A Research on Social Capital, Absorptive Capacity and Technological Innovation Performance

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Abstract: Based on pointed literature studies, the paper brings forward the integrated analytical framework about social capital, absorptive capacity and technological innovation performance in order to supply corresponding theory support. Through questionnaire survey to 94 companies in Guangdong province, the studies have found that social capital and absorptive capacity show positive influence to technological innovation performance remarkably, while absorptive capacity significantly moderates the relationship between social capital and technological innovation performance.

Keywords: Social capital; Absorptive capacity; Technological innovation performance

I. Introduction

On the background of technology development and environmental uncertainty rapidly, technological innovation has increasingly become a complex activity, which is much more difficult to complete innovative activities by single company, thus plenty of companies seek cooperative innovation with university or research institution. Cooperative partner range over suppliers, vendors, customers, universities, research institutions and other non-profit organizations, even past rivals begin to strengthen mutual cooperation, which aims to obtain innovative resources through experience exchange with social community and institutions. The congregation of organization and institutions is the important element of corporate social capital.

II. Literature review and theoretical hypothesis

Concepts and Research dimensions
(1) The content and dimensions of social capital.
At present there are four typical definition of social capital in the mainstream literatures: First is the network of relationships (Coleman, 1988)[1], which believes social capital equals to social network formally; Second is the theory of honesty and standards (Pumtnan, 1993; Fukuyama, 2000)[2][3]; Third is the theory of resources (Burt, 1992; Baker, 2002)[4][5]. In Burt's opinion, social capital refers to a variety of resources reserved or mobilized from the network of interpersonal and business relationships. Fourth is the theory of capability. (Portes, 1995; Bian Yanjie, 2000)[5][6].

Learning from the above observations, this article defines social capital as: the network of relationships between the enterprises and external society and the actual or potential resources obtained through these relationships. It mainly refers to the capital within the industries (between enterprises and suppliers, customers, competitors, other firms) and out of the industries (between enterprises and government, universities and research institutions).

(2) The content and dimensions of absorption capacity. Absorptive capacity of enterprises is defined that enterprises identify, assimilate and apply skills and knowledge outside of the firm for the commercial purpose. Zahra & George (2002) classified absorptive capacity into two categories: potential absorptive capacity and the realized absorptive capacity [7]. In this article, we summarize the absorptive capacity as the capability in the following three dimensions: knowledge identifying and obtaining, knowledge digesting and knowledge sharing and integrating.

Theoretical hypotheses
(1) Corporate Social Capital and Technological Innovation Performance.
Some scholars put forward the social capital within large multinational companies which can influence the degree of product innovation by affecting the exchange of resources between business units (Tsai and Ghoshal, 1998) [8], Other scholars, based on the linkages between business and various external entities, directly or indirectly confirmed these contacts can promote technological innovation performance (Cooke and Clifton, 2002; Zhangfang Hua, 2004) [9][10]. Thus, we propose hypothesis 1:
H1a: Social capital within the industries and technological innovation is positively related.
H1b: Social capital outside the industries and technological innovation performance is positively related.
(2) Absorptive capacity and innovation performance.
Since innovation is the output of organizational learning, which is closely related to the absorptive capacity of enterprises, absorptive capacity and innovation performance has the recurrence relations. This means that absorptive capacity can improve the transfer of knowledge and technology, promote new product development so as to improve the enterprise's technological innovation performance. Thus, we propose hypothesis 2:
H2a: knowledge acquisition and recognition capability and technological innovation performance is positively related.

H2b: knowledge digestion capability and technological innovation performance is positively related.

H2c: knowledge integration and sharing capability and technological innovation performance is positively related.

(3) Moderate effect of absorptive capability on relationship between external social capital and technological innovation performance.

Keld, Nicolai & Torben (2006) thought that the absorption capacity of the enterprises is of key regulatory role in the acquisition of external knowledge-especially the relationship between knowledge of users and innovation performance, and the knowledge of users is embedded in the social capital among enterprises[11]. Thus, we propose hypothesis 3:

H3a: The stronger knowledge acquisition and recognition capability is, the greater effect corporate social capital has on technological innovation performance.

H3b: The stronger knowledge digestion capability is, the greater effect corporate social capital has on technological innovation performance.

H3c: The stronger knowledge integration and sharing of capacity is, the greater effect corporate social capital has on technological innovation performance.

III. Empirical analysis and Result

Sample and Characteristic

The study adopted a way of sending out questionnaires to enterprises to get data. Questionnaires sent out in several ways. According to the list of enterprise in industrial park, we have delivered 150 questionnaires and collected 43 samples, and had 35 effective samples. In additional, with the research of MBA students in colleges, we delivered 112 questionnaires and collected 67 samples, and had 59 effective samples. We delivered 262 questionnaires and had 94 effective samples with a response rate of 35.8% effective totally.

To the aspects of industry composition of 94 companies, there are 20 electronics enterprises in all and weigh a big proportion, so dose companies of communication equipment and software, these three types of companies accounted for 56.4% in all; To the aspects of area composition, sample companies are mainly from Guangzhou、Shenzhen and Dongguan; To the size of the employees, about 29.8% of the

sample enterprises have a scale of 100 to 500 employees; To the R&D inputs, the number of enterprises with R&D intensity at 1%-2% or 2%-5% accounts for 68% of the total samples.

Variable's measurement

(1) Social Capital Measurement.

Social relationship capital refers to the relationship between enterprises and external organizations such as universities, research institutions, governments and financial institutions. In this article, we will use 9 indexes to measure external social capital. The 9 indexes are the relationship with suppliers and customers, the degree of longitudinal cooperation, the relationship with competitors and other enterprises, the degree of horizontal cooperation, the relationship with governments, the relationship with universities and research institutions and so on.

(2) Absorptive Capacity Measurement.

Szulanski used nine indexes to measurement the absorptive capacity; other studies show that the absorptive capacity which is the enterprise's access to external knowledge, as to spread and digestion among the enterprise, design the measurement indexes accordingly. Combined with previous research and the actual situation of the Chinese enterprises, in this study, 13 indexes are designed to measure the absorptive capacity. (See Factor analysis diagram)

(3) Technogical Innovation Performance.

This paper explains the enterprises' technical innovation performance at the two sides, namely the product innovation and the process innovation, including 5 items and 4 items respectively.

Factor analysis and Reliability test

According to the results of factor analysis, social capital can be divided into two common factors, factor one stands for social capital within industries, while factor two means social capital out of industries. Similarly, absorptive capacity can be divided into three parts: the capability of knowledge acquisition and recognition, knowledge integration and sharing, knowledge digestion. In addition, the mean value of Cronbach α is above 0.6 by means of reliability analysis of indicators, which means high consistency of each index.

Table I Factor analysis of social capital

Indicators of social capital	Component		Cronbach α
	1	2	
Vertical cooperation in supply chain	.864	.137	0.893
Relations with suppliers	.846	.077	
Relations with competitors	.822	.181	
Horizontal cooperation with competitors and other enterprises	.803	.191	
Relations with customers	.778	.157	
Relations with other enterprises	.677	.228	
Relations with research institutions	.092	.878	0.765
Relations with universities	.187	.848	
Relations with the government	.199	.695	

Table II Factor analysis of absorptive capacity (Remaining eleven indicators)

Indicators	Component 1	Component 2	Component 3	Cronbach α
Technology Search	.898	.140	-.015	
Technology Assessment	.837	.244	.027	
Market Search	.709	-.077	.065	0.8071
Technology Forecast	.669	.119	.190	
Products development within multi-sectoral	-.029	.817	.126	
Technology and Market Integration	.217	.735	.256	
Digested technology and new technology integration	.326	.730	.112	0.7268
Sharing of information, experience and skills	-.002	.721	.162	
Investment on training	-.049	.143	.783	
Employees' education background	.066	.368	.738	0.6878
Enthusiasm to learn introduced knowledge and skills	.241	.095	.728	

Note: Factors-extraction use principal component analysis with orthogonal rotation.
Data source: Statistical data based on collected questionnaires.

Correlation and regression analysis of social capital, absorptive capacity and technological innovation performance.

Using the data of standardized factor values, the correlation analysis have been tested between technological innovation performance, two factors of social capital and three factors of absorptive capacity. And the results showed in Table Ⅲ.

Table Ⅲ Correlation analysis of social capital, absorptive capacity and technological innovation performance

	1	2	3	4	5	6	7
1.Ln(No. of R&D Staff)	1						
2.R&D intensity	-.006	1					
3.Capital within industries	-.179	.367**	1				
4.Capital out of industries	.220*	.041	.000	1			
5. Acquisition capability	.002	.328**	.343**	.058	1		
6. Integration capability	.096	.193	.294**	.246*	.000	1	
7. Digestion capability	-.052	.576**	.174	.023	.000	.000	1
8. Product innovation	.110	.408**	.402**	.361**	.347**	.292**	.245*
9. Process innovation	.025	.429**	.428**	.342**	.342**	.317**	.280**

Note: (1) Firm size and R&D intensity are included as control variables;
(2) * significant at 5% level, ** significant at 1% level (two-tailed test).

As can be seen from Table Ⅲ, two dimensions of corporate social capital show positive impact on enterprise's technological innovation performance. The influence between absorption capability and innovation performance is also positively correlated. Further, we construct separated regression models to analysis the influence degree by multiple linear regression method (As table Ⅳ). The models we built do not exist seriously defective in the course of correlation analysis, such as multicollinearity, serial correlations or heteroscedasticity. Meanwhile, the models generally got remarkably influence, the fit index improved with different degree after drawing absorptive capacity into the models as moderator variable. The fit index have significantly improvement (significance level is 5%) in the model 4 and model 8, which interprets the rationality to adopt absorptive capacity as moderator variable in the regression analysis.

Table Ⅳ Hierarchical multiple regression of social capital, organizational absorptive capacity and technological innovation performance

Independent variable	Product innovation performance				Process innovation performance			
	MODEL	MODEL	MODEL	MODEL	MODEL	MODEL	MODEL	MODEL

		1	2	3	4	5	6	7	8
Social capital	Capital within industries (CWI)	0.317** (3.439)	0.240* (2.421)	0.227* (2.268)	0.145 (1.460)	0.321** (3.502)	0.236* (2.408)	0.236* (2.371)	0.148 (1.524)
	Capital out of industries (COI)	0.328** (3.796)	0.295** (3.336)	0.251** (2.798)	0.268** (2.979)	0.327** (3.807)	0.285** (3.268)	0.258** (2.888)	0.274** (3.114)
Absorptive capacity	Acquisition capacity (AC)		0.194* (2.023)	0.210* (1.992)	0.201* (1.999)		0.193* (2.035)	0.144 (1.377)	0.137 (1.393)
	Integration capacity (IC)		0.110 (1.176)	0.103 (1.090)	0.133* (1.460)		0.147 (1.591)	0.146 (1.560)	0.177* (1.998)
	Digestion capacity (DC)		0.108 (1.015)	0.041 (0.365)	0.013 (0.122)		0.142 (1.349)	0.086 (0.763)	0.059 (0.556)
CWI×AC				-0.064 (-0.669)	-0.069 (-0.744)			0.085 (0.901)	0.067 (0.747)
CWI×DC				0.150 (1.525)	0.133 (1.385)			0.111 （1.131）	0.087 (0.933)
CWI×IC				0.156 (1.729)	0.180* (2.083)			0.131 （1.462）	0.153 (1.810)
COI×AC					0.070 (0.822)				0.105 (1.262)
COI×DC					0.101 (1.231)				0.158 (1.958)
COI×IC					0.255** (3.050)				0.256** (3.123)
Ln(No. of R&D Staff)		0.097 (1.101)	0.084 (0.961)	0.080 (0.906)	0.029 (0.333)	0.013 (0.146)	-0.001 (-.015)	-0.008 (-.088)	-0.057 (-.672)
R&D intensity		0.278** （3.066）	0.160 (1.371)	0.211 (1.751)	0.288* (2.450)	0.297** (3.295)	0.156 (1.355)	0.180 (1.502)	0.257* (2.242)
F-value		13.051**	8.309**	6.491**	6.404**	13.458**	8.823**	6.591**	6.994**
R2 R2adj		0.191 0.341	0.034 0.355	0.439 0.371	0.071 0.430	0.192 0.349	0.041 0.371	0.443 0.375	0.089 0.456

Note: The variables in the table adopted the value of standardized factor by factor analysis. And the content of independent variables line listed standardized β and t-values in parentheses. + $P < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

IV. Results discussion of experiential studies

From the results of experiential studies, for all regression models, outside industries dimension of social capital has positive effect on innovation performance, which confirms the hypothesis 1b. Most of regression analysis models support the hypothesis 1a, which indicates better relationship between enterprises and suppliers, customers and even competitors is beneficial. All regression models do not support the significant relationship between the digestion capability dimension in absorption capacity and innovation performance, which fails to support the hypothesis 2b. Maybe the reason is that most of the enterprises in our country emphasis on introducing technology, neglecting the importance of digestion. Acquisitive capability and product innovation performance are significantly positively correlated, but no significant relation with the process of innovation performance, thus partially supports hypothesis 2a. It shows those companies which focus on new product ideas, designs and the level and speed of imitation by obtaining external information of new products can improve the product innovation performance, but it cannot improve the level of process innovation significantly in the company. The relation between integration dimension and innovation performance is not apparent in most of the models, however, after all the variables adjusted, it become significantly correlated, which shows significant adjustment effect between social capital and innovation performance, which support the basic assumption 3c but not 3a or 3b. This shows that when the company establishes social capital with the outside world, especially carrying out the production-education-research innovation, it needs the

capacity to effectively integrate and share its technical capacity with the knowledge from the universities and research institutes, which will greatly enhance the level and performance of innovation. But simply relying on the capability to obtain information is difficult to effectively enlarge the positive correlation between corporate social capital and innovation performance.

V. Conclusion

On the background of open innovation system, enterprise should pay attention to internal- and external-aspects simultaneously in order to improve the level of technological innovation. An enterprise with abundant social capital can gain needed knowledge through exchanging and connection with outside institutions, but probably there is not enough strength to digest and absorb these knowledge. Therefore absorption capacity is vitally to utilize the obtained knowledge, which is a kind of capability to recognize, digest and integrate the new knowledge. The stronger this absorptive capacity grows, the more efficient enterprise makes use of outside knowledge to improve innovation performance. Meanwhile, social capital is also moderated by its owned absorptive capacity when it affects enterprise's innovation performance. The outcome reveals that the enterprise should appropriately invest in terms of reinforcing knowledge absorptive capacity in the course of expanding social capital and enrich network resources.

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