objects). In this case, the so-called traditional "features" of a product become a service provision delivered by the service appliance (e.g., physical product). With today's social networking, companies can easily involve other parties (including end users) in product or service development and market promotion. In addition, due to the free and rapid multi-lateral information flow to and from suppliers, customers, and end users on the Internet (e.g., forums, videos, and micro blogs), a brand's image can be enhanced or destroyed much more rapidly than before. Firms inevitably establish relationships with customers, partners, and end users via the Internet. Through the Internet, firms can now understand the end-use value (value in use) much better than they did before. Today, firms communicate mostly to downstream customers (Lusch et al., 2010). SDO firms strategically build relationships with their networks of suppliers, customers, partners (universities

and other collaborating partners), and even competitors. If the firms use their external network wisely, then this network will contribute to overall performance and innovation. This study confirmed that SDO firms can achieve enhanced innovative performance through relationship learning.

SDO firms focus on intangibilities, value co-creation, and value-in-use. They have shifted from being G-D oriented to S-D oriented by embedding service within their products. However, this situation does not mean that product companies should withdraw their product strategies and become service companies. Our study suggests that product firms can design products based on the view that a product is a service appliance. Miles (2010, p. 514) pointed out the commonalities of product and service activities as follows: “*Many service activities share common features, such as the intangibility of their core offering or product, and the interactivity between the service supplier and client.*” This service–product dual property allows product companies to innovate in a different dimension. With SDO adoption, service innovation experience may be used in product innovation. Ordanini and Maglio (2009) pointed out that new service development involves a key decision process that comprises proactive market orientation and open innovation. Our findings are also in line with external network and proactive marketing activities, including active participative co-creation by suppliers and customers/users. These findings are consistent with those of Paswan, D'Souza, and Zolfagharian (2009), who developed a service innovation topology in which customer involvement is the key strategy in service innovation. Co-creation as a form of partnership supports the argument of Agarwal and Selen (2009), who defined service innovation as an “evaluated service offering” that can be achieved through collaboration. Our study is consistent with those of Chen et al. (2009a), Bogers, Afuah, and Bastian (2010), and Michel, Brown, and Gallan (2008), who pointed out that innovation can be a result of the co-creation process with the external party’s collaboration.

Hence, value co-creation can be regarded as a sustainable strategy of customer knowledge acquisition for innovation. For example, consumers may use a product in an innovative way that the supplier never thought of before. Michel et al. (2008) called for further research on value-in-use as opposed to customer satisfaction in firms that adopt S-D logic. Learning and performance measurement should focus on the use value to customers and end users, which is consistent with our findings.

LIMITATIONS, IMPLICATIONS, AND FUTURE STUDIES

Limitations of the Research

One of the key limitations of this study is the small sample size of 82 relatively young companies (about 50% are younger than 5 years and more than 76% are younger than 10 years) in HKSTP. Purposive sampling selected a group of technology companies located in HKSTP, where R&D intensity is supposed to be higher than that in the rest of the society. The results may vary if the same study is performed in a larger scale outside HKSTP.

Managerial Implications

According to Pine and Gilmore (1998), the economy is now migrating to a service and experience economy. Service-product bundle have become more and more important in both product companies and technological companies. Thus, this study provides the needed language and measurement tools for managers to understand and communicate the status adoption of SDO of their firms. Although many firms incorporate service in their strategy due to competition, it becomes very costly over time and so many managers tried to reduce service. However they may not be aware that service like innovative product design, is a resource that generates new ideas. Managers of product companies can adopt SDO to develop new products. The contribution of service to innovative performance on products was not obvious in the past. However, this study demonstrates that managers now have a better reference and understanding of how the “service” (based on S-D logic definition by Vargo and

Lusch (2004)) the firm provides can contribute to innovation so that resources can be wisely reallocated to service strategies. This study found that the effective adoption of SDO measures positively influences a firm's innovative performance. Due to the product innovation vs. service innovation similarity in properties (Tether, 2005), product firms can design the "service" that the product can deliver instead of embedded feature (value). They can also find opportunities to co-create with customers as well as design products based on value-in-use. Designers can design products based on the perspective of how users consume the service provided by the product instead of its functional features. Our empirical results show that SDO, knowledge sharing and external network positively influence innovative performance via relationship learning. Managers should pay attention to how their firm allocates marketing resources. Instead of one-directional selling and information pushing, managers should look for opportunities in strengthening the experience of customers, co-creating values with network partners, using the use-value learning to drive performance and providing dependable services to enforce relationships. Firms may not have high SDO could be due to the following reasons: (1) They are goods-dominant driven. They mostly focus on what they do instead of interactions with their relevant partners; (2) Adoption of SDO requires investment in time and efforts (cost) onto interactions with network partners. Small firms may not have the resources (money and manpower); (3) Training is not enough for different level of staff being able to interact with the network and bring back information to share with internal; (4) There is also a potential dark side of adopting high SDO. According to Stam and Elfring (2008), over-embeddedness in one network may have some negative impact to the firm if the firm is smaller in size (entrepreneurs) or young in age (start-up). It could be due to the limited information processing capability of the organization in dealing with conflicting information. An optimal and arm's length connections may be enough. Managers should also notice the resistance of organization to adopt SDO and the potential drawbacks of adoption. Industries that may benefit the most if adopting SDO could be those who have massive customers base such as consumer (e.g. cell phone manufacturing

company, banking company, telecom and public service providers and retail / online retail businesses) or a massive number of B2B downstream customers. If the market only has a handful of customers, SDO may not be too important due to small size of customer community. That is the degree of benefits may also vary from a value chain position standpoint that benefit is higher if the firm is closer to the consumer. Managers should also evaluate the position of its supply chain before planning for the adoption of SDO because resource may not be well used for meaningful return.

Theoretical Contributions

This study makes the following contributions to the literatures. First, a research model of the influence of SDO on innovative performance was developed. According to the future research suggestion made by Lusch et al. (2010), the innovation of a firm is related to how much knowledge sharing of the firm does with external network. We developed an integrative framework that SDO which represents activities of interactions, knowledge sharing which represents content (technical knowledge) being shared, and external network which represents the broadness and depth of involvement of external parties in innovative R&D are positively influencing product innovative performance. The frame work with supports from empirical data of HKSTP serves as a response to the suggestion for future research by Lusch et al. (2010). The firms who are actively involved themselves in interaction activities (SDO) to increase its absorptive capacity to learn more for its innovation. We have advanced knowledge on innovation theory that SDO can be an important antecedent to product innovative performance according to the empirical results. Traditional innovation researches were based on G-D logic, and the innovation output is embedded in the value offer to customers in the product. There was no prior research on product innovation in relation to SDO based on S-D logic. Our empirical results show that SDO, knowledge sharing and external network positively influence innovative performance. This study has filled the gap of literature on SDO adoption and innovation such that innovation theory is extended to include SDO as an

antecedent of innovative performance and relationship learning. In a broader sense, service is not limited to traditional customer service. Vargo and Lusch (2004) defined “service” as the application of specialized competences to oneself or another via a process or a product as the service appliance. We have confirmed part of the argument made by Lusch et al. (2010) that SDO positively influence competitive advantages (e.g. innovative performance). This study serves as a starting point from which researchers can further develop innovation theories or competitive advantages theories based on S-D logic.

Second, we contribute to relationship learning theory by identifying three antecedents of relationship learning, namely, SDO, knowledge sharing, and external network. Our framework confirmed that the firm who is able to integrate innovative resources in the network (hub firm) can produce higher learning from relationships that our empirical study added new support to network and organizational learning literature (Dhanaraj and Parkhe, 2006; Tsai, 2001). This study also makes contribution by demonstrating how service dominant oriented activities, sharing of technical knowledge and depth and broadness of external parties’ involvement are also important in contributing to the firm’s innovative performance that relationship learning has a significant mediation role. This empirical finding is the first to explain the mechanism of innovation in firms that have adopted SDO, knowledge sharing and external network. Our empirical study is consistent with Lavie (2006) that the nature of relationship is more important than the nature of resource. That is, given a firm have its own technological knowhow (knowledge) as well as a network connection; it cannot advance its own knowledge if it cannot learn by exchanging knowhow for new knowhow in the relationships (make use of the network resource). After such learning, a firm needs to make decision to change or modify ideas or knowhow to advance the innovation. There are two processes involved, (1) a relational exchange process, and (2) a decision making process. The nature of relationship such as tight or loose is largely depending on the relational trust between the parties in

the relational exchange process (Morgan and Hunt, 1994). However, in interfirm collaboration, how firms are organizing the knowledge gained from relational memory according to Selnes and Sallis (2003) and share with the rest of organization remains a challenge. In this study, innovative performance is depending on relationship learning in which decision is made to change and to improve the innovation.

Future Research

Future studies are encouraged to expand the sample size to cover different countries and wider industries in order to test further the frame work we proposed. Moreover, different cultures may foster different ways of collaboration, different perceptions of service expectation, and different perceived value-in-use of service/product. An empirical study on cultural differences in the adoption of SDO may be interesting. Other innovative performance such as service innovation, process innovation and business model innovation are not included in this study. It would be interesting in future studies to find out the relationships of SDO to those innovations. Potential more studies may be needed on the development of measurements scale for service, process and business model innovation. In addition, further studies can assess the influence of the sub-dimensions on different types of innovations. For example, intangibilities potentially have a positive impact on service innovation (Drejer, 2004), co-creation is potentially has a positive impact on service innovation (Maglio and Spohrer, 2008), and value-in-use (people – product interaction) potentially has a positive impact on product innovation (Mascitelli, 2000). It would also be interesting to determine whether value-in-use is a better measure than customer satisfaction. Similarly, deeper understanding of market needs (from customers to end-users) will enable more innovation (Han, Kim, and Srivastava, 1998). It would be interesting to know the factors that contribute to different levels of innovation - incremental and radical (Hill and Rothaermel, 2003), for example. Service dominant oriented behaviour will foster a great deal of customer co-creation. However, some researchers have

argued that too much customer orientation actually makes the firm a market-driven organization instead of market-driving organization (Connor, 1999; Slater and Narver, 1998). A service dominant oriented firm may or may not be aware that they already have a network of partners. For example, besides the downstream customers (buyers), some firms may already have an end-user group / community. There is a great deal of information from those users as well as development partners to different levels of staff within the firm. Furthermore, the SDO concept can also be applied to organizational strategy in which leaders can treat subordinates as service clients. For example, managers can focus on intangibilities ties with subordinates instead only monetary ties. The value-in-use focus can help managers understand the real needs of the employees both in the work environment and in their families. It would be interesting to conduct an empirical research on a SDO strategy in an organizational management context. Firm specific factors and environmental factors may also affect the links between SDO and innovation. Factors such as firm innovativeness, firm competitive strength, technological turbulence and competitive intensity could also be factors moderating innovation (Augusto and Coelho, 2009). Internal knowledge management or sharing between R&D and marketing can also be moderating factor that affects innovative performance (Sherman et al., 2005). In addition, the other environmental factor involves the proximity of the knowledge sharing partners (Weterings and Boschma, 2009), which affects the effectiveness of knowledge sharing between the partners. Empirical study is encouraged to determine whether SDO is sustainable in different situations involved in the firm or in the environment.

CONCLUSIONS

In current business environment, embedding more services in the product is an inevitable trend. Before Vargo and Lusch (2004), service was not well defined (Lusch et al., 2007). We observed the migration of service research from Zeithaml, Parasuraman, and Berry (1985) (service characteristics: intangibility, heterogeneity, inseparability, and imperishability) to (Grönroos, 1995, p. 252) (service

is relational and is a process or performance involving the customer). Vargo and Lusch (2004, p. 2) finally defined service as “*the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself*”. S-D logic assumes that all economies are service economies and products are appliances of service (Vargo and Lusch, 2004). With this new definition, any firm (even product firm) can be service dominant oriented. Therefore, this study attempted to establish a relationship between the adoption of S-D logic via service dominant orientation and the innovative performance of technology firms. We successfully tested the hypothesis that service dominant orientation positively influences the innovative performance of a firm through the mediation of relationship learning. A survey was conducted with technology companies in HKSTP to test empirically the proposed model. The key findings are that service dominant orientation, knowledge sharing and external network has a positive impact on innovative performance through the mediation of relationship learning. The mediation effect of relationship learning is salient to the links of service dominant orientation, knowledge sharing and external network. Higher service dominant oriented firms have higher innovation because they learn from the relationships built up with their network of external parties. They also facilitate reliable services that build relationships with customers, which also provide a very good co-creation environment. The focus on value-in-use aspect also enables the firm to innovate better products or services. This result is expected to challenge most current beliefs that services that the company provides to customers are not related to innovation. The findings might inspire managers in the future to focus the adoption of SDO organization wide and consider blending products and services offered by the firm. Relationship learning among relevant partners should be facilitated in order to achieve innovative performance. Furthermore, managing the co-creative partners in the network is more important than ever to create of more knowledge for learning through the relationships.

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REFERENCES

- Ackroyd, S., Hughes, J. A., & Soothill, K. (1989). Public sector services and their management. *Journal of Management Studies*, 26(6), 603-619.
- Agarwal, R., & Selen, W. (2009). Dynamic capability building in service value networks for achieving service innovation. *Decision Sciences*, 40(3), 431-475.
- Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 14(3), 396-402.
- Augusto, M., & Coelho, F. (2009). Market orientation and new-to-the-world products: Exploring the moderating effects of innovativeness, competitive strength, and environmental forces. *Industrial Marketing Management*, 38(1), 94-108.
- Autio, E., Kanninen, S., & Gustafsson, R. (2008). First- and second-order additionality and learning outcomes in collaborative R&D programs. *Research Policy*, 37(1), 59-76.
- Baba, Y., Shichijo, N., & Sedita, S. R. (2009). How do collaborations with universities affect firms' innovative performance? The role of "Pasteur scientists" in the advanced materials field. *Research Policy*, 38(5), 756-764.
- Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, 36(3), 421.
- Belderbos, R., Carree, M., & Lokshin, B. (2004). Cooperative R&D and firm performance. *Research Policy*, 33(10), 1477-1492.
- Benitez, J., Castillo, A., Llorens, J., & Braojos, J. (2018). IT-enabled knowledge ambidexterity and innovation performance in small US firms: The moderator role of social media capability. *Information & Management*, 55(1), 131-143.
- Benitez, J., Henseler, J., & Castillo, A. (2017). *Development and update of guidelines to perform and report partial least squares path modeling in Information Systems research*. Paper presented at the the 21st Pacific Asia Conference on Information Systems, Langkawi, Malaysia.
- Benitez, J., Llorens, J., & Braojos, J. (2018). How information technology influences opportunity exploration and exploitation firm's capabilities. *Information & Management*, 55(4), 508-523.
- Bergenholtz, C. (2011). Knowledge brokering: spanning technological and network boundaries. *European Journal of Innovation Management*, 14(1), 74-92.
- Blazevic, V., & Lievens, A. (2008). Managing innovation through customer coproduced knowledge in electronic services: An exploratory study. *Journal of the Academy of Marketing Science*, 36(1), 138-151.
- Bledow, R., Carette, B., Kühnel, J., & Bister, D. (2017). Learning from others' failures: The effectiveness of failure stories for managerial learning. *Academy of Management Learning & Education*, 16(1), 39-53.
- Bogers, M., Afuah, A., & Bastian, B. (2010). Users as innovators: A review, critique, and future research directions. *Journal of Management*, 36(4), 857-875.
- Boudreau, M. C., Gefen, D., & Straub, D. W. (2001). Validation in information systems research: A state-of-the-art assessment. *MIS Quarterly*, 25(1), 1-16.
- Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2), 81-105.

- Chen, J. S., Tsou, H. T., & Huang, A. Y. H. (2009a). Service delivery innovation antecedents and impact on firm performance. *Journal of Service Research*, 12(1), 36-55.
- Chen, Y. S., Lin, M. J. J., & Chang, C. H. (2009b). The positive effects of relationship learning and absorptive capacity on innovation performance and competitive advantage in industrial markets. *Industrial Marketing Management*, 38(2), 152-158.
- Cheng, C. C. J., & Krumwiede, D. (2017). What makes a manufacturing firm effective for service innovation? The role of intangible capital under strategic and environmental conditions. *International Journal of Production Economics*, 193, 113-122.
- Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In G. A. Marcoulides (Ed.), *Modern Methods for Business Research* (pp. 295-336). Mahwah, N.J.: Lawrence Erlbaum.
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (Second ed.). Lawrence Erlbaum Associates.
- Collins, C. J., & Clark, K. D. (2003). Strategic human resource practices, top management team social networks, and firm performance: The role of human resource practices in creating organizational competitive advantage. *Academy of Management Journal*, 46(6), 740-751.
- Connor, T. (1999). Customer-led and market-oriented: A matter of balance. *Strategic Management Journal*, 20(12), 1157-1163.
- Coombs, R., & Hull, R. (1998). 'Knowledge management practices' and path-dependency in innovation. *Research Policy*, 27(3), 237-253.
- Cronbach, L. J. (1971). "Test validation," in educational measurement. In R. L. Thorndike (Ed.), *American Council on Education* (pp. 443-507). Washington, D. C.
- Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *The Academy of Management Journal*, 34(3), 555-590.
- Deshpande, R., Farley, J. U., & Webster, F. E. (1993). Corporate culture, customer orientation, and innovativeness in Japanese firms - a quadrad analysis. *Journal of Marketing*, 57(1), 23-27.
- Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review*, 31(3), 659-669.
- Diamantopoulos, A., & Siguaw, J. A. (2006). Formative versus reflective indicators in organizational measure development: A comparison and empirical illustration. *British Journal of Management*, 17(4), 263-282.
- Drejer, I. (2004). Identifying innovation in surveys of services: a Schumpeterian perspective. *Research Policy*, 33(3), 551-562.
- Drucker, P. F. (1994). *Post-Capitalist Society*. NY, USA: HarperCollins Publishers New York.
- Englund, R. (2002). From knowledge management to strategic competence: measuring technological and organisational innovation. *Journal of Product Innovation Management*, 19(1), 105-106.
- Flint, D. J. (2016). Innovation, symbolic interaction and customer valuing: thoughts stemming from a service-dominant logic of marketing. *Marketing Theory*, 6(3), 349-362.
- Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error - algebra and statistics. *Journal of Marketing Research*, 18(3), 382-388.
- Freel, M. S. (2003). Sectoral patterns of small firm innovation, networking and proximity. *Research Policy*, 32(5), 751-770.
- Frenz, M., & Ietto-Gillies, G. (2009). The impact on innovation performance of different sources of knowledge: Evidence from the UK Community Innovation Survey. *Research Policy*, 38(7), 1125-1135.
- Gebauer, H. (2009). An attention-based view on service orientation in the business strategy of manufacturing companies. *Journal of Managerial Psychology*, 24(1-2), 79-98.
- Gebauer, H., Krempf, R., Fleisch, E., & Friedli, T. (2008). Innovation of product-related services. *Managing Service Quality: An International Journal*, 18(4), 387-404.

- Grönroos, C. (1995). Relationship marketing: The strategy continuum. *Journal of the Academy of Marketing Science*, 23(4), 252-254.
- Grönroos, C. (2016). Adopting a service logic for marketing. *Marketing Theory*, 6(3), 317-333.
- Gummesson, E., Lusch, R. F., & Vargo, S. L. (2010). Transitioning from service management to service-dominant logic. *International Journal of Quality and Service Sciences*, 2(1), 8-22.
- Hagedoorn, J., & Cloudt, M. (2003). Measuring innovative performance: is there an advantage in using multiple indicators? *Research Policy*, 32(8), 1365-1379.
- Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414-433.
- Håkansson, H. (1987). *Industrial Technological Development: A Network Approach*. London: Croom Helm.
- Han, J. K., Kim, N., & Srivastava, R. K. (1998). Market orientation and organizational performance: Is innovation a missing link? *Journal of Marketing*, 62(4), 30.
- Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems*, 116(1), 2-20.
- Hill, C. W. L., & Rothaermel, F. T. (2003). The performance of incumbent firms in the face of radical technological innovation. *Academy of Management Review*, 28(2), 257-274.
- Jantunen, A. (2005). Knowledge-processing capabilities and innovative performance: an empirical study. *European Journal of Innovation Management*, 8(3), 336-349.
- Jiang, X., & Li, Y. (2009). An empirical investigation of knowledge management and innovative performance: The case of alliances. *Research Policy*, 38(2), 358-368.
- Karmarkar, U. (2004). Will you survive the services revolution. *Harvard Business Review*, 82(6), 100-107.
- Karner, P. (1995). Competence as process and the social embeddedness of competence building. *Best Papers Proceedings - Fifty-Fifth Annual Meeting of the Academy of Management*, 427-431.
- Kim, J.-Y., & Miner, A. S. (2007). Vicarious learning from the failures and near-failures of others: Evidence from the U.S. commercial banking industry. *Academy of Management Journal*, 50(3), 687-714.
- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3), 383-397.
- Kotabe, M., Martin, X., & Domoto, H. (2003). Gaining from vertical partnerships: knowledge transfer, relationship duration, and supplier performance improvement in the U.S. and Japanese automotive industries. *Strategic Management Journal*, 24(4), 293-316.
- Lavie, D. (2006). The competitive advantage of interconnected firms: An extension of the resource-based view. *Academy of Management Review*, 31(3), 638-658.
- Lawson, B., Petersen, K. J., Cousins, P. D., & Handfield, R. B. (2009). Knowledge sharing in interorganizational product development teams: The Effect of formal and informal socialization mechanisms. *Journal of Product Innovation Management*, 26(2), 156-172.
- Lee, C., Lee, K., & Pennings, J. M. (2001). Internal capabilities, external networks, and performance: A study on technology-based ventures. *Strategic Management Journal*, 22(6-7), 615-640.
- Lee, J.-N. (2001). The impact of knowledge sharing, organizational capability and partnership quality on IS outsourcing success. *Information & Management*, 38(5), 323-335.
- Li, L.-y. (2006). Relationship learning at trade shows: Its antecedents and consequences. *Industrial Marketing Management*, 35(2), 166-177.
- Luo, Y. L., Liu, Y., & Xue, J. Q. (2009). Relationship investment and channel performance: An analysis of mediating forces. *Journal of Management Studies*, 46(7), 1113-1137.

- Lusch, R. (2014). *The service-dominant logic of marketing : Dialog, debate, and directions*. Armonk, N.Y.: ME Sharpe.
- Lusch, R. F., & Nambisan, S. (2015). Service innovation: A service-dominant logic perspective. *MIS Quarterly*, 39(1), 155-175.
- Lusch, R. F., Vargo, S. L., & O'Brien, M. (2007). Competing through service: Insights from service-dominant logic. *Journal of Retailing*, 83(1), 5-18.
- Lusch, R. F., Vargo, S. L., & Tanniru, M. (2010). Service, value networks and learning. *Journal of the Academy of Marketing Science*, 38(1), 19-31.
- Maglio, P. P., & Spohrer, J. (2008). Fundamentals of service science. *Journal of the Academy of Marketing Science*, 36(1), 18-20.
- Mascitelli, R. (2000). From experience: Harnessing tacit knowledge to achieve breakthrough innovation. *Journal of Product Innovation Management*, 17(3), 179-193.
- Michel, S., Brown, S. W., & Gallan, A. S. (2008). An expanded and strategic view of discontinuous innovations: deploying a service-dominant logic. *Journal of the Academy of Marketing Science*, 36(1), 54-66.
- Miles, I. (2010). Service Innovation. In P. P. Maglio, C. A. Kieliszewski, & J. C. Spohrer (Eds.), *Handbook of Service Science* (pp. 511-533). Boston, MA: Springer US.
- Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20.
- Murray, K. B., & Schlacter, J. L. (1990). The impact of services versus goods on consumers' assessment of perceived risk and variability. *Journal of the Academy of Marketing Science*, 18(1), 51-65.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge creation company: how Japanese companies create the dynamics of innovation*. New York: Oxford University Press.
- Ordanini, A., & Maglio, P. P. (2009). Market Orientation, Internal Process, and External Network: A Qualitative Comparative Analysis of Key Decisional Alternatives in the New Service Development. *Decision Sciences*, 40(3), 601-625.
- Panteli, N., & Sockalingam, S. (2005). Trust and conflict within virtual inter-organizational alliances: a framework for facilitating knowledge sharing. *Decision Support Systems*, 39(4), 599-617.
- Paswan, A., D'Souza, D., & Zolfagharian, M. A. (2009). Toward a contextually anchored service innovation typology. *Decision Sciences*, 40(3), 513-540.
- Pine, I. I. B. J., & Gilmore, J. H. (1998). Welcome to the experience economy. *Harvard Business Review*, 76(4), 97-105.
- Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research - problems and prospects. *Journal of Management*, 12(4), 531-544.
- Prahalad, C. K., & Ramaswamy, V. (2004). *The Future of Competition: Co-creating Unique Value with Customers*: Harvard Business School Pub.
- Rathmell, J. M. (1966). What is meant by services? *Journal of Marketing*, 30(4), 32.
- Rogers, E. M. (2010). *Diffusion of innovations*: Simon and Schuster.
- Ronkko, M., & Ylitalo, J. (2011). *PLS marker variable approach to diagnosing and controlling for method variance*. Paper presented at the the 32nd International Conference on Information Systems, Shanghai, China.
- Roy, S., Sivakumar, K., & Wilkinson, I. F. (2004). Innovation generation in supply chain relationships: A conceptual model and research propositions. *Journal of the Academy of Marketing Science*, 32(1), 61-79.
- Rueda, L., Benitez, J., & Braojos, J. (2017). From traditional education technologies to student satisfaction in Management education: A theory of the role of social media applications. *Information & Management*, 54(8), 1059-1071.

- Selnes, F., & Sallis, J. (2003). Promoting relationship learning. *Journal of Marketing*, 67(3), 80-95.
- Sherman, J. D., Berkowitz, D., & Souder, W. E. (2005). New product development performance and the interaction of cross-functional integration and knowledge management. *Journal of Product Innovation Management*, 22(5), 399-411.
- Slater, S. F., & Narver, J. C. (1998). Customer-led and market-oriented: let's not confuse the two. *Strategic Management Journal*, 19(10), 1001-1006.
- Song, M., & Di Benedetto, C. A. (2008). Supplier's involvement and success of radical new product development in new ventures. *Journal of Operations Management*, 26(1), 1-22.
- Spencer, J. W. (2003). Firms' knowledge-sharing strategies in the global innovation system: empirical evidence from the flat panel display industry. *Strategic Management Journal*, 24(3), 217-233.
- Stam, W., & Elfring, T. (2008). Entrepreneurial orientation and new venture performance: The moderating role of intra- and extraindustry social capital. *Academy of Management Journal*, 51(1), 97-111.
- Straub, D. W. (1989). Validating instruments in MIS research. *MIS Quarterly*, 13(2), 147-169.
- Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350.
- Tether, B. S. (2005). Do services innovate (differently)? Insights from the European innovometer survey. *Industry & Innovation*, 12(2), 153-184.
- Tsai, K.-H. (2009). Collaborative networks and product innovation performance: Toward a contingency perspective. *Research Policy*, 38(5), 765-778.
- Tsai, W. P. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal*, 44(5), 996-1004.
- Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1), 1-17.
- Vargo, S. L., & Lusch, R. F. (2008a). From goods to service(s): Divergences and convergences of logics. *Industrial Marketing Management*, 37(3), 254-259.
- Vargo, S. L., & Lusch, R. F. (2008b). Service-dominant logic: continuing the evolution. *Journal of the Academy of Marketing Science*, 36(1), 1-10.
- Weterings, A., & Boschma, R. (2009). Does spatial proximity to customers matter for innovative performance? *Research Policy*, 38(5), 746-755.
- The World Factbook 2017*. (2018). Retrieved from <https://www.cia.gov/library/publications/download/download-2017/index.html>
- Yiu, H. L., & Ngai, E. W. T. (2012). *Service Dominant Orientation Conceptualization and Measurement Development*. Department of Management and Marketing. The Hong Kong Polytechnic University.
- Yu, L. (2008). Collaborating with the right partners. *MIT Sloan Management Review*, 50(1), 8-9.
- Zeithaml, V. A., Parasuraman, A., & Berry, L. L. (1985). Problems and strategies in services marketing. *Journal of Marketing*, 49(2), 33.

TABLES

Table 1 Construct Definitions

Construct	Definition
Service Dominant Orientation	SDO refers to a set of behaviors of a firm in transition from G-D logic to S-D logic (Lusch et al., 2010).
Relationship Learning	Relationship learning is defined as an ongoing joint activity between the customer and the supplier organizations directed at sharing information, making sense of information, and integrating acquired information into a shared relationship-domain-specific memory to improve the range or likelihood of potential relationship domain-specific (Chen et al., 2009b; Selnes & Sallis, 2003).
Innovative Performance	Innovative performance is defined as the results for companies in terms of introducing inventions (products) into the market, i.e. new product introduction, as well as the achievement in the trajectory from conception of an idea up to the introduction of an invention into the market, i.e. combination of R&D input (investment), patent count and patent citations. It is measured by (any one) of the achievements of companies in terms of patent counts, R&D investment and new products introduction (Hagedoorn & Cloudt, 2003).
External Network	External network is defined as how many external players such as suppliers, institutions, competitors, and customers in the value chain and their involvement in the innovation process of a firm (Ordanini & Maglio, 2009).
Knowledge Sharing	Knowledge sharing is defined as technical exchanges between the staff of the two firms in collaboration (Kotabe et al., 2007).

Table 2 Sub-dimensions and Respective Items

Basic-dimension	Sub-dimension	Summary	Items after Validation
Intangibilities	Service Dependability	Service Income	1. Our company's main source of income is selling our services.
		Knowledge Selling	4. We are selling our expertise and knowledge as services to customers.
		Service Information System	5. We are providing customers a reliable information system. (e.g. secured e-business platform, ease-of-use website, EDS, ERP, etc.)
		Value Base Pricing	7. We emphasis on product selling ONLY rather than product plus service selling.
	Experience Enforcement	Quality of Service Experience	8. We are putting focus on the quality of service we deliver with our products / services.
		Customer Interaction Regularity	2. We are regularly interacting with customers for technical/non-technical support. (e.g. through web, phone, email or face-to-face, etc.)
		Competitiveness via Service with Products	3. We are combining more services with product to enhance competitiveness. (e.g. pre/after sales support, customization, etc.)
		Loyal Customer Treatment	6. We are providing privileges for loyal customers. (e.g. customer club, social gathering, etc.)
Value co-creation	Integrative Co-creation	Customer Perceive Value of the Firm	19. We are investing effort in brand recognition development to boost positive quality image of our company to customers.
		Co-design with Customers	13. We are co-designing products / services with customers.
		Customer Resource Leverage	14. We are leveraging on customer's resource in collaborations.
		Customer Integration in Development	15. We are integrating customers into our product / service development process.
		Customer Ownership of Development	16. We are making customers to feel ownership in any product / service development. (e.g. providing private label, personalized design, customer owned tooling, etc.)
		Customer Integration in Business Process	17. We always integrate customers in our business process.
	Participative Co-creation	End-user Direct Communication	18. End-users of our products / services are in our communication loop for promotion or feedback.
		Customer Self-service	10. We are training our customers to enable their self-service capability. (e.g. via web-minar/face-to-face, Youtube, FAQ, Online Enquiry, etc.)
		Customization done by Customer	11. We are providing tools to customers to perform customization by themselves. (e.g. customer development kit)
	Value in use	Value Learning	Customer Sharing Mobilization
Customer Communication Enhancement via Technology			9. We are utilizing new technology in enhancing two way communications with customer. (e.g. Netmeeting, blog, forum, social network, instant message, etc)
Use-value Pricing using Technology			23. We are utilizing technology or resources to capture end-users' use-value information to determine right pricing.
Value Driven Performance		Resource to Drive use-value Strategy	24. We are having dedicate resources in analyze customer use-value information to drive current or next generation product / service strategy.
		Use-value Information Gathering	20. My customers or relevant partners are giving us lots of knowledge on end-users' use-value of our products / services.
		Use-value Offer	21. We are selling our products / services base on their production cost rather than their use-value.
	Value Driven Performance	22. We are improving business performance based on customer's use-value feedback in financial terms. (e.g. price customer willing to pay, margin, cashflow, etc.)	

Table 3 Results of the Confirmatory Composite Analysis

Discrepancy	First-order Constructs			Second-order Constructs			Third-order Constructs		
	Value	HI ₉₅	Conclusion	Value	HI ₉₅	Conclusion	Value	HI ₉₅	Conclusion
SRMR	0.092	0.101	Supported	0.051	0.069	Supported	0.03	0.05	Supported
d _{ULS}	5.951	7.156	Supported	0.24	0.438	Supported	0.049	0.137	Supported
d _G	2.721	4.73	Supported	0.094	0.161	Supported	0.029	0.069	Supported

Table 4 Construct Correlations and Square Root of AVE Comparison

	KS	EN	IN	RL	SD	EE	CC	PCC	VL	VDP
KS	0.89									
EN	0.451	NA								
IN	0.464	0.391	NA							
RL	0.667	0.556	0.572	0.74						
SD	0.482	0.295	0.283	0.454	NA					
EE	0.444	0.252	0.221	0.393	0.585	NA				
CC	0.473	0.311	0.319	0.629	0.333	0.443	NA			
PCC	0.318	0.167	0.142	0.29	0.272	0.120	0.344	NA		
VL	0.174	0.274	0.152	0.233	0.334	0.231	0.369	0.284	NA	
VDP	0.517	0.384	0.348	0.586	0.293	0.406	0.631	0.156	0.319	NA

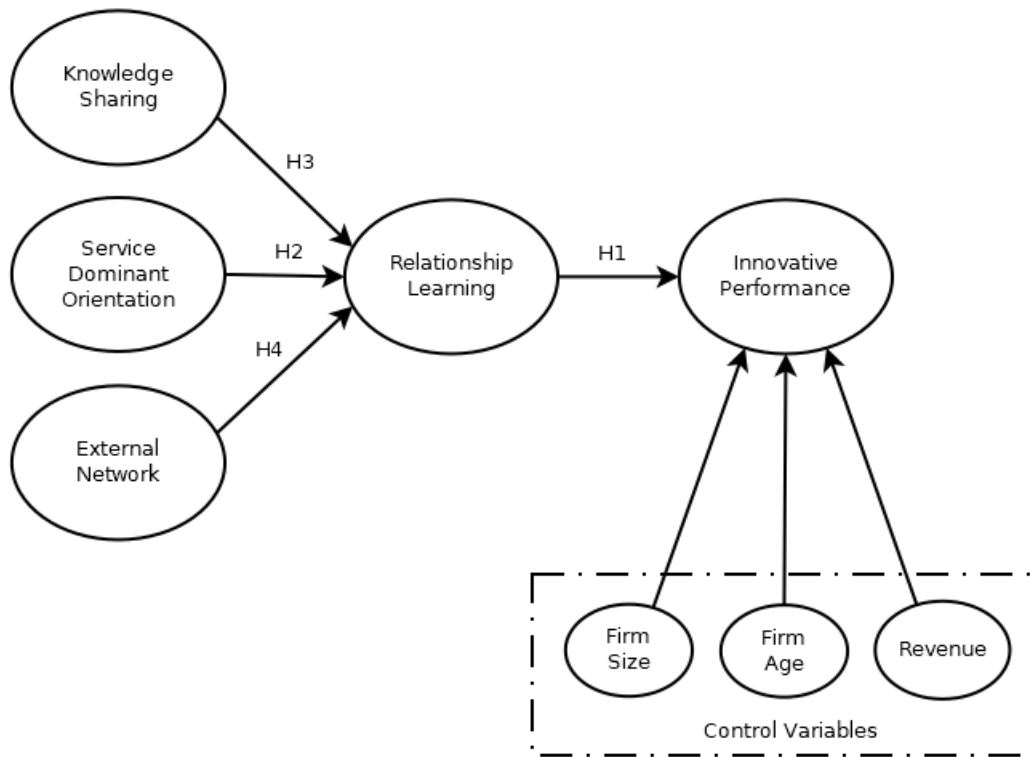
Key: SD = Service dependability, EE = Experience enforcement, ICC = Integrative co-creation, PCC = participative co-creation, VL = Value learning, VDP = Value driven performance, IN = Innovative performance, RL = Relationship learning

Table 5 Measurement Model Evaluation at First-, Second-, and Third-order Level

	Mean	S.D.	VIF
Service dominant logic (composite third-order construct)			
Intangibilities (composite second-order construct)			1.251
Service dependability (composite first-order construct)			1.52
SDO1	4.844	1.481	1.623
SDO4	5.5	1.114	1.84
SDO5	4.927	1.303	1.364
SDO8	5.598	1.216	1.141
Experience enforcement (composite first-order construct)			1.52
SDO2	5.439	1.177	2.007
SDO3	5.463	1.219	2.007

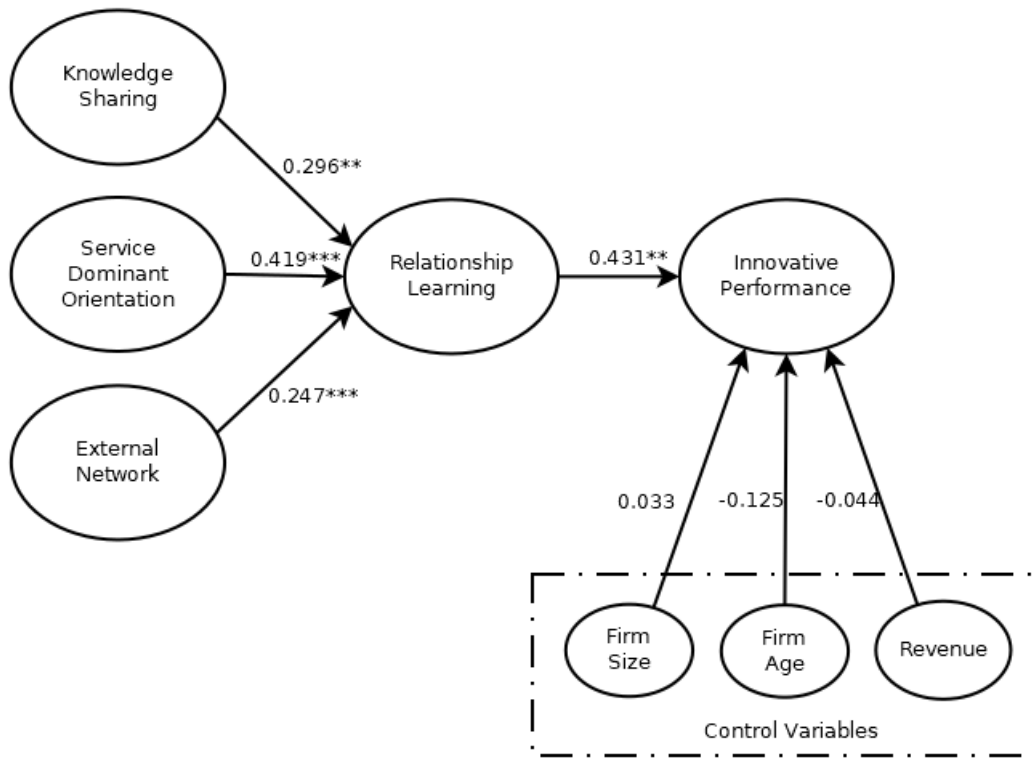
Value co-creation (composite second-order construct)			1.781
Integrative co-creation (composite first-order construct)			1.135
SDO13	5.098	1.151	2.545
SDO14	4.976	1.1	2.548
SDO15	5.256	1.004	2.39
SDO16	5	1.333	2.491
SDO17	5.28	0.879	1.864
SDO18	5.146	1.032	1.164
Participative co-creation (composite first-order construct)			1.135
SDO10	4.817	1.371	1.48
SDO11	4.634	1.301	1.353
SDO12	4.598	1.304	1.356
Value-in-use (composite second-order construct)			1.723
Value learning (composite first-order construct)			1.114
SDO23	4.756	1.117	2.279
SDO24	4.659	1.168	2.279
Value driven performance (composite first-order construct)			1.114
SDO20	5.329	0.917	1.309
SDO22	4.939	0.96	1.309
External network (composite first-order construct)			
EN1	3.939	1.731	1.233
EN2	5	1.315	1.285
EN3	3.878	1.559	1.324
EN4	4.207	1.489	1.624
EN5	4.451	1.424	1.47

FIGURES



*H5 does not show in the figure

Figure 1 Research Model



*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Figure 2 Path Analysis