

Network capability and radical innovation of SMEs: mediating function of knowledge field activity and moderating function of effectiveness of innovation strategy

QIAN JIANG², GUANGSONG DAI², YUYAN TIAN²

Abstract. This study constructs theoretical framework and hypotheses of the impact of network capability on radical innovation of SMEs, tests the hypotheses using large data sample from SMEs operating in China, uses integrated methods set, combinational evaluation method, smart PLS and AMOS software to verify and demonstrate reliability and validity test and structural equation model analysis of conceptual framework. The results show that network capability plays significantly positive roles in radical innovation of SMEs through knowledge field activity, effectiveness of innovation strategy has significantly positive moderating function between knowledge field activity and radical innovation of SMEs.

Key words. Network Capability, SMEs, radical innovation, knowledge field activity, effectiveness of innovation strategy.

1. Introduction

Innovation is considered as the outcome of successful knowledge swap and interaction of different participants in interactive conditions of the complicated social network. McEvily *et al.*[1] pointed out enterprises could capture valuable information, grasp new business opportunities, and maintain their competitive advantages through external network organizations. Angel *et al.*[2] believe that it is a core element for enterprises to complement each other's resources and share each other's knowledge with suppliers, distributors, competitors and other market sub-

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²Workshop 1 - School of Management, Liaoning University of Technology, Jin Zhou, China

jects through external network organizations. Kale *et al.*[3] argued that corporate performance is decided by accumulation ability of external knowledge. For gaining valuable knowledge from external network at maximum, it appears very important for enterprises to manage, control, coordinate, and utilize the network of external organizations. Walter *et al.*[4] pointed out network capability provides strong theoretical support for enterprises to establish, maintain, and utilize knowledge and skills of various partners. As a dynamic evolution process, Tang *et al.*[5] argued that radical innovation of SMEs is characterized by typical discontinuity and nonlinearity. It is essentially different from current knowledge or technology. Successful radical innovation of SMEs are required to break organizational boundary constraints, make up deficiency of innovation resources, and gather internal and external innovation elements of organizations in order to form up interactive knowledge field among multiple knowledge subjects, which is put forward by Japanese scholar Nonaka on the basis of spillover, spread and absorption of knowledge[6]. Zhang and Wang[7] Knowledge energy and knowledge nodes of various subjects promote knowledge inheritance and innovation in the knowledge field through alternations and transformations. Realization of the “field” effect depends on active knowledge field formed up by various node subjects, knowledge customers or knowledge suppliers through mutual trust, common ideas, similar feelings, and consistent missions on basis of sharing values and visions. This active knowledge field aims at promoting interaction of explicit and implicit knowledge and thus realizing radical innovation of SMEs. It is a real fact that radical innovation of SMEs is a dynamic process on technology, knowledge and organizations. SMEs characterized by short growth period, resource accumulation cycle, and deficiency of internal implicit knowledge can reasonably apply network capability, implement effective information communication, in-depth interaction, knowledge inheritance, and innovation strategy among members of the organizational network. By fully tapping internal transcendental knowledge and ability as well as assimilating and integrating heterogeneity knowledge of external network, SMEs can achieve the convergence of internal and external knowledge and then acquire radical innovation.

2. Conceptual framework and research hypotheses

2.1. *Network capability and knowledge field activity*

According to researches of Bertrand and Andreas (2013) as well as Fan and Guo (2014), this study investigates the network capability from perspectives of network relationship capability, network process capability, and network knowledge capability. Network relationship capability aims to deepen the relationships of organizations by stressing on natures and establishment of such relationship. Network relationship capability strengthens mutual dependency of network members, reduces tendency of opportunism, increases mutual trust of network subjects, and improves activity of knowledge field by developing special relationship assets. Network process capability aims to establish standards or regulations for orderly interactions between organizations. It focuses on development, maintenance, and dispute settle-

ment of relationships between members of the organizational network. Interactions between network members is an outcome of relational embeddedness and structural embeddedness. We can reduce unnecessary conflicts or contradictions between organizations and improve their commitment level and satisfaction level by promoting the interactive process between network members. Network knowledge capability aims to establish a sharing platform for knowledge transfer, knowledge spread and knowledge absorption of network members. The platform can improve knowledge communication quality and communication intensity of each other. Trust level, psychological contracts and emotional commitments between companies are closely to inter-organizational knowledge activity.

To sum up, this study puts forward the following hypotheses:

Hypothesis 1: network relationship capability has significant positive influence on knowledge field activity.

Hypothesis 2: network process capability has significant positive influence on knowledge field activity.

Hypothesis 3: network knowledge capability has significant positive influence on knowledge field activity.

2.2. Knowledge field activity and radical innovation of smes

Knowledge field activity provides great support for the knowledge innovation process. Knowledge field activity provides sustainable impetus during the process of radical innovation of SMEs. Higher knowledge field activity means more opportunities for knowledge customers and suppliers to communicate over the knowledge points. Knowledge field activity leads to differences between internal motives and intentions of personal knowledge sharing. Shi Liping et al.[8] argue that knowledge activity can effectively promote knowledge embeddedness and thus influence knowledge integration. Xie et al. studied cooperative innovation environment and differences between various elements exert significant positive influence on corporate innovation performance. Knowledge field with higher activity can promote radiation effect of knowledge nodes. Dispersed and disorderly heterogeneity knowledge facilitates convergence of transcendental knowledge and external valuable knowledge through in-depth interactions in the innovation environment with higher knowledge field activity.

To sum up, this study puts forward the following hypothesis:

Hypothesis 4: knowledge field activity has significant positive influence on SMEs.

2.3. Mediating function of effectiveness of innovation strategy

Effectiveness of innovation strategy can be evaluated by measuring operation mechanism, organizational practice, and strategic performance of the comprehensive innovative moderating. Wei et al. argued that Effectiveness of innovation strategy depends on insight into the external environment and thorough investigation about customer demands. Zafar and Mumin (2016) believe effectiveness of inno-

vation strategy not only improves efficiency of innovation network and competitive advantages of companies but also influence innovation intentions of staffs. Those innovation strategies with higher openness, quality and efficiency can help companies quickly acquire knowledge information and technical resources in the competitive market, so as to improve innovation performance by making up deficiency of innovation resources and eliminating organizational boundary constraints. Effectiveness of innovation strategy can promote efficiency and ability of companies in developing new products .

To sum up, we came up with the following hypothesis:

Hypothesis 5: effectiveness of innovation strategy can effectively moderate the relationships between knowledge field activity and SMEs.

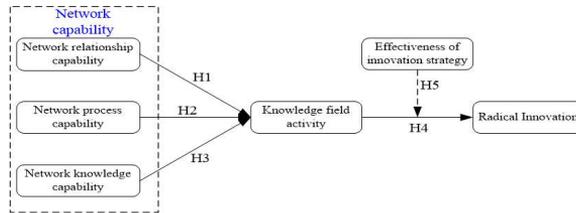


Fig. 1. Conceptual framework of impact of network capability on radical innovation of smes-mediating function of knowledge field activity and moderating function of effectiveness of innovation strategy

3. Research method

The study uses Likert Scale to design the questionnaire, in which the questions draw experience from the advice of experts and industry senior managers on basis of previous research outcomes. In addition, the questionnaire is subjected to pretest in order to ensure the validity and effectiveness. This study sends out 500 pieces of questionnaires and collects 328 pieces. Excluding faulty and unfilled pieces or those with extreme answers, this study gets 263 pieces of effective questionnaires, which indicate an effectiveness rate of 52.6%. Scale, staff number, and total asset of investigated enterprises shows certain representativeness. Age groups in investigated enterprises are at a normal distribution. Sample enterprises comply with the SME classification standard issued by the state. Among the samples, biomedicine enterprises take up 11.3%, electronics and information enterprises occupy 28.8%, new energy and new material enterprises possess 23.2%, high-tech service enterprises hold 19.4%, and energy and environment protection enterprises take up 17.3%. According to posts of investigation objects, directors of strategic intelligence department occupy 35%, project managers take up 47%, and innovation staffs possess 18%.

4. Empirical analysis outcome

4.1. Descriptive analysis

The empirical outcome reveals network capability, knowledge field activity, effective of the innovation strategy, and radical innovations of SMEs are significantly correlated. Subsequent hypothesis tests can be conducted on such a basis. Besides, correlation coefficients of network relationship capability, network process capability, network knowledge capability, knowledge field activity, effectiveness of the innovation strategy, and 6 measurement variables for radical innovation of SMEs is smaller than 0.7(Table1). There are no collinearity problems. Therefore, this study can implement further empirical tests.

Table 1. Mean, S.D. and Pearson Correlation Coefficient

Measured variables	Mean	S.D.	(1)	(2)	(3)	(4)	(5)
network relationship capability	4.793	1.135	1				
network process capability	4.814	1.181	0.572**	1			
network knowledge capability	4.659	1.235	0.561**	0.572**	1		
knowledge field activity	4.922	1.367	0.692**	0.615**	0.659**	1	
effectiveness of innovation strategy	4.876	1.434	0.513**	0.691**	0.565**	0.648**	1
Radical innovation	4.758	1.298	0.688**	0.678**	0.633**	0.690**	0.546**

4.2. Reliability and validity analysis

Table 2 shows confirmatory factor analysis (CFA) of various observable variables, including Cronbach’s α coefficient, construct reliability (CR), and average variance extracted (AVE). The outcome shows, Cronbach’s α coefficients of network relationship capability, network process capability, network knowledge capability, knowledge field activity, effectiveness of innovation strategy, and radical innovation of SMEs are respectively 0.825, 0.813, 0.854, 0.878, 0.869 and 0.891. Cronbach’s α coefficients of various variables are higher than 0.7. AVE values of 6 variables of network relationship capability, network process capability, network knowledge capability, knowledge field activity, effectiveness of innovation strategy, and radical innovation of SMEs are respectively 0.718, 0.692, 0.723, 0.704, 0.735, and 0.744. These AVE values are higher than 0.5. This shows the questionnaire investigation and measurement items which are used in the research are characterized by excellent reliability and validity. They comply with the requirements to implement tests of the structural equation model.

Table 2. Reliability and validity

Variable	Number	Cronbach' s α	CR	AVE
network relationship capability	3	0.825	0.913	0.718
network process capability	3	0.813	0.922	0.692
network knowledge capability	3	0.854	0.887	0.723
knowledge field activity	4	0.878	0.924	0.704
effectiveness of innovation strategy	4	0.869	0.905	0.735
Radical innovation	4	0.891	0.933	0.744

Note: All indexes are more than 0.5

4.3. Structural equation model analysis

This study has tested the path coefficient and T value of conceptual model with AMOS software and goodness of fit analysis. The result of goodness of fit in Table 3 shows $\chi^2=315.627$, $df = 128$, and $c2/df = 2.466$. In addition, the indicators of goodness of fit are respectively $NFI = 0.911$, $TLI = 0.928$, $CFI = 0.950$, all of which are bigger than 0.9. RMSEA equals to 0.0709, which is less than 0.10. All of the research hypotheses are supported by the hypothesis test, which shows that the model has a good overall fit.

Table 3. Results of structural equation model

	<i>Hypothesis</i>	<i>P</i>	<i>T</i>	Results	Goodness of Fit
Network relationship capability→Knowledge field activity	H1(+)	0.192	2.954**	support	$\chi^2=315.627$ $\chi^2/df=2.466$ $NFI = 0.911$ $TLI = 0.928$ $CFI = 0.950$ $RMSEA=0.0709$
Network process capability→Knowledge field activity	H2(+)	0.188	3.651**	support	
Network knowledge capability→Knowledge field activity	H3(+)	0.196	0.173**	support	
Knowledge field activity→Radical innovation	H4(+)	0.193	2.955**	support	

Note: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Table 4. Moderating results of effectiveness of innovation strategy

Path	Mean significance level, confidence interval of 95% percentage of posterior mean does not include value zero	Path	Mean significance level, confidence interval of 95% percentage of posterior mean does not include value zero
Knowledge field activity→Radical innovation	0.762 **, does not include value zero	Knowledge field activity × Effectiveness of innovation strategy → Radical innovation	0.358 **, does not include value zero
Effectiveness of innovation strategy→Radical innovation	0.435 *, does not include value zero		

Note: *means $p < 0.05$ **means $p < 0.01$ ***means $p < 0.001$

Table 4 shows the empirical test results of innovation strategy effectiveness of moderating variables. According to test steps and principles of moderating variables of SEM model, posterior mean value of interactive term of effectiveness of innovation strategy and knowledge field activity is 0.358 ($p < 0.01$). The confidence interval of 95% of posterior mean does not include value 0. Effectiveness of innovation strategy plays positive moderating roles in relationships between knowledge field activity and radical innovation of SMEs. The Hypothesis 5 passed the verification.

5. Conclusion

According to empirical research results, we can find that the 5 hypotheses of conceptual model in this study are verified by statistical test. The network capability exerts a positive influence on radical innovation of SMEs through the mediating function of knowledge field activity. Effectiveness of innovation strategy can positively moderate relationships between knowledge field activity and radical innovation of SMEs.

(1) Network capability has a significant positive influence on knowledge field activity. As a mediating variable, knowledge field activity exerts positive influence on radical innovation of SMEs. Numerous scholars focus on relationships between network capability and innovation. The key point for SMEs to realize radical innovation is to rationally use network capability (network relationship capability, network process capability and network knowledge capability) to form better knowledge field activity with external network organization. The suggestions are related to strengthen organizational cohesion, organizational commitment, mutual trust, and other active knowledge fields through network relationship perception, network relationship linkage, network process interaction, network process optimization, and network knowledge absorption etc. It can promote long-term and well-oriented cooperation between SMEs and external network organization and thus realize radical

innovation of SMEs.

(2) Effectiveness of innovation strategy can positively moderate relationships between knowledge field activity and radical innovation of SMEs. Exploratory innovation or utilization-based innovation of SMEs should be sustainable, clear and consistent in actual implementation. These innovation patterns are beneficial for establishment of knowledge element field and innovation resource field of SMEs and external network organization. In addition, they can help managers to establish operable, sophisticated, and complete innovation management system in order to realize radical innovation.

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