

External Network, Absorptive Capacity and Innovation Performance: A Case Study Based on Shandong Manufacturing Enterprises*

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Abstract Innovation performance is an important goal for enterprises, and enterprises external network is an important way to improve enterprise innovation performance. While most of the related researches merely emphasize the role of their network location and neglect the heterogeneity themselves, thus leading to contradictory conclusions. In this paper, absorptive capacity is used as the intermediate variable. Based on 205 valid questionnaires, the paper conducts a further study on enterprise external network and its innovation performance, sets up and verifies the mechanism that enterprise external network affecting its innovation performance.

Key words External network; Network structure; Absorptive capacity; Innovation performance; Manufacturing enterprises

1 Introduction

Coase (1937) first took transaction costs as a tool to analyze enterprises activity, which opened the traditional black box on enterprises problems and changed the perspective new classical economics analyze enterprises. From then on, modern theory of enterprise arose and developed along two paths, the contractual theory and the competitive advantage theory.

Related researches on enterprises to obtain competitive advantage can be divided into two categories. One is competitive advantage exogenous represented by Porter's (1980) industry-analysis theory, the other is competitive advantage endogenous represented by Rumelt (1984) and Teece (1997).

Theory of competitive advantage endogenous started from Penrose and her enterprise internal growth theory. It is mainly discuss the resources and capacity enterprises needed to produce competitive advantage. Further researches on theory of competitive advantage endogenous include resource based view (Wernerfelt, 1984; Rumelt, 1984; Barney, 1991; Nonaka, 1994; Putnan, 1993; Lin Nan, 1999) and ability based view (Richardson, 1959; Prahalad & Hamel, 1990; Leonard-Barton, 1992; Teece, 1994).

The concept of absorptive capacity arose from the macro level and was first used to analyze technology catching-up of lagging countries. Cohen and Levinthal (1990) first introduce absorptive capacity into the level of the firm. With the development of globalization economy and knowledge economy, there have been great changes in enterprise living space and growth model. It is becoming more and more important for enterprises to make full use of its external resources, particularly knowledge resources and networks have become an important way to improve enterprise performance. Enterprise external network not only combine enterprise performance decision theory both external and internal, but also expand the source of enterprise resources. Therefore, it is significant both in theory and in reality to making research on the impact of enterprise external network on its performance.

While, however, most of the existing research on the impact of enterprise external network on its performance merely emphasize the role of their network location and neglect the heterogeneity themselves, and thus, leading to contradictory conclusions. Being an enterprise's capacity to deals with information and knowledge, the absorptive capacity has received extensive attention from researchers. Thus, based on absorptive capacity, the paper conducts a further study on the mechanism of enterprise external network affecting its innovation performance.

2 Theoretical Framework, Concept Model and Hypotheses

2.1 Theoretical analysis

Enterprise external network is a kind of relation between external free market and internal

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organizations. Enterprise external network is not only the collection of enterprise relations but also the collection of resources contain in these relations (Williamson, 1975; Larson, 1992).

The absorptive capacity is a series of ability that enterprise manages its knowledge, and this ability can improve both enterprise performance and enterprise competitive advantage (Zahra & George, 2002). Cohen and Levinthal (1990) first introduce absorptive capacity into the level of the firm, they given that absorptive capacity refers not only the acquisition or assimilation of information by an organization but also the organization's ability to exploit it. The absorptive capacity decides the extent of enterprise making use of external knowledge, and this furthermore, affects enterprise innovation performance (Lane et al., 2002).

From the perspective of social network analysis, indicators of network structure include network size, network density, network centrality and network heterogeneity. What's the structural dimension concentrated including not only resources given by enterprise position in the net but also the ability possessing resources (Burt, 1992; Granovetter, 1973). Network structure impact on the flow of resources (Nonaka, 1994), thereby affecting enterprise absorptive capacity. And absorptive capacity furthermore, determines enterprise performance.

2.2 Concept model and hypotheses

Social network analysis method provides a new perspective to analyze enterprise issues, while, however, most of existing researches on the impact of enterprise external network on its performance merely emphasize the role of their network location and neglect the heterogeneity themselves, and thus, leading to contradictory conclusions. Thus, it is necessary to introduce intermediate variable to clarify this problem.

Being a core issue, choosing proper intermediate variables generated some scholars concern. Nahapiet and Ghoshal (1998) took organization intellectual capital as the intermediate variable to analysis social capital and the organizational advantage, they pointed that the role of social capital has two sides, the different dimensions of social capital impact of intellectual capital through the integration and conversion of four dimensions, thereby affecting the organizational advantage. Yli-Renko (2001) employing a sample of 180 entrepreneurial high-technology ventures based in the United Kingdom, examined the effects of social capital in key customer relationships on knowledge acquisition and knowledge exploitation, confirmed that social capital facilitates external knowledge acquisition in key customer relationships and that such knowledge mediates the relationship between social capital and knowledge exploitation for competitive advantage. Weiyang introduced the perspective of absorptive capacity to analyze the relation of social capital and technological innovation, based on empirical analysis of Chinese manufacture enterprises, the research results show that social capital significantly affects innovation performance by improving absorptive capacity.

Introducing of new intermediate variable helps to clarify the mechanism of network working. These intermediate variables are all related to knowledge analyzing process, while, however, two problems are still exist. First of all, too much knowledge-related content are included in the intermediate variable, which complicated the matter. Besides, the analysis on the intermediate variable itself is insufficient, therefore, limited the explanation for the mechanism.

To make up the above problem, it is necessary to introduce a new intermediate variable in analyzing on enterprise external and its performance. Being a kind of process ability related to knowledge, the absorptive capacity is exactly reflected the process that resources flowing in network. Thus, the absorptive capacity is selected as the intermediate variable to analyze the impact enterprise external network on its performance.

Integrated previous literatures on absorptive capacity (especially Zahra & George, 2002; Todorova & Durisin, 2007), this research redefine the concept of absorptive capacity. The essence of the absorptive capacity is a kind of accommodation capacity in the ever-changing business environment. The absorptive capacity is a processing ability including four dimensions, which are recognize the value, acquire resources, assimilate resources and apply resources.

On the basis of the above definition, the paper conducts a further study on the mechanism of enterprise external network affecting its performance. Theoretically speaking, there are two aspects enterprise external network affected enterprise performance.

On one hand, enterprise external network structure directly affects its innovation performance. This means that the specific network position itself is critical, the position determines the knowledge, information, capital and other resources for enterprises and furthermore affects enterprises performance, whether it is who in this place.

On the other hand, enterprise external network is a collection of potential resources filled with

knowledge, information, capital and etc. These potential resources can be translated into real resources, and the conversion rate is determined by enterprises abilities of recognize, acquire, understanding and exploit resources.

Based on the analysis, the hypotheses are proposed:

H 1a The larger of enterprise network size, the stronger of its absorptive capacity.

H 1b The higher of enterprise network density, the stronger of its absorptive capacity.

H 1c The more of enterprise network centrality, the stronger of its absorptive capacity.

H 1d The more of enterprise network heterogeneity, the stronger of its absorptive capacity.

H 2a The larger of enterprise network size, the stronger of its innovation performance.

H 2b The higher of enterprise network density, the stronger of its innovation performance.

H 2c The more of enterprise network centrality, the stronger of its innovation performance.

H 2d The more of enterprise network heterogeneity, the stronger of its innovation performance.

3 Methods

3.1 Sample selection and data collection

The following analysis is according to 205 valid questionnaires based on three sampling criteria: at least 3 years; no less than 20 employees; manufacture enterprises in Shandong Province of China. First, sample enterprises are 3-year upper can eliminate the abnormal volatility of enterprise performance. Second, enterprises' employees less than 20 are mostly in start-up period that enterprise network depend on not enterprise but entrepreneur. Third, external network of manufacture enterprises are more stable.

The questionnaires are collected from target-company's senior management. From Dec. 2007 to Sep. 2008, 298 responds are received from 470, and 205 of them are valid. The response rate is 63.40% and the valid response rate is 43.62%.

3.2 Variables

Dependent Variable is innovation performance, measured by change rate of recent 3-years' new business output. Independent variable is enterprise external network structure, measured by network scale, network density, network centrality and network heterogeneity. Intermediate variable is absorptive capacity, measure by recognize the value, acquire the resources, assimilate the resources and apply the resources.

All the above variables are measured by several questions through Likert-5Points.

4 Results

4.1 Reliability of the data

SPSS is used to analyze the data and all data belong to normal distribution. The reliabilities analogous to Cronbach alpha values are all above the recommended mini-mum of 0.70. The adjustment CICT are all above the recommended mini-mum of 0.35. Thus, all of the constructs demonstrate good internal consistency and, hence, reliability.

4.2 Correlation and regression analysis

According to correlation analysis, shown as Table 1, there are 25 correlations among enterprise external network structure, absorptive capacity and innovation performance.

Table 1 Means, Standard Deviations, Ranges, and Correlations for the Variables in the Model

	1	2	3	4	5	6	7	8	9
1 network scale									
2 network density	.571**								
3 network centrality	.265**	.373**							
4 network heterogeneity	.138*	.339**	.056						
5 recognize the value	.120	.158*	.191**	.134					
6 acquire the resources	.367**	.216**	.196**	.164*	-.037				
7 assimilate the resources	.193**	.165*	.164*	-.166*	.026	-.057			
8 apply the resources	.357**	.339**	.150*	-.045*	.022	.002	.124		
9 innovation performance	.304**	.239**	.224**	-.072	.230**	.117	.583**	.602**	
Means	3.53	3.96	3.87	3.54	2.63	3.00	2.47	1.96	3.20
S. D.	1.16	0.90	0.86	0.98	0.89	0.84	0.92	1.07	1.26
Min.	1.18	1.23	1.74	1.17	0.01	0.50	-0.56	-0.61	1.00
Max.	5.90	5.85	5.89	5.87	4.56	5.09	4.57	4.57	5.00

N=205. * $p \leq 0.05$ (2-tailed). ** $p \leq 0.01$ (2-tailed tests).

Stepwise method is used to give linear regression and the results are shown in Table 2. The results

showed that enterprise external network structure not only has a significant positive impact on innovation performance, furthermore, the absorptive capacity, as the intermediate variable, decides the extent of this impact. The intermediary role of absorptive capacity is mainly in two aspects. On one hand, enterprises external network structure do not affects innovation performance significantly, but affects absorptive capacity apparently. That is, the impact of enterprise external network structure on its innovation performance is indirect. These indicators include network density and network heterogeneity. One the other hand, enterprises external network structure affects enterprise innovation performance significantly, while, the extent of this impact are decided by absorptive capacity. These indicators include network size and network centrality.

Table 2 Results of Linear Regression

	R	R2	Δ R2	Sig. (F)	Sig. (t)	D-W	VIF max
$Y = 0.263X_1 + 0.154X_3$	.338	.114	.105	.000	.026	2.182	1.076
$Y = 0.532F_4 + 0.521F_3 + 0.210F_1 + 0.154F_2$	.831	.690	.684	.000	.000	1.971	1.005
$F_1 = 0.191X_3$	.191	.036	.032	.006	.006	1.820	1.000
$F_2 = 0.367X_1$	.367	.135	.131	.000	.052	1.707	1.000
$F_3 = -0.251X_4 + 0.250X_2$	.288	.083	.074	.000	.001	2.146	1.130
$F_4 = 0.228X_1 + 0.266X_2 - 0.167X_4$	.423	.179	.167	.000	.015	1.787	1.136

X1: network scale; X2: network density; X3: network centrality; X4: network heterogeneity; F1: recognize the value; F2: acquire the resources; F3: assimilate the resources; F4: apply the resources; Y: innovation performance. $0.05 \leq p \leq 0.1$.

According to the above analysis, hypotheses 1a, hypotheses 1b, hypotheses 1d hypotheses 2a and hypotheses 2c are partially supported, hypotheses 1c is partially back-supported, hypotheses 2b and hypotheses 2d are denied. The revised concept model is shown in Figure 1.

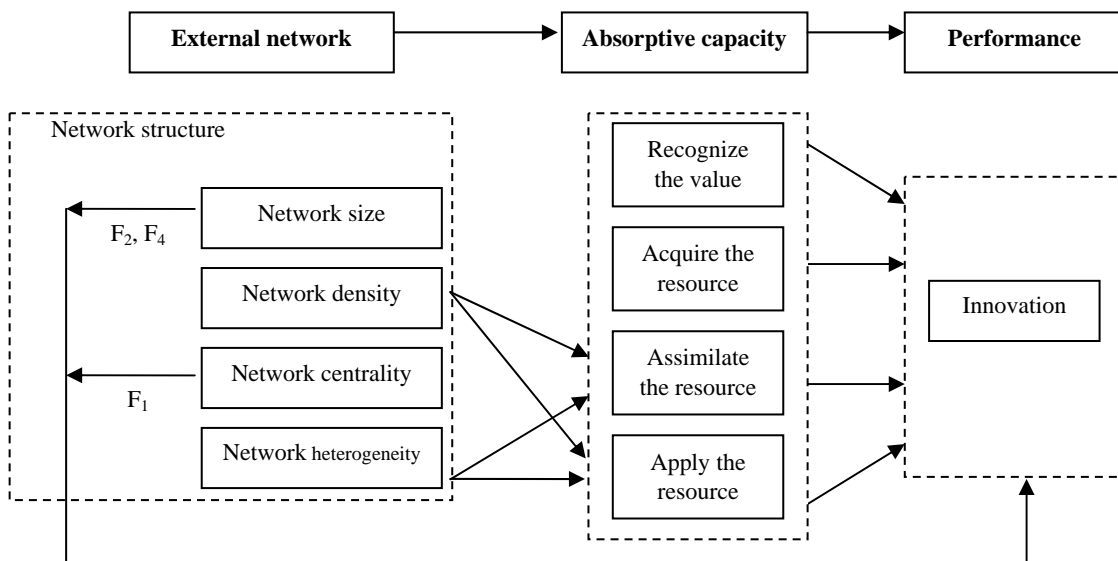


Figure 1 The Revised Concept Model

5 Conclusions

The paper probe into the mediating role of absorptive capacity, set up and verify the mechanism that enterprise external network affecting its innovation performance. According to the empirical analysis, the impact of enterprise external network indicators on enterprise innovation performance and absorptive capacity is multidimensional. Absorptive capacity plays an intermediary role in the process of enterprise external network affects enterprise performance. Specially speaking:

First, enterprises external network affects enterprise innovation performance significantly, while, the absorptive capacity, as the intermediate variable, decides the extent of this impact.

Second, enterprises external network do not affects enterprise innovation performance significantly,

but affects absorptive capacity apparently. That is, the impact of enterprise external network on its innovation performance is indirect.

Third, the absorptive capacity can be divided into the potential absorptive capacity and the realized absorptive capacity, which coincide with the research of Zahra and George (2002). Further, the potential absorptive capacity is the ability to recognize and acquire resources such as information. The realized absorptive capacity is the ability to assimilate and apply resources, and it mainly decides the innovation performance.

The survey sample is limited to Shandong manufacturing enterprises, which limits the applicability of the conclusions to other settings. The access of the survey sample is primarily by way of convenience sampling, which decreases the representativeness of the sample. Besides, this research is based not on longitudinal research but on lateral research, and thus, it can't give an reasonable explanation from dynamic perspective.

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