Research on Relationship of Network Embeddedness and Logistics Enterprises Service Innovation Performance

----Based on the Dynamic Capability

Xue TIAN
Associate Professor of Beijing Wuzi University, Beijing, China

Caiyun ZHENG, Xiaoyi LI, Yingying Liu,Weipeng SI, Jianglong YANG
Postgraduate of Beijing Wuzi University, Beijing, China

ABSTRACT: This paper integrates the theory of network embeddedness and dynamic capability effectively. From the view of structural embeddedness and relational embeddedness, a conceptual model which network embeddedness has impacts on logistics' service innovation performance is built and a series of assumptions are proposed based on that regards dynamic capability as intermediary variable. Studying on 151 logistics enterprises, it puts forward that structural embeddedness and relational embeddedness have positive impacts on logistics enterprises' service innovation performance through dynamic capability.
KEYWORDS: structural embeddedness; relational embeddedness; service innovation performance; prediction capability; innovation capability

1 INTRODUCTION

With the development of economic globalization and tertiary industry, services play more and more important role in economy. It has been regraded as one of the most important factors that could help enterprises occupy market. In order to strengthen comprehensive competitiveness in international market and promote sustained growth of the national economy, it is important for logistics enterprises to innovate service actively, satisfy changing market demands and provide a more personalized logistics services.

Facing to rapid changes in the market environment, enterprises need more complicated resources in the process of service innovation. Even though large enterprises, they can't have all various resources (Heikkinen et al, 2007). Enterprises must seek beyond their organisational boundaries to integrate resources and capability (Victoria&Walsh 2002, Perks&Jeffrey 2006). It also fits for logistics enterprises. The process of service innovation not only needs internal resources but also needs external information, knowledge and capital which gained through network. Under this background, logistics enterprises can enhance innovation capability and international competitiveness, thus improving service innovation performance (Granovetter, 1985). Therefore, logistics enterprises tend to form alliances to enhance the level of resources and capability. In the process of service innovation, it is vital for logistics enterprises to adapt to dynamic conditions. They need to acquire heterogeneous resources via network with the purpose of improving their ability to respond to dynamic changes.

Referring to Granovetter's theoretical results, this paper divided network embeddedness into structural embeddedness and relational embeddedness. It analyzes the condition of embeddedness in logistics network and puts forward that dynamic capability which subdivided into innovation capability and prediction capability is intermediary variables between network embeddedness and innovation performance. By building a conceptual model that defined as follow network embeddedness→dynamic capabilities→innovation performance, this paper studies that logistic network embeddedness has specific impacts on service innovation performance through the method of structural equation.

2 THEORETICAL ANALYSIS AND PROPOSITIONAL HYPOTHESIS

2.1 *The theory of embeddedness*

Embeddedness represents potential opportunities that decided by the type of network which enterprises embedded (Lee, 2004). Whether enterprises could seize the opportunity is determined by the position and relationships in the network (Hagedoorn,2006). In 1985, Granovetter first divided network embeddedness into structural embeddedness and relational embeddedness. This classification has always been referred by the subsequent studies and has become the most classic classification framework in the field of embeddedness.

Structural embeddedness refers to overall structure for network, it emphasizes that the relationships and mechanism of groups have influences on transaction. Burt argued that if members link to external network, they can access to resources efficiently and affect others by controlling the acquisition of information. For this, he put forward the concept of structure hole (Burt,1992). In the supply chain, logistics enterprises is just at the position of structure hole. Peng Wang showed that logistics enterprises which located in structure hole have special resources and establish a weak connection with high density network. Enterprises' strategy develop new products mainly and adjust the manner of connection with high density network constantly and thus improving performance (Peng Wang, 2010). Haiping Wang suggested that logistics enterprises should grasp the potential opportunities which provided by structural embeddedness. Only improving the quantity and quality of weak connection with manufacturing enterprises and reinforcing cooperation then turn weak connection into strong connection, can enterprises increase service innovation performance (Haiping Wang, 2011).

Relational embeddedness refers to the impacts from members to others in the network, it stresses interactive process. Members share more information and knowledge through connection (Burt,1992). Chen argued that relational embeddedness is a kind of informal personal network between enterprises and suppliers, partners, customers. This connection result in supporting each other, exchanging information and communicating each other (Chen,2001). Through empirical research, Lin found that network embeddedness and innovation performance have positive association,the stronger of embeddedness is, the better innovation performance is. Enterprises can increase service innovation performance by establishing corporate alliances and improving network embeddedness among customers, upstream and downstream suppliers (Lin,2012). The position of logistics enterprises in the supply chain determines its close connection with customers, suppliers, government, intermediaries and competitors. By absorbing and integrating network resources, logistics enterprises could improve service innovation performance significantly.

This paper puts forward Hypothesis 1: logistics enterprises' network embeddedness in the network has positive impacts on service innovation performance.

2.2 *The theory of dynamic capability*

Teece defined dynamic capability as the firm's ability to integrate, build and reconfigure internal and external competences to answer rapidly changing environment (Teece,1997). Zollo considered that dynamic capability is a stable collective learning model and it can enhance firm's effectiveness through creating system or adjusting operating rules(Zollo,2002). Based on the previous researches, this paper puts forward that dynamic capability is flexible capability which enterprises can build, adjust, recombine internal and external resources and intelligence constantly in order to create new products rapidly, grasp changing opportunities and achieve more competitiveness. Dynamic capability is subdivided into prediction capability and innovation capability.

The definition of innovation capability is that enterprises seize the market opportunity, form their own advantage and make profits through learning knowledge from external environment. Yan Li, found that every dimension of network embeddedness can facilitate innovation power thus having positive impacts on innovation capability (Yan Li,2010). There are some researchers argue that network core, the number of collaborative relationships and strong contacts among members within a wide network are positively related to firm's innovation capability(Shan 1994, Tsai 2001, Xiaobo Wu 2005, Qunlin Fan 2011). Logistics enterprises is regarded as bridge between manufacturers and customers. This paper puts forward hypotheses as follow.

Hypothesis 2: structural embeddedness of logistics enterprises in the network has positive impacts on innovation capability.

Hypothesis 3: relational embeddedness of logistics enterprises in the network has positive impacts on innovation capability.

Prediction capability refers to ability that recognize and absorb external information thus creating trendy products. The position of logistics enterprises which located in structure hole determines the possibility that absorb and integrate heterogeneous resources by building close connection with upstream and downstream firms. This enhance firm's predictability of service innovation and provide systematic guidance for the direction of service innovation. Therefore, this paper put forward hypotheses as follow.

Hypothesis 4: structural embeddedness of logistics enterprises in the network has positive impacts on prediction capability.

Hypothesis 5: relational embeddedness of logistics enterprises in the network has positive impacts on prediction capability.

In the recent studies, Hui Li proposed that improving innovation performance of small and medium enterprises lies in two aspects. On one hand, enterprises should draw attentions on cultivating innovation capability and accumulating external social capital, on the other hand they should integrate it fully (Hui Li, 2013). Through an

empirical analysis, Xuan Zhang has found that knowledge innovation ability has positive impacts on innovation performance of knowledge-intensive service enterprises (Xuan Zhang, 2013). Xinyan Liu suggested that cluster atmosphere environment has inverted-U-shaped impacts on firm's innovation capacity, then it has inverted-U-shaped impacts on firm's innovation performance (Xinyan Liu, 2014). Logistics enterprises, as a typical productive services industry, determines the number of partners and relational embeddedness according to their strategic target. In order to improve service innovation performance, firms choose and integrate resources that derived from network embeddedness. This lead to hypothesis 6.

Hypothesis 6: innovation capability of logistics enterprises in the network has positive impacts on service innovation performance.

Complexity, universality, flexibility, interactivity, asymptotic property, diversity and customer-oriented are characteristics for service innovation, they are reflected especially in logistics enterprises. Due to these characteristics, in the process of service innovation logistics enterprises build close connection with network of surrounded firms. This can help logistics enterprises enhance the ability to predict and affect service innovation performance by dynamic prediction. This paper puts forward hypothesis as follow.

Hypothesis 7: prediction capability of logistics enterprises in the network has positive impacts on service innovation performance.

Basing on above hypotheses, this paper build a conceptual model that indicates association between network embeddedness and logistics' service innovation performance, which shown as Figure 1.

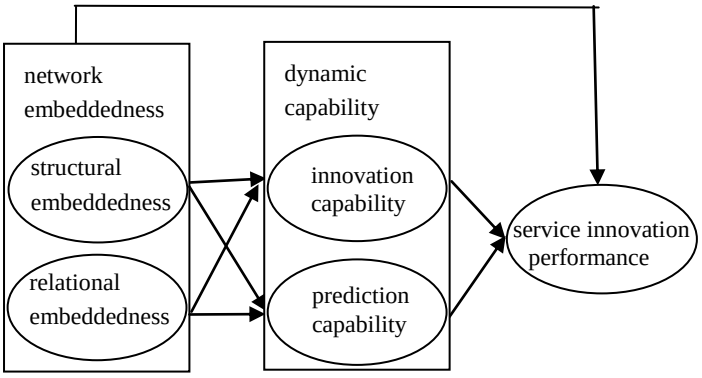

Figure 1 conceptual model that indicates association between network embeddedness and service innovation performance.

3 DATA COLLECTION AND VARIABLES MEASURE

3.1 *Sample and data*

Applying questionnaire survey methodology, this paper investigates a wide range of companies and regions. It include transport companies, warehousing companies, third-party logistics, logistics parks and other institutions. From the view of regions, northeast, the Yangtze River Delta, north china are included. This increase the persuasiveness of samples. The total quantity of questionnaire is 299 and 151 valid questionnaires were recovered. The questionnaires which I personally sent out to business people are 62 and 58 were recovered including 52 valid questionnaires. The rate of availability is 89.66%. Questionnaires which commissioned friends are 167 and 155 were recovered including 99 valid questionnaires. The rate of availability is 63.87%. As a whole the rate of availability is 70.89%. In order to ensure the truth and reliability, the questionnaire was distributed mainly among managers who have worked on firms long time and have rich experience. All kinds of item which have been revised constantly were presented basing on documentary research, field research and expert opinions.

3.2 *Variables measure*

In this paper the latent variables including structural embeddedness, relational embeddedness, innovation capability, prediction capability and innovation performance. Because these latent variables are difficult to measure, this paper utilizes Liker seven scale scoring method. According to firm's reality, people give score to each item. The score ranges from 1 to 7 which represent the degree from disagree to agree.

3.2.1 *Network embeddedness*

Network embeddedness, that reflect the obtained knowledge and information for logistics enterprises within network, is measured generally by structural embeddedness and relational embeddedness. Basing on study of Y1i-Renko (2001)and Weibo Li(2008) , this paper selects three measured items to measure network embeddedness. They are listed as follow. a1: collaborative enterprises are very different in scale, type and main business. a2: the connection among other firms must go through our firm. a3: connected firms have many external network embeddedness. Basing on the study of Fanghua Zhang(2010) and Fengdong XIN(2011), this paper select four measured items to measure relational embeddedness. a4:collaborative enterprises trust each other. a5:collaborative enterprises can cope with difficulty coordinately. a6:the connection between collaborative enterprises are frequent. a7:the enterprises invest a lot of resources(such as, human resources, equipment, funds) in the collaboration.

3.2.2 *Dynamic capability*

Summing up the theory of dynamic capability, this paper subdivides dynamic capability into innovation capability and prediction capability. Innovation

capability which based on the study of Zhi CUI(2007) and Lu LIU(2008) has three items to measure. a8: the firm can grasp changing information about market and industry. a9: the firm can recognize the value for new knowledge to develop new products. a10:the firm can apply the external new knowledge to develop new service. Prediction capability which based on the research of Hargadon(1997) and Li(1998) has three items to measure. a1 1: the firm can recognize the opportunities and feasibility for developing new service. a1 2: the firm can analyze the risks and benefits accurately in the process of innovation. a1 3: the firm could know how many years it is when its innovation advantages are surpassed by competitors.

3.2.3 *Innovation performance*

Innovation performance measured by innovation benefits and innovation efficiency. Based on the research of Hongbin YING(2010) and Fanghua ZHANG(2013), this paper selects three items to measure. a14:the number of innovation in the firm is greater than competitors. a15:the firm has faster speed to innovation, comparing with competitors. a16:the firm is more responsive to service innovation market than competitors.

4 THE ANALYSIS OF DATA AND THE TEST OF HYPOTHESES

4.1 *The analysis of reliability and validity for questionnaire*

The reliability of questionnaire defined as the consistency and stability for measuring results. Only higher consistency index, can satisfy the credibility requirements. This paper adopt Cronbaeh's α coefficient to test reliability of variables. As shown as Table 1, the values of Cronbaeh's α for all variables are all greater than 0.7, this indicate that the questionnaire has higher reliability. Validity is the degree that measuring tools could measure out the desired properties properly, namely the correctness of measurement. This paper adopt KMO Test and Bartlett Teat of sphericity to test the validity of the data. The results are shown in Table2, the KMO values for five latent variables including structural embeddedness, relational embeddedness, innovation capability, prediction capability and innovation performance are all greater than 0.5. In addition, significance level of Chi-square values which tested by Bartlett Teat of sphericity for five latent variables are all equate to P = 0.000. Factor loading for each item that shown as Table 1 are all greater than 0.5, this indicate that the validity of the questionnaire are within the acceptable range. Therefore, this questionnaire is suitable for the analysis of structural equation model.

Table 1 The analysis of reliability and validity for variables

Latent Variables	Variable	Descriptive statistics		Factor loading coefficient	Cronbach's α coefficient
		Mean	Standard deviation		
structural embeddedness	a1	4.433	1.223	0.567	0.75
	a2	4	1.462	0.867	
	a3	5.1	1.155	0.631	
relational embeddedness	a4	4.867	1.074	0.58	0.708
	a5	4.633	0.964	0.768	
	a6	4.833	1.053	0.91	
	a7	4.833	1.053	0.664	
innovation capability	a8	5.03	1.217	0.765	0.756
	a9	4.9	1.296	0.81	
	a10	4.77	1.331	0.715	
prediction capability	a11	4.93	1.048	0.663	0.79
	a12	4.77	0.898	0.794	
	a13	4.9	0.96	0.892	
innovation performance	a14	4.63	1.189	0.912	0.872
	a15	4.47	1.074	0.877	
	a16	4.57	1.04	0.889	

Table 2 KMO and Bartlett 's Test for sample data

	KMO	results for Bartlett			The results of test	Cumulative explained variation for variables
		Approx.Chi-square	df	Sig		
Embeddedness	0.537	56.196	21	0.000	pass	57.14%
Dynamic capability	0.714	54.098	10	0.000	pass	72.55%
Service innovation performance	0.733	41.732	3	0.000	pass	91.48%

4.2 *The construction of structural equation model.*

For the above mentioned conceptual model that network embeddedness has impacts on logistics service innovation performance, this paper constructs the initial structural equation model which shown in Figure 2. This model measure two exogenous latent variables (structural embeddedness, relational embeddedness) through seven exogenous variables (a1, a2, a3, a4, a5, a6, a7) and set up nine endogenous significant variables (a8, a9, a10, a12, a13, a14) to measure three endogenous latent variables (innovation capability, prediction capability, service innovation performance).

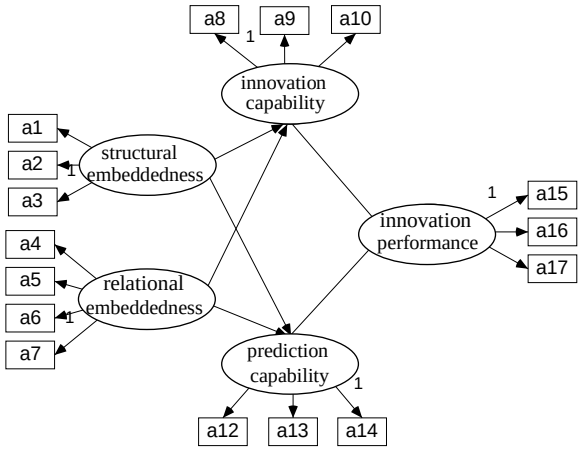

Figure 2 Initial structural equation model based on conceptual model

4.3 *Model verification and hypothesis testing*

The fitting between the connection of suggested variables and actual data is core content in the assessment of structural equation model. The model is valid only when the fitting indexes are within reference value. This paper analyzes structural equation model by AMOS17.0 and selects χ^2/df、RMSEA、TLI and CFI as fitting indexes (Wen Zhonglin, 2004) [32]. The result of fitting indexes is shown as Table 3: χ^2/df =2.35, RMSEA=0.181, GFI=0.98, NFI=0.836, TLI=0.909, CFI=0.98. All fitting indexes are within reference value and reach the level of significant, so the model is acceptable.

Table 3 Fitting results of structural equation model for logistics service innovation

Model fitting index	Statistical values	Fitting situation
$\chi 2$	484.108	good
df	206	good
$\chi 2$/df	2.35	good
NFI	0.836	good
RMSEA	0.181	good
IFI	0.868	good
TLI	0.909	good
CFI	0.98	good

According to the analysis of statistical results, we can get Table 4 which lists path coefficients of theoretical model. It indicates that the model has statistical significance at the level of p=0.05. The influences among paths which refer to innovation capability←structural embeddedness, prediction capability←relational embeddedness, prediction capability←structural embeddedness, innovation capability←relational embeddedness, innovation performance ← innovation capability, innovation performance←prediction capability are all the positive influences among variables.

Table 4 Path coefficients of structural equation model for logistics service innovation

	Path		Path coefficients	Standardized path coefficient	C.R.	P
innovation capability	←	structural embeddedness	0.438	0.128	3.415	***
prediction capability	←	relational embeddedness	0.869	0.179	4.848	***
prediction capability	←	structural embeddedness	0.834	0.186	4.494	***
innovation capability	←	relational embeddedness	1.042	0.22	4.749	***
innovation performance	←	innovation capability	0.267	0.24	1.111	0.037
innovation performance	←	prediction capability	0.784	0.262	2.998	0.003

By surveying samples and analyzing structural equation model, this paper tested conceptual model which suggested network embeddedness impacting logistics service innovation performance and drawn conclusions that original hypothesis were confirmed as shown as Table 5.

The embeddedness of enterprises in the global manufacturing network has positive association with dynamic capability and has positive association with service innovation performance further.

The structure model which presents mechanism that network embeddedness impacting logistics service innovation performance is shown as Figure3.

5 CONCLUSIONS AND MANAGEMENT INSPIRATION

Basing on the integration of studies from the country and the abroad, this paper builds conceptual model of network embeddedness impacting logistics service innovation performance and regards dynamic

capability as mediating variables. According the questionnaire of 151 logistics enterprises and verification analysis of structural equation model, the paper drawn conclusions as follow.

Table 5 Summary of hypotheses verification for mechanism that network embeddedness has impacts on logistics service innovation performance

Hypothesis No.	Hypothesis content	Verified situation
Hypothesis 1	logistics enterprises's network embeddedness in the network has positive impacts on service innovation performance.	pass
Hypothesis2	structural embeddedness of logistics enterprises in the network has positive impacts on innovation capability.	pass
Hypothesis(3	relational embeddedness of logistics enterprises in the network has positive impacts on innovation capability.	pass
Hypothesis 4	structural embeddedness of logistics enterprises in the network has positive impacts on prediction capability.	pass
Hypothesis 5	relational embeddedness of logistics enterprises in the network has positive impacts on prediction capability.	pass
Hypothesis6	innovation capability of logistics enterprises in the network has positive impacts on service innovation performance.	pass
Hypothesis 7	prediction capability of logistics enterprises in the network has positive impacts on service innovation performance.	pass

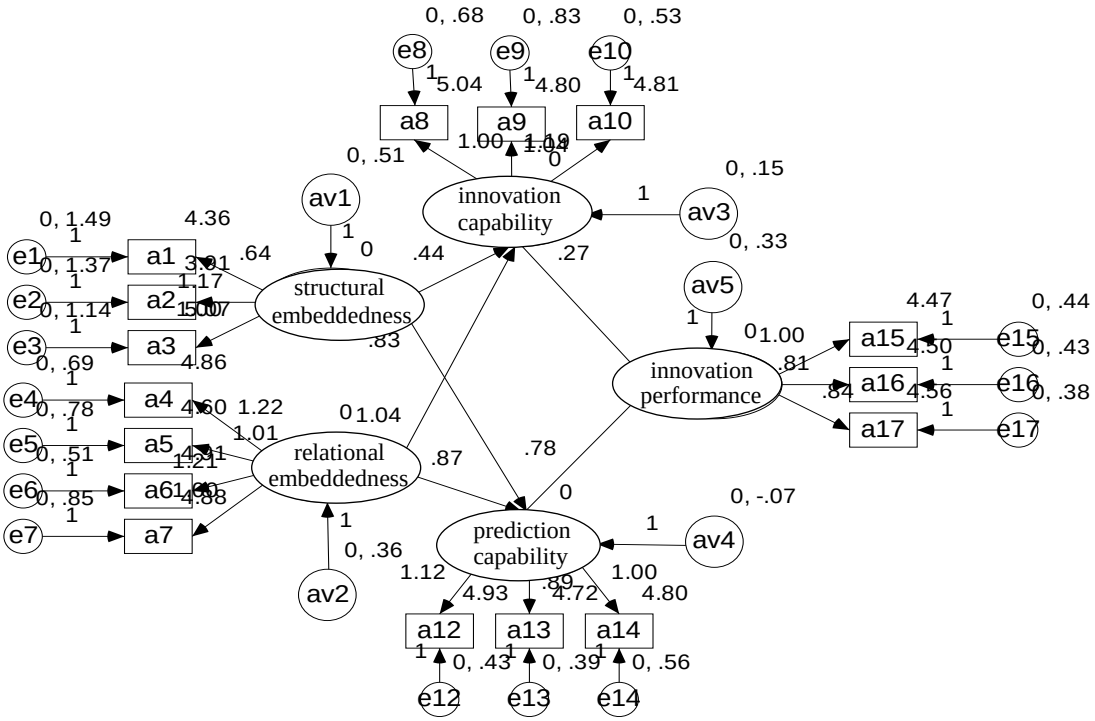

Figure 3 The structure model that network embeddedness impacting logistics service innovation performance

(1) The embeddedness of logistics in the network has significantly positive impacts on improving service innovation performance. As one of the important direction of social network research, embeddedness can help enterprises achieve competitive advantages. The empirical study in this paper indicates that the improvement of structural embeddedness and relational embeddedness between logistics and the network is benefit for the promotion of firm's service innovation performance.

(2) Embeddedness has influences on logistics service innovation performance and the influences come from the delivery function of dynamic capability. Logistics dynamic capability means the ability that seizing the new information and new opportunities. Now competitions have entered the era of globalization, dynamic capability play an important role in the process of achieving competitive advantages. In addition, it is key intermediary variables between the external network embeddedness and service innovation. Through an empirical study, this paper builds conceptual model then conclude that structural embeddedness and relational embeddedness in firms have positive impacts on service innovation performance through the firm's dynamic capability.

(3)Logistics enterprises should find collaboration with external partners actively. In the development of service innovation, under any conditions, it can't be leading tendency that imitate competitors merely or remain the existed service level. Logistics enterprises should integrate the internal and external

varied resources which can promote service innovation and do its best to improve the level of service innovation.

There are limitations in this paper. First, sample data in the questionnaire can't be absolutely rational due to the limitations of districts. This result in that the influences from special enterprises can't be excluded, so it has a certain extent impacts on the conclusions. In addition, this study doesn't subdivide further for the service areas and regional property. Different types of logistics are significant different, different regions have their own characteristics and logistics that be in different stage in life cycle are different, these factors may have influences on the action mechanism. This need researchers to study further in the future.

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