The Impact of Relational Embeddedness, Knowledge Sharing on Service Innovation Performance*

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Abstract: Drawing from the social network and knowledge sharing literature, we develop a conceptual model. We tested the model using empirical data from 243 firms across six industries. The empirical results show that relational embeddedness has a positive impact on service innovation performance, and knowledge sharing has mediating effect.

Key words: relational embeddedness; structural embeddedness; knowledge sharing; service innovation performance

1 Introduction

In the modern economy, the service industry has become an important engine of economic growth and a significant symbol for modernization. Services are no longer an “appendage” to manufacturing, but play a pivotal role in the economy of a country. The experience of Japan and South Korea's economic development shows that in the later stages of industrialization, services have become a dominant industry (Paton and McLaughlin 2008). According to economic census figures from 2007, more than 80 percent of the U.S. gross domestic product derives from service industries. International competitiveness in the future depends largely on the strength of the service edge, and the international trend of service industry will head many countries into more intense market competition. With liberalization, internationalization, optimization and technicalization in the development of the service industry, the service sector in China has made great progress, but the problem still exists in internal structure and overall strength compared to other developed countries, therefore competitiveness in areas such as service delivery is yet to be strengthened.

Given the dominance of service industries in the economy, it makes sense that stakeholders are interested in how to manage them properly. Over the past three decades, many excellent books have been written about services strategy, management, marketing, and operations. Yet, there is still one nagging area of confusion that demands attention-service innovation. Globalization and new information technology have resulted in increased competition, increased mobility of skilled workers, and consequently shorter product life cycles, smaller profit margins, and higher risks (Chesbrough, 2003). To stay in business, companies must spread risk and must innovate, that is, develop new products and services, at a high speed and on an efficient scale. Innovation is a top priority for service executives, but they lack the guidance required to innovate in a meaningful way. With the difference between physical products getting smaller and smaller, more and more companies turn their attention to reflecting service differentiation from the perspective of services so as to avoid fierce price competition with rivals, making service innovation increasingly important for competitive advantage (Sundbo, 2008). Service innovation requires complex knowledge, skills and resources. However, many important innovation resources are not an exclusive privilege, but exist in the network of corporations.

* This research is supported by the National Natural Science Foundation of China (No. 70872030 & No. 71090403/71090400).
(Afuah, 2003). Facing increased uncertainty and cost as well as heightened competition, firms consider not only in-house development but also collaboration or acquisition to increase their innovativeness (Pisano, 1990). In recent years, many organizations have stepped over the boundary to integrate the resources and abilities of external partners to improve the ability of enterprise innovation (Hanna et al., 2002; Perks et al., 2006; Heimeriks et al., 2007; Capaldo, 2007). Therefore, the notion of relationship networks has become an effective way to explore service innovation.

The recognition of the paramount importance of networks for innovation management leads to the concept of open innovation systems. This approach is consistent with former studies which argue that innovations are increasingly the result of a joint effort of a number of parties involved in the process (Chesbrough, 2003; Noteboom, 1999). To examine service innovation from the network perspective, integrating internal and external networks of complementary resources, capabilities and knowledge, can help enterprises to improve their innovation performance (Blazevic et al., 2008 & Yuan 2010), Gemünden et al. (1996) and Perks and Jeffrey (2006) suggest that network structure is used to describe the business relationships with external partners, as well as the shape and position of the enterprise in the network of relationships to obtain the resources, knowledge, ability and information that benefit innovation. Network theory expands the discussion by indicating the possibility of tapping into resources available in a network through collaborations/external partnership (Gulati, 1998). By studying both individual dyadic links and environment features of networks, it becomes possible to understand the factors influential in inter-firm collaborations in technology and innovation development (Osborn and Hagedoorn, 1997).

A great part of the recent interest in market or customer based innovation derives from studies of the service sector including knowledge services (e.g. Gallouj 1994, 2002, Miles et al. 1994, Sundbo 1998, Haukness 1999, Boden and Miles 2000, Edvardsson et al. 2000, Hipp 2000, van Aa and Elfring 2002.). In service development research, customers represent an important resource, or even the very basis of service innovation (Martin and Horne 1995, Lilien et al. 2002). Innovation models are changing and in advanced countries, companies use alternative external sources of innovative competencies such as strategic technology alliances, mergers and acquisitions, or a mix of these (NSF, 2004). Benefits range from knowledge sharing and risk reduction to increased competitive power. In fact, knowledge sharing is the intermediate variable in the path of relational embeddedness configuration on service innovation performance. Knowledge sharing is one of the key factors in knowledge management and successful innovation, but how to encourage organizations to share knowledge voluntarily is very difficult. Although knowledge creation begins with interpersonal interaction, knowledge sharing is based on the foundation of the interpersonal relationship network (Hoffmann, 2007), therefore the individual network is the key medium in sharing personal knowledge. Network relationships appear to be critically important to the issue of knowledge-sharing, however, existing studies on the whole have ignored such a problem. Therefore, this study will explore the control of relational embeddedness configuration and organization in different positions of network over resources and knowledge, and it will help clarify the interaction between network relationship and knowledge sharing, as well as to understand the knowledge-sharing process within the dynamics network and its impact on service innovation performance.

2 Literature Review

2.1 Relational Embeddedness Configuration

Granovetter (1985) proposes that most economic actions are facilitated or constrained by an actor’s social surroundings, which represents a nexus of social relations and contexts. The enterprise networks
with external partners are one of the organizational characteristics; the complementary characteristics and interdependence between external partnerships, as well as the innovative network structure can be conceptualized as the status of enterprises in the shape of network management, which aims to achieve and utilize all important resource and knowledge existing in the network beneficial for innovation activities (Perks and Jeffrey, 2006). As Echols and Tsai (2005, 221) argue, the strategic decisions (and actions) of a firm are not made solely internally but have to “take into account the social context in which it interacts with other firms. Through collaborations with other firms in the industry, a firm involves itself in an inter-firm network that contains useful information and resource flows.” Embeddedness theory emphasizes that stable relationships and structure can create trust and prevent unlawful and illegal acts. Clegg (1990) contends that embeddedness occurs on behalf of the relationship profile, with one part being autonomous, the other part being dependent (Clegg, 1990). Halinen and Törnroos (1998) refer embeddedness to the level of association and dependence between organizations in different forms of networks.

Academics have not yet arrived at a conclusion whether there is an optimal network structure. Enterprises determine the most suitable network structure with regard to their goals. Many previous studies have pointed out that the network structure should be set in accordance with the industry environment and business goals. Gemünden et al. (1996) indicated that the network structure can be described in two dimensions of a technically intertwined pattern and intensity between companies, customers, suppliers and universities. During the cooperation process, members build their interaction on clan or community recognition (Dyer and Singh, 1998; Gulati, 1995) instead of self-interest. The greater the intensity of such interaction, the higher the chance that members will contribute and act upon collective benefits. Under a reciprocal cooperation with community identity, individual network members are more willing to share knowledge and ensure the quality and quantity of the acquired knowledge (Blyler and Coff, 2003; Koka and Prescott, 2002) to improve their innovation performance.

It is argued here that taking into account the strength of relational embeddedness for the discription of the dimension within the network structure, can help to overcome the defects caused by putting too much emphasis on research while neglecting the quality of the network structure itself (Roberta, 2009), which is more in line with the nature of network relations and service innovation. As noted from previous works, network embeddedness “describes the structure of a firm’s relationship with other firms—specifically, the extent to which a firm is connected to other firms (Echols and Tsai, 2005).” We adopt this concept and extend such structural description to the relational, structure and cognitive aspects. This paper explores the mechanisms between network embeddedness structure, knowledge sharing and innovation performance based on distinguishing the three kinds of network embeddedness structure - the relational embeddedness, the structural embeddedness and the cognitive embeddedness. (Anderson et al., 2001)

2.2 Knowledge Sharing

In the knowledge economy era, knowledge is the source of competitive advantage and the main driving force to create value for enterprises. However, knowledge is usually found scattered among individual members, whose task differs in creation, recognition, gain and application of knowledge (Renu and Willen, 2009). The purpose of knowledge management is to make an overall plan of the creation, transfer and application of organizational knowledge. Besides knowledge management, similar concepts are mentioned in the literature such as interpartner learning (Hamel, 1991), networks of learning (Powell, Koput, & SmithDoerr, 1996), learning alliances (Khanna, Gulati, & Nohria, 1998), collective knowledge development in strategic alliances (Larsson, Bengtsson, Henriksson, & Sparks, 2009).
In this way, resources such as human resources, technology, and customer information are pooled to improve and speed up the innovation process, whereas at the same time risks are spread (see e.g. Parkhe, 1991; Ring & Van de Ven, 1994). In this article, we propose the concept of knowledge sharing. Knowledge sharing occurs in the acquisition and ongoing application of related information at individual and social levels. The internal and external knowledge sharing is the most important process of knowledge management, to which enterprises should pay attention.

The process of knowledge sharing within business partners involves three elements: (1) knowledge sharing subject - includes knowledge owner, knowledge demander and their roles are likely to exchange during the process of knowledge sharing; (2) enterprise knowledge - the object of knowledge sharing; (3) sharing rules, procedures and methods - which purposes are to share knowledge rapidly, effectively, economically and reasonably as well as to coordinate conflicts of benefit among the participants. Knowledge sharing is composed of two processes, namely the externalization and internalization of knowledge, the process whereby the owner transfers knowledge while the gainer absorbs knowledge. Given that, knowledge sharing requires not only both sides’ will to share knowledge, but also the ability to complete knowledge encoding, transmission and decoding activities.

According to the purpose of this study, combined with the existing definition and content, inter-organizational knowledge sharing is defined as the specific knowledge within the organization through four interaction processes such as socialization, exteriorization, integration and internalization under the principles and norms of cooperation in order to achieve the diffusion of knowledge and the generation of new knowledge.

2.3 Service Innovation

The study of networks and service innovation is far from new. It has been a topic of interest in many scientific fields. Previous research has demonstrated that “innovation in service firms goes across firm and industry boundaries” and is not limited to an individual firm. Along the value chain the borders between firms get blurred through outsourcing of service functions, through the use of networks of service professionals, and through mixed project teams in which client and contracting service firm co-produce solutions to problems. As the boundary between industrial and service sectors is becoming increasingly blurred, Grönroos (2000) believes that all businesses are service industries, so there is no distinction between service and manufacturing companies in the study of service innovation (Sundbo, 2008). The emphasis here is that in the study of service innovation, we must focus on information flow, procedures and interaction level, and attach importance to the social interaction factors in the process of innovation, which include customers, suppliers, competitors and research institutions. The interaction between enterprises and these objects can access much useful knowledge and resources conducive to service innovation, thereby affecting the likelihood of successful service innovation. Services that provide distinctive value to customers have more than three times the success rate of other services. And services that clearly align with customer needs achieve more than five times the success rate of services that have a poor fit with customer needs (Cooper and Edgett, 2004). It can be seen that the research of service innovation requires exploration from a network perspective more than that of industrial innovation, because the basic unit of network analysis is actors and ties between actors, and its core idea is that information, knowledge and resources can be transmitted by the interaction of members, which can effectively interpret and analyze the service innovation process and its outcome (Blazevic, 2008).
This study covers service innovation from the view of the relational network and internal and external network integration, which can help improve the ability to solve complex problems, increase creativity potential, improve customer’s activity focus, shorten the services development period, promote effective communication and thereby reduce the risk and cost of development of new service innovation through the external network. Through the investigation and analysis of innovation in the United States in 2005 by the Council on Competitiveness, the results show that the main source of knowledge in service innovation comes from customers and suppliers. Tether’s (2003) study concludes with the same findings. However, Leiponen (2005) points out that the main source is customers and competitors; among which the knowledge source of technological innovation in manufacturing is knowledge-intensive services (KIBS), various universities, research institutions and outside enterprises, though the impact of which in service innovation is not obvious (Leiponen, 2005).

3 Research Hypotheses

3.1 Relational Embeddedness Configuration and Service Innovation Performance

The e-service situation sets new demands to the service provider in terms of helping the customer and marketing the service. Instead of the customer being a co-producer as depicted in the old service management theory (e.g. Eiglier and Langeard 1988), the service provider must put himself in the customer’s place and be a co-consumer to assure that the customer’s problem is solved in the best way (Fuglsang and Sundbo 2006, Prahalad and Ramaswamy 2000). When there is frequent interaction between customers and service business, customers will voluntarily provide enterprises with information about their needs and desires as well as complementary knowledge, therefore through close interaction with customers, companies can obtain information that even customers themselves do not find or feel difficult to express, so as to increase service opportunities for innovation. However, customers usually can not express their potential needs for integrity. In order to get the real need of customers, companies must maintain a strong relationship with customers, and especially for those service-oriented enterprises whose final product is the service itself. Chetty and Holm (2000) thought that relational embeddedness has a significant positive impact on service innovation through the research of the information services industry in the US. The construction of an enterprise network will enhance value with mutual trust and mutual commitment between members, but not all the network constructions will have a significant effect. Different network constructions will lead to different consequences. The rationale for teaming up with partners then is formed by possibilities to obtain complementary know-how (Teece, 1986) and/or to speed up the R&D process in industries where time-to-market is crucial. Here, cooperation is attractive as partners have a good understanding of the relevant issues at hand and alliances enable a rapid diffusion of knowledge among partners, enhancing the efficiency and speed of cooperation (Gilsing, 2005). Based on this, the paper puts forward the following hypothesis:

Hypothesis 1: Relational embeddedness configuration has a positive impact on innovation performance.

3.2 Relational Embeddedness Configuration and Knowledge Sharing

Knowledge management has become a key factor in the success of modern enterprises, with knowledge sharing being a core element. To stay in business, companies must spread risk and must innovate, that is, develop new products and services, at a high speed and on an efficient scale. Cohen and Levinthal (1990) advise that knowledge sharing between individuals can increase the exchange of different knowledge and enhance organizational capacity, which is more important than personal
innovation ability (Cohen, 1990). Subsequently, Boland and Tenkasi (1995) also indicated that knowledge sharing, exchange and assistance among individuals contribute to the organization’s competitive advantage and product’s success. Therefore, the knowledge, transfer and links that exist among individuals has changed the original economic and competitive value (Hendriks 1999). On the one hand, companies increasingly rely on inputs from others’, and the consequence of specialization (increasingly companies choose a business model to specialize in one area, where they develop strong brand names and (patented) technology to grow toward an efficient scale of production) is that to innovate (discover new combinations). On the other, because of their specialized advantages, the companies have also become attractive partners for others. This “mutual attraction” has resulted in an innovation trend called “open innovation,” in which companies develop new products, markets, or services collaboratively by using each others’ know-how, brands, licenses, technology, or market channels (Chesbrough, 2003; Chesbrough & Schwartz, 2007).

Nahapiet & Ghoshal (1998) have successfully applied the theory of social embeddedness to the field of strategic management, especially in the interpretation of the capital generation mechanism of internal intellectual knowledge and obtained organizational competitive advantage. In the light of theory and research methods, this study on the internal transfer and transformation of tacit knowledge, and the cooperative relations unit within the organization has confirmed that relational embeddedness configuration does have an important impact on knowledge sharing within organizations. Therefore, it can be inferred that relational embeddedness configuration is more or less related to knowledge sharing. Based on this, the paper raises the following hypothesis:

Hypothesis 2: Network embeddedness structure has a positive impact on knowledge sharing.

3.3 Knowledge Sharing and Service Innovation Performance

Heide (1994) points out that it is impossible for enterprises to have all the key knowledge resources, which requires companies to constantly acquire knowledge from external resources to meet the demand for product innovation (Heide, 1994). The use of external knowledge resources for business innovation not only alleviates the constraints of limited resources within the enterprise, but also reduces development costs and increases the speed of implementation of innovation. From the external organization perspective of knowledge sharing in the activity or process of exchange or communication among enterprises, the stimulation of new ideas or thoughts come from the pipeline links of knowledge and resources. Through rapid and correct knowledge sharing, enterprises are able to quickly respond to the market and make the right decisions. Therefore, the circulation of knowledge within the organization will increase organizational capacity, and the flow of external knowledge will enhance the company’s response speed, thus the importance of knowledge sharing can be seen. Hu Ming (2009) takes the hotel chain services as an example and has empirically discovered that inter-organizational knowledge sharing in the hospitality industry has a significant positive effect on organizational performance through human capital and other factors (Huming, 2009). Based on this, the paper raises the following hypothesis:

Hypothesis 3: Knowledge sharing has a positive impact on innovation performance.

3.4 Mediating role of knowledge sharing in the relational embeddedness configuration’s impact on innovation performance

Previous research shows that social networks within the organization will affect the knowledge owner’s behavior of knowledge sharing, and the location of the network center will help individual members to quickly become the recipients, intermediaries of knowledge; previous studies also have analyzed the effect of different network structure on the speed, breadth and depth of knowledge sharing
Relational embeddedness theory has to some extent made a good interpretation of the producing mechanism for the competitive advantage of corporate networks. For example, some researchers believe that the proper use of the inter-organizational “relationship” can enhance the exchange of resources and the cohesion between organizations, thereby increasing the transfer and exchange efficiency of “hidden knowledge” embedded in the organizations (Nahapiet, 1998). Hansen (1999) also finds that the connection type has obvious relevance to the transfer and collection of organizational knowledge (Gallouj, 2009). Hu Ming’s investigation (2009) in the hotel chain services has shown empirical support to the social capital of inter-organizational networks having a positive impact on knowledge sharing, and structural capital and relational capital has a significant positive impact on organizational performance. Therefore, it can be inferred that relational embeddedness configuration has a positive impact on knowledge sharing, and furthermore the extent of knowledge sharing will affect service innovation performance (Huming, 2009). Based on this, this study proposes the following hypothesis:

Hypothesis 4: Knowledge sharing is the mediating variable in the relational embeddedness configuration’s impact on innovation performance.

4 Research Design
4.1 Research Framework
Based on previous research findings, interviews and group discussions, the research framework model shown in Figure 1 is developed.

![Fig. 1 The research model](image)

4.2 Variable Definition and Measurement
In this study, in order to ensure the validity and reliability of measurement tools, scales which have been used in the published literature have been adopted. Before handing the questionnaire, a pilot test was conducted in a small number of firms to evaluate the questionnaire’s validity, and then revise it based on the feedback received.

The scale measuring relational embeddedness configuration is divided into relational embeddedness, structural embeddedness and cognitive embeddedness, three dimensions and a total of 13 question items based on the Nahapiet and Ghoshal (1998) correction scale.

Based on the measurement of knowledge sharing by Fang et al. (2004), the research takes knowledge transfer and knowledge receiving as measured variables, defines knowledge sharing as mutual sharing, providing timely and meaningful information among enterprises, customers, suppliers and scientific research institutions, and designs 6 items to measure.

Synthesizing the research results from Miles et al. (2008), Minna et al. (2006), Storey and Kelly
(2001) and Voss et al. (1992), combined with the new scale standard with the characteristics of service innovation, the research selects 7 indexes such as return on investment, market share, cost control, customer satisfaction, competitiveness, and business objectives as the measurement of service innovation.

4.3 Research samples

From July 2010 to January 2011, we received 292 questionnaires of the 485 copies distributed, with a total recovery rate of 60.2%. Removing 49 invalid questionnaires, valid questionnaires are 243 and the final valid return rate is 50.1%. Questionnaire distribution and collection was mainly taken in four different ways: The first way is through the Yellow Pages and mentor business cards recorded by e-mail questionnaires. In this way, in a total of 172 questionnaires, 110 were recovered with the recovery rate of 64.0%; and 79 valid questionnaires were recovered with the valid return rate of 45.9%. The second way is through the personal distribution by one of the the author to the relevant companies. In this way, out of a total of 116 questionnaires, 93 were recovered with a recovery rate of 80.2%; and 77 valid questionnaires were recovered with the valid return rate of 66.4%. Lastly, we distributed the questionnaires through a personal relationship network. In this way a total of 87 questionnaires were issued, with 88.5% returned, and all of which are valid.

The structure of the sample firms is sufficiently diverse and heterogeneous: (1) Industry categories: 16.5% in professional, scientific and technical industries, 11.9% in the finance and insurance industry, 14.0% in wholesale and retail, 3.3% in the culture, sports and leisure industry, 6.2% in the optoelectronics industry, 5.8% in logistics, transportation and warehousing services; (2) Established time: less than 3 years accounted for 9.5%, 4 to 6 years accounted for 12.8%, 7 to 9 years accounted for 15.2%, 10 to 20 years accounted for 43.6%, 20 to 30 years accounted for 15.2, 30 to 450 years accounted for 6.6%, more than 50 years accounted for 7.4%; (3) Capital sum: less than 10 million Yuan (RMB) accounted for 36.2%, 10 million to 50 million Yuan accounted for 13.6%, 50 million to 100 million Yuan accounted for 7.4%, 100 million to 500 million Yuan accounted for 9.1%, 500 million to 1 billion Yuan accounted for 10.7 %, more than 1 billion Yuan accounted for 23.0%; (4) Number of employees: 33.3% have less than 100 employees, 11.1% have 101 to 200 employees, 15.2% have 201 to 500 employees, 9.5% have 501 to 1000 employees, and 30.9% have more than 1000 employees.

4.4 Sample Reliability and Validity

This research uses the coefficient of Cronbach’s alpha to examine the reliability of each factor or variable. As Table 1 shows, the alpha of each factor or variable belongs to an acceptable scope (higher than 0.7), and thus demonstrates the scales we use have good reliability.

Table1 The $\alpha$ coefficient of each variable

<table>
<thead>
<tr>
<th>Research variables</th>
<th>Cronbach’s $\alpha$</th>
<th>results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relational embeddedness configuration (13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>relational embeddedness (5)</td>
<td>0.789</td>
<td>0.746</td>
</tr>
<tr>
<td>structural embeddedness</td>
<td></td>
<td>0.768</td>
</tr>
</tbody>
</table>
In the validity, we carry out inspection from two levels of the content validity and construct validity. As to the content validity, the question items in this study are all from published literatures and a lot of scholars have also used these scale tables to measure related variables. We modify the questionnaire by pilot survey to confirm final questionnaire regarding the characteristics of the domestic high-tech industries. Therefore, this questionnaire ought to have good content validity. As to the construct validity, we adopt confirmatory factor analysis to examine each scale’s construct validity, as shown in Table 2. The factor analysis in our study used Bartlett test and the KMO test to examine the correlation. Bartlett test conducts a mutual independent examination between variables through conversion to a χ² test. The KMO index value tests the applicability of factor analysis, if its value is between 0.8 and 0.9, indicating highly appropriate; between 0.7 and 0.8, indicating appropriate, between 0.6 and 0.7 indicating less appropriate. It is thus obvious that the indicators have reached an acceptable level in general, therefore, the initial sample of this study has good construct validity.

<table>
<thead>
<tr>
<th>KMO and Bartlett Test</th>
<th>Relational embeddedness configuration</th>
<th>Knowledge sharing</th>
<th>Service innovation performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</td>
<td>0.741</td>
<td>0.758</td>
<td>0.867</td>
</tr>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td>Approx. Chi-Square</td>
<td>950.763</td>
<td>256.516</td>
</tr>
<tr>
<td>Df</td>
<td>78</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

After the principal component analysis, three factors are extracted from the relational embeddedness configuration, and the cumulative explained variance is 57.484%, indicating that this factor can better reflect sample information. Through factor analysis, three factors are extracted. Within the factor 1, the factor loadings greater than 0.5 are classified as the same category. The results show the first five items are all belonging to factor 1, and are named relational embeddedness in this study; the other four following belong to the factor 2, and are named structure embeddedness; the last four items are part of factor 3 and are named cognitive embeddedness. It can be seen that the factor analysis of the classification are consistent with prior assumptions, verifying the construct validity of the relational embeddedness. Knowledge sharing and service innovation performance extract a factor respectively,
illustrating that the two indicators corresponding to the two variables can be viewed as a variable, whose cumulative explained variance was 42.832% and 59.577%, showing that the factor can well reflect the sample information.

5 Results and Discussion
5.1 single-hypothesis testing
To illustrate the role of knowledge sharing as the intermediate variables, we purposely study the relational embeddedness configuration’s impact on service innovation performance without knowledge sharing. The main goodness-of-fit indexes are shown in Table 3. In the table, we know the value of $\chi^2/df$ is 4.984 which is less than 5.0, while the value of CFI is 0.953 which is more than 0.9, the values of RMR and RMSEA are less than the values of saturated model and independence model which meet the evaluation criteria of the index. Every fitting index reaches the acceptable criteria in SEM. The measurement model fits the data satisfactorily. Therefore, the model does not have to be modified.

From results in Table 3, the parameters estimate of relational embeddedness structure and service innovation performance goes through the significance test. In the model, the fully standardized effect’s value of relational embeddedness configuration and service innovation performance is 0.723, and has passed the test of significance, indicating that there is a significant positive correlation between relational embeddedness configuration and service innovation performance.

Table 3 The regression weights of variables

<table>
<thead>
<tr>
<th>Path</th>
<th>Estimate value</th>
<th>Standardized estimate value</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service innovation performance&lt;-- Relational embeddedness configuration</td>
<td>0.950</td>
<td>0.723</td>
<td>0.1</td>
<td>9.37</td>
<td>**</td>
<td>H1</td>
</tr>
</tbody>
</table>

Notice: *** means p<0.001, ** means p<0.01, * means p<0.05

5.2 The hypothesis testing of integrated model
The path estimated coefficients of the impact on innovation performance through knowledge sharing are shown in the second-order integration of the variable model (hereinafter referred to as “integrated model”) via the computation of AMOS. In the model, all the factor loadings of the impact path are less than 0.95. The model is reasonable and further analysis can be made. The value of $\chi^2/df$ is 3.058 (less than 5), RMR value is 0.021 (less than 0.05), RMSEA is 0.092 (less than 0.1), CFI value is 0.952 (more than 0.90). All the values meet the evaluation criteria. Therefore, the goodness-of-fit index of the model is relatively good, and the model does not have to be modified.

In the integrated model, the parameter estimates within variables all pass the test, as shown in Figure 2, Table 4. The fully standardized effect’s value of the relational embeddedness configuration and service innovation performance is 0.217 (P<0.05), and basically goes through the test of significance, thereby supporting the Hypothesis 1 in this study. The fully standardized effect’s value of the relational embeddedness configuration and service innovation performance is 0.735 (P<0.001), while the knowledge sharing and service innovation performance is 0.696 (P<0.001). Both of these go through
the significant test. Hypothesis 2 and Hypothesis 3 are supported in the research. These indicate that the relational embeddedness configurantion has a significant direct positive impact on service innovation performance, while relational embeddedness configuration has a significant direct positive impact on knowledge sharing, and knowledge sharing has a significant direct positive impact on service innovation performance.

Table 4 The regression weights of variables

<table>
<thead>
<tr>
<th>Path</th>
<th>Estimate</th>
<th>Standardized estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
<th>Hypothesis</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relational embeddedness configuration→Service Innovation performance</td>
<td>0.285</td>
<td>0.217</td>
<td>0.144</td>
<td>1.973</td>
<td>*</td>
<td>H1</td>
<td>support</td>
</tr>
<tr>
<td>Relational embeddedness configuration→Knowledge sharing</td>
<td>0.753</td>
<td>0.735</td>
<td>0.092</td>
<td>8.221</td>
<td>***</td>
<td>H2</td>
<td>support</td>
</tr>
<tr>
<td>Knowledge sharing→Service Innovation performance</td>
<td>0.894</td>
<td>0.696</td>
<td>0.170</td>
<td>5.260</td>
<td>***</td>
<td>H3</td>
<td>support</td>
</tr>
</tbody>
</table>

Notice: *** p≤0.001, ** p≤0.01, * p≤0.05

5.3 Mediating Hypothesis Testing

There is a lot of controversy regarding the testing of the mediating effect. MacKinnon et al (2002) summarized 14 kinds of approach to test the mediating effect, and concludes that the statistical effect of the traditional Baron and Kenny (1986) method is low. Therefore, they proposed to directly test “relations between independent variables and the mediating variables” (parameters denoted by a) and
“relations between mediating variables and the dependent variable” (parameters denoted by b). The direct assumption $H_0$ is: $ab = 0$. The logic of this approach is that if the “relations value of independent variables and the mediating variables” (parameter a) is zero, or “relations value of intermediate variables and the dependent variable” (parameter b) is zero, then the product of ab is zero. Conversely, if the product of a b is not zero, it means neither a nor b is zero, indicating that M is the mediating variable of X and Y.

In this study, neither of the parameters that indicate “relations between independent variables and the mediating variables” nor “relations between intermediate variables and the dependent variable” are zero, so the hypothesis $H_0: ab = 0$ is not true, that is to say H4 goes through the hypothesis testing, and part of the mediating role of knowledge sharing is verified. Consequently, the hypothesis in this research “H4: knowledge sharing in the relational embeddedness configuration plays a mediating role in its impact on service innovation performance” is validated.

In order to explain the relationship between the variables more roundly and clearly, the research further decomposes the effects on the basis of what has been done above. Effect decomposition includes the direct effect and indirect effect. The direct effect is measured by the path coefficient from cause variable to outcome variable, and indirect effect can be measured by the product of the two path coefficients (when there is only an mediating variable) (Wen et al., 2004). We know from Table 5 that the total effect on service innovation performance brought by the relational embeddedness configuration in the variable model exactly equals the direct and indirect total effect in the mediating model. The ratio of the indirect effect and direct effect is $0.735 \times 0.696/0.217 = 235.94\%$. The indirect effect is a little bigger than the direct effect, as shown in Table 5.

<table>
<thead>
<tr>
<th>Path</th>
<th>Standardized direct effect</th>
<th>Standardized indirect effect</th>
<th>Standardized total effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relational embeddedness configuration $\rightarrow$ Service Innovation performance</td>
<td>0.217</td>
<td>0.512</td>
<td>0.729</td>
</tr>
<tr>
<td>Relational embeddedness configuration $\rightarrow$ Knowledge sharing</td>
<td>0.735</td>
<td>—</td>
<td>0.735</td>
</tr>
<tr>
<td>Knowledge sharing $\rightarrow$ Service Innovation performance</td>
<td>0.696</td>
<td>—</td>
<td>0.696</td>
</tr>
</tbody>
</table>

6 Results and Implications

6.1 Conclusions

(1) The path of the relational embeddedness configuration’s impact on service innovation performance

Through model validation we find that the fully standardized effect of relational embeddedness configuration and the service innovation performance is 0.217, and it goes through the significance test at the 95% confidence level, indicating there is a significant positive correlation between the relational embeddedness configuration and service innovation performance, thereby supporting hypothesis H1 of this study.
In this paper, the main measurements of service innovation performance include development costs of new service product, returns on investment, market share and customer satisfaction. Innovative behavior services such as new product development demand a lot of technology, services and market information, also have to bear the enormous market risk at the same time. Therefore, enterprises need to integrate internal and external networks of relationships and resources to reduce the risk of service innovation and to improve output efficiency of service innovation. Empirical research validates the significant positive impact of the relational embeddedness configuration on service innovation performance; it shows that in the process of business service innovation, the relational embeddedness configuration with partners is one of the most important factors that affects service innovation performance. Therefore, in order to enhance corporate innovation performance of their services, a closer relations link should be established with many corporate partners, which helps corporations in the competitive environment to achieve better market performance.

(2) The path of relational embeddedness configuration’s impact on knowledge sharing

The fully standardized effect of relational embeddedness configuration and knowledge sharing is 0.735, which goes through the significance test at the 99% confidence level, indicating there is a significant positive correlation between relational embeddedness configuration and knowledge sharing, thereby supporting hypothesis H2 of this study. The establishment of the path has verified the exploration into the enterprise network by many scholars, namely: the more inseparable the relational embeddedness configuration is, the higher the degree of knowledge sharing can be.

(a) Being the center of the network means that the enterprise is possessed of more information flow and a broader, deeper and more frequent information exchange and sharing with its partners.

(b) A fairly good co-operation requires more extensive knowledge sharing. It is clear that frequent interaction and collaboration between enterprises and business partners makes the links to each other more close; that is to say the more intensive the relational embeddedness configuration between business and the external network is, the more likely the enterprise will acquire valuable information and knowledge from corporate partners through formal or informal activities. What deserves special attention is that knowledge sharing can select and determine the extent and content of sharing through the characteristics and the degree of mutual trust of the cooperation object correlated to the relational embeddedness configuration, which is what business needs.

(3) The path of knowledge sharing’s impact on service innovation performance

The fully standardized effect of relational embeddedness configuration and knowledge sharing is 0.696, and it goes through the significance test under the 99% confidence level, indicating there is a significant positive correlation between knowledge sharing and service innovation performance, thereby supporting hypothesis H2. Research on knowledge sharing’s impact on the performance of technological innovation has been relatively mature, and enjoys a high degree of consistency in findings; while after analyzing sufficient samples and doing standard empirical studies, this study on the other hand strongly supports the significant impact of knowledge sharing on service innovation performance, which is rare in the current research. Knowledge sharing plays an important part in the course when enterprise is constantly seeking to grow. In the light of the cooperation objectives, the compromise of views, the communication and the information sharing will greatly improve the sensitivity of the market; increase the fitness degree of cooperative behaviors in service innovation; and make the service innovative output meet market demand through the improvement of innovation efficiency.

It is noteworthy how inseparable knowledge sharing is in the co-operation process which requires
careful discretion; what knowledge or information belongs to business secrets and what is generally limited to specific partners. Therefore, a signed contract is essential in the process of cooperation. Under these conditions, to maximize knowledge sharing is what an enterprise has been pursuing, as well as a method that leads to higher returns.

(4) The intermediary role of knowledge sharing

In the research framework constructed in this paper, there are two paths in which the relational embeddedness configuration has an impact on innovation performance. One is the direct path whose fully standardized effect is 0.217 (P <0.05), indicating relational embeddedness configuration’s direct influence on innovation performance is 0.217. The other one which indicates relational embeddedness configuration’s indirect influence on innovation performance through knowledge sharing is 0.512. The indirect impact through intermediate variables should be far greater than that of the direct one. Therefore, knowledge sharing plays an indirect amplifying role in relational embeddedness configuration’s influence on innovation performance. For this reason, knowledge sharing is part of the intermediary variables between relational embeddedness configuration and innovation performance, thereby supporting the hypothesis H4 in this study.

In corporate innovation between service-oriented business and external partners, the interactive process of knowledge and information transfer and sharing is essential. Knowledge sharing can improve the efficiency and benefit of cooperation, enhance mutual trust, so that both sides receive useful complementary information with lower cost and this raises the success rate and profitability of innovation projects; and an emphasize on cooperation in knowledge sharing can achieve a higher service innovation performance rate. Therefore, knowledge-sharing plays a mediating role in the relational embeddedness configuration’s influence on service innovation performance.

6.2 Managerial implications

(1) The government’s policy guide in the embeddedness network construction

The services industry is enjoying an unstoppable momentum of development, while the currently available experience is still scarce. The empirical results of this study demonstrate the significance of the relational embeddedness configuration in the enterprise’s service innovation performance in the context of the corporate network. Therefore, in addition to the active construct of service-oriented enterprises, there is also an urgent call for the government’s guide in policy, platform and system construction.

First, the government should change the situation in which too much emphasis has been placed on technological innovation policy, to the neglect of service innovation encouragement and support. Their focus balance should be properly adjusted to technological and service innovation (i.e., non-technical innovation) both, introducing more investment and guidance in supporting the non-technical forms of innovation.

Second, there is a need to improve and perfect the platform and system construction for service innovation, start the investigation and summary of service innovation experience and undertake the data analysis, thereafter to build a platform for knowledge-intensive enterprises’ development, especially in expanding and consolidating a business relationships network to provide adequate conditions for exchange and cooperation.

What’s more, to invest in service-oriented enterprises’ common support system required for service innovation. There is an urgent need for external service support in service development and innovation activities. Government should increase monetary support for research and development of common services, promoting the rapid spread of common service to the benefit of more business.
(2) Improve the quality and efficiency of knowledge sharing

Since the relational embeddedness configuration’s indirect impact on service innovation performance through knowledge sharing is greatly larger than that of a direct impact, the empirical results demonstrate the significance of knowledge sharing in the areas of service innovation.

However, in the practice of foreign cooperation, there are many practical concerns and constraints in the process to achieve high-quality knowledge sharing. For example, the company’s core knowledge and technology, key customer list and information are confidential for business, and once disclosed, it may lead to serious consequences such as instant defeat by business competitors. If all of the partners have such ideas, there will be no cooperation and innovation activities; but if enterprises spare no effort to share all of the information, the situation will also be very dangerous. Therefore, how to take effective measures to improve business and knowledge sharing between partners is crucially important.

First, enterprises should strengthen their knowledge and information management, putting internal information, technology and knowledge at different levels. After explicitly understanding what can be shared and what cannot, try to expand the scope of knowledge sharing to obtain more favorable knowledge and information from corporate partners so as to improve the quality and efficiency of knowledge sharing, while reducing a variety of unnecessary disputes in confidential information.

Second, high-caliber knowledge transfer and sharing requires an interactive innovation situation. The establishment of the environment for knowledge sharing and maintenance is a long process, but once accomplished, it will continuously promote the flow and sharing of knowledge and technology. This requires companies to take advantage of formal and informal networkings sincerely and carefully to treat every opportunity of knowledge sharing practice. When the accumulation of trust between partners is developed to a certain extent, knowledge sharing will become a daily business activity for each partner. Such knowledge-sharing can achieve the best effect, and therefore enhance the performance of service innovation.

Reference


Acknowledgement: This research is supported by the National Natural Science Foundation of China (No. 70872030 & No. 71090403/71090400)