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The impact of a company's network competence and technology management competence on its innovation performance

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Past research has consistently shown that companies with high level of technological competence are more likely to have higher product and process innovation performance. However, apart from technological competence, companies need other competences to promote innovation performance. In this paper, a theoretical model analyzing the impact of managerial competences on innovation performance is developed, consisting of four elements: network competence, technology management competence, technological competence and innovation performance. The model is empirically tested using data collected from a large scale survey of 191 manufacturing companies in China. The results show that both network competence and technology management competence have a significant direct positive impact on a company's innovation performance. Besides, the results indicate that a company's network competence and technology management competence support the development of technological competence, which, in turn, leads to high innovation performance.

Keywords: Innovation performance; Network competence; Technology management competence; Technological competence.

INTRODUCTION

The aim of technology innovation is to help the companies to make more competitive products and have more effective processes. As technology innovation can offer companies opportunities for both product differentiation and totally new businesses to strengthen their competitiveness, both academia and managers have been paying much attention to the explanation of innovation success. Nowadays, most companies face major problems related to new product and process development due to the shortening of the innovation cycle, the higher complexity and inter connectedness of technologies, and the higher costs of innovations. One main solution to these problems is to develop the companies' innovation competence. Several studies have looked at the content or types of innovation competence

(Lawson and Samson, 2001; Bell, 2003; Wang et al., 2008). While the focus has traditionally been on technological competences and their impact on innovation and corporate success (Praest, 1998; Ritter and Gemünden, 2004; Kuen, 2004), in fact, a company's technological competence is not the only factor of its innovation success (Ritter and Gemünden, 2004), and the phenomenon that lots of Chinese companies with high level of technological competence fail to achieve innovation success has verified this point. Recent studies have taken a broader view by also including managerial competences (Malerba and Marengo, 1995, Sanchez and Heene, 1997). Two types of managerial competences are of particular interest for innovation success: network competence and technology management competence. A group of researchers have explained innovation success as the result of collaborations between various companies within the innovation network (Biemans, 1992; Assis, 2003; Rogerio et al., 2007). Thus, a company's ability to initiate, handle, use, and terminate outside relationships with its different types of partners becomes

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of central importance, this ability is called network competence, which captures the level of network management task performance and the network management qualifications (Ritter, 1998). A company's network competence allows a company to develop and use its innovation network and improves its overall position in a network, and enables a company to acquire significant resources for innovation. In recent years, technology management has attracted much attention from scholars, enterprises, and governments in practical applications and academic discussion. Technology management can help a company to manage its technological resources effectively and efficiently, which is vital to the company's innovation performance. Several studies have highlighted the contributions of technology management to a company's innovation (Cotec, 1998; Bao and Yang, 2004; Levin and Barnard, 2008).

Given these two main types of competences for the promotion of innovation performance, we need to analyze the impact of two types of managerial competences on innovation performance: network competence describing the outside view and technology management competence describing the inside view. In addition, we need to understand the relative importance of these two types of managerial competences and technological competence. Furthermore, as there is almost no research on the relationships between managerial competences and technological competence, we need to look into the role managerial competences play in the development of technological competence. So this paper will address two main research questions: What impact does a company's network competence and technology management competence have on its innovation performance? What role does a company's network competence and technology management competence play in technological competence development?

This paper is organized as follows: First, a theoretical model describing the impact of network competence and technology management competence on a company's innovation performance is developed. Then technological competence and its relationships with network competence and technology management competence are incorporated in this model. Subsequently, the results of an empirical test of the model with the data of manufacturing companies in China are discussed. Finally, the managerial implications and further research questions are outlined.

THEORY AND HYPOTHESES

The impact of technological competence on innovation performance

There are many definitions regarding technological competence. Some consider it as an ability to find and use technology to secure and sustain competitive

advantage (Rush et al., 2007), while others use a narrower definition of executing all technical functions entailed in operating, improving and modernizing a firm's productive facilities (Lall, 1990). A widely used definition describes technological competence as "a company's ability to understand, use and exploit relevant state-of-the-art technology internally". Several studies have looked into the role technological competence plays in innovation performance and treat technological competence as one of the internal success factors of innovation (Cooper, 1997; Ritter and Gemünden, 2004). The findings show that technological competence enables a company to add value to products and processes, and through new product development and the use of new production processes, the company can become a market pioneer. Thus, companies with a high level of technological competence will have greater innovation success than companies with only a low level of technological competence (Malerba and Marengo, 1995; Zheng et al., 2007). This leads to the following hypothesis:

Hypothesis 1: A company's level of technological competence has a positive impact on its innovation performance.

The impact of network competence on innovation performance

Many researchers have examined innovations as the result of collaborations between various companies which are embedded in an innovation network (Biemans, 1992; DeBresson and Amesse, 1991; Bhaskar, 2004; Rogerio et al., 2007). Innovation network offers companies the opportunities to get significant resources from their partners and leads to shorter innovation processes, reduced innovation costs and higher innovative output. Network competence enables a company to establish and use relationships with other organizations in the innovation network, and it leads to a high degree of technological interweavement, which is, in turn, a major contributing factor to innovation success (Ritter and Gemünden, 2003). Network competence captures the level of network management task performance and the network management qualifications possessed by the people handling a company's relationships (Ritter, 1998). Networking activities may serve as a basis for selling innovative products to customers with whom the company is not collaborating technologically, and network management qualifications are useful for successful completion of internal innovation processes as those that require social interaction and managerial skills as well. Thus, companies with a high level of network competence follow more realistic and more market-oriented innovation development paths and establish a better relationship marketing strategy for selling innovative

products (Li and Calantone, 1998; Ritter and Gemünden, 2003). This leads to our second hypothesis:

Hypothesis 2: A company's level of network competence has a positive impact on its innovation performance.

The impact of technology management competence on innovation performance

It is argued that technology management is a kind of dynamic aiming to explain the way in which a company allocates resources and establishes processes for innovation over time, how it generates and deploys its existing resources and processes, and where it obtains new resources, and how it improves technology management activities (Cetindamar et al., 2009). Thus technology management competence can be viewed as the combinations of resources and processes which can be developed, deployed and protected for managing technology. Gaynor (1991) argues that technology management implies how technologies can be optimized with all the other business resources including marketing, financial and human resources. Badawy(1998) regards technology as a corporate resource and he emphasizes the integration of technology and business which "requires the co-ordination of the research, production, and service functions with the marketing, finance, and human resources functions of the company". A recent study defines technology management as the capability to make effective use of technical knowledge and skills, not only in an effort to improve and develop products and processes but also to improve existing technology and to generate new knowledge and skills in response to the competitive business environment (Jin and Zedtwitz, 2008). Scott (2000) analyzed the technology management issues in the new product development processes of high-tech companies, and the results show that technology management exerts great influences on new product development performance. Through technology management competence, the effectiveness of technological resources utilization will be greatly improved, which is important to promote the innovation performance. We summarize these arguments in the following hypothesis:

Hypothesis 3: A company's level of technology management competence has a positive impact on its innovation performance.

The impact of network competence on technological competence

The knowledge perspective highlights the close relationship between network competence and technological competence.

The accumulation of technological competence is an alternating spiral process of both internal and external ways: the internal way is to acquire new knowledge through increasing Research and Development (R&D) input, and the external way is to acquire new technological knowledge from other organizations (Zhao and Xu, 2006). Network competence determines the scope and depth of the connection with other organizations, and limits the intensity and frequency of knowledge transfer, thus it can inevitably affect absorbing efficiency of new technological knowledge, which, in turn contributes technological competence (Xing and Tong, 2007). Network competence is a company's ability to manage the relationship with other organizations, through network competence, more resources can be acquired from other organizations, i.e., more man power, more technological facilities, increased quantity and increased quality of information (Ritter and Gemünden, 2003), which are the basic components of technological competence. Network competence has a coupling relationship with technological competence (Hao et al., 2009). We summarize these arguments in the following hypothesis:

Hypothesis 4: A company's level of network competence has a positive impact on its level of technological competence.

The impact of technology management competence on technological competence

Technology management is described as "a process, which includes planning, directing, control and coordination of the development and implementation of technological capabilities to shape and accomplish the strategic and operational objectives of an organization" (NRC, 1987), and it can be conceived as the development and exploitation of technological capabilities that are changing continuously (Best, 2001). The main elements of a technology management system are technology management activities, and each technology management activity is related to a certain technological competence, for example, a major activity of technology management competence is technological learning, which is to capture and accumulate technological competence (Wu et al., 2010). Technological competence exists in the form of knowledge reserve, only through activation, it can be functional. Effective technology management can activate and build technological competence (Ortt, 2008; Phaal et al., 2004; Levin et al., 2008). As the capability for managing technological activities, technology management competence plays a positive moderating role in the relationship between technological competence and new product development performance (Wu et al., 2010). We summarize these arguments in the following hypothesis:

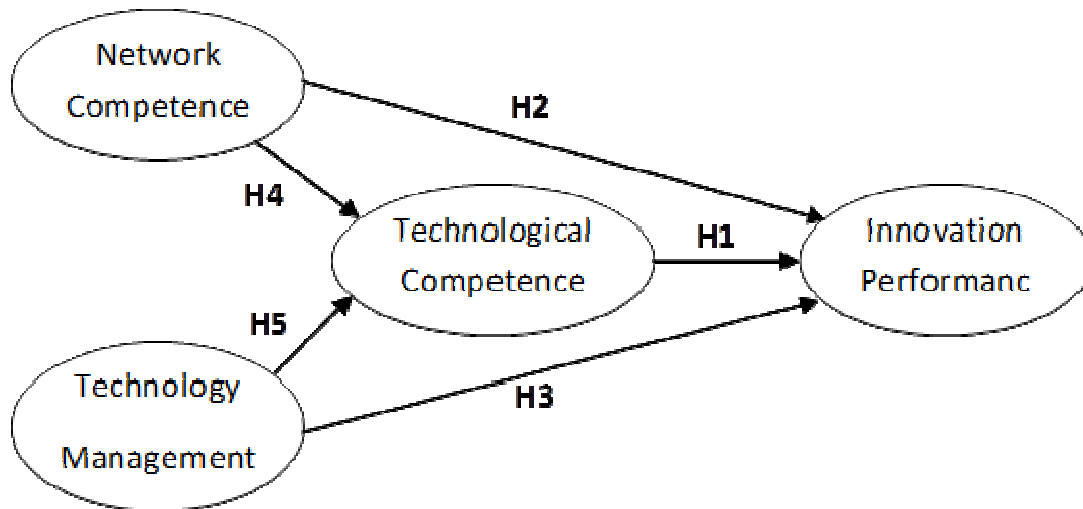


Figure 1. The theoretical model.

Hypothesis 5: A company's level of technology management competence has a positive impact on its level of technological competence.

The above hypotheses are summarized in Figure 1. This theoretical model will be empirically tested in next Section.

THE EMPIRICAL STUDY AND RESULTS

Data collection and sample

Data were collected during July and September 2010 using a standardized questionnaire. The questionnaire was designed and pretested to 10 companies. We used the five-level Likert scale to measure the questions. Then we contacted 191 manufacturing companies in China to ask them to participate in this study. We sent out 191 questionnaires to these companies. Half of the questionnaires were administered on one-on-one interview formats, while others were distributed to the designated respondents within each company. We interviewed persons with an overview of the company, the company's technology management and network, and its innovation development. Most of the designated respondents were CEOs, and others were the managers of R&D department and marketing departments.

The sample frame was defined by identifying the manufacturing companies with annual sales over 5 million Yuan, and there are 6.8% "5-20 million", 35.1% "20-100 million", 39.3% "100-500 million", 18.8% "over 500 million". The sample consists mainly of large state-owned corporations with more than 1000 employees (48.2%), and the remaining companies are medium-sized, 30.9% of the companies have between 500 and 1000 employees and 20.9% have between 250 and 500

employees. Most of the interviewed companies have been established for more than 10 years.

Measures

The variables were measured with multiple-item scales. Network competence scales was adopted from Ritter and Gemünden (2003). Technological competence was measured with an 8-item scale adopted from Ritter and Gemünden (2004). Based on the conception of technology management (Cetindamar et al., 2009) and the measurement of innovation success (Hauschildt, 1991; Smith, 1992), we developed the measurement items of technology management competence and innovation performance specifically for this study. The appendix provides a detailed description of the scales used to measure each of the variables. Table 1 shows construct-level correlation matrix and descriptive statistics.

Reliability and validity analysis

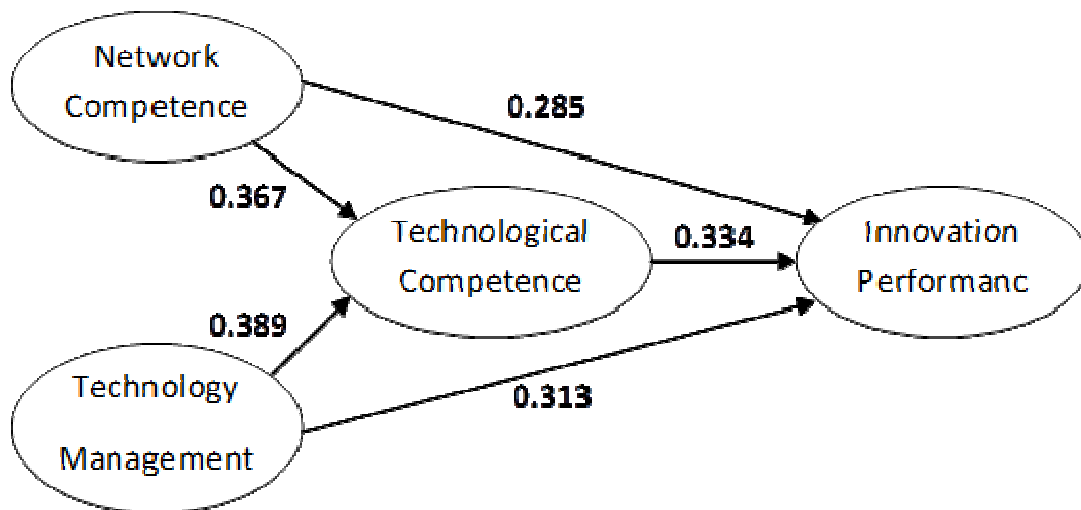
Reliability was tested through Cronbach's alpha coefficients, multi-item measures were developed based on Cronbach's alpha exceeding appropriate levels (Cronbach's alpha > .70). We use "Cronbach's alpha" tool in SPSS16.0 to test the reliability. The results indicate that all the Cronbach's alpha coefficients of the constructs exceed 0.7 (see Table 2), so the questionnaire is reliable.

The validity includes content validity and constructs validity. The initial questionnaire is designed according to the available scales of the domestic and foreign relevant literatures, and then revised through pretesting on 10 companies, so the items can fully reflect the actual situation of the companies and the questionnaire has a good

Table 1. Means, standard deviations, and correlations

	NC	TMC	TC	IP
Mean	3.14	3.44	3.17	3.25
Standard deviations	0.75	0.80	0.82	0.87
NC	1.00			
TMC	0.68**	1.00		
TC	0.63**	0.59**	1.00	
IP	0.61**	0.56**	0.64**	1.00

Note: NC=network competence; TMC=technology management competence; TC=technological competence; IP=innovation performance. * $p < 0.05$ ** $p < 0.01$

**Figure 2.** Empirical results of the model

content validity. Construct validity is checked through factor analysis. We put the collected data into SPSS16.0 and got the test results, the minimum KMO coefficient is 0.764, and the Bartlett coefficient is 0.00, which proves that it could make factor analysis. Factor loading for each item is almost above 0.6 (see Table 2), and they all passed the t test, significant level is all below 0.05. Given the above results, the questionnaire has good construct validity.

Hypothesis Testing

The research hypotheses are tested in two sets of regression models. The first set of regressions consists of innovation performance as outcome of network competence, technology management competence and technological competence. The second set of model involves technological competence as dependent variables and network competence, and technology management competence as independent variables. The data was analyzed using SPSS 16.0. The regression

results are shown in Table 3 and Figure 2.

As shown in Table2 and Figure 2, the results support all the proposed hypotheses, this shows that the theoretical model may be accepted as consistent with the data. As well as technological competence, both network competence and technology management competence have a significant positive impact on innovation performance. The path coefficients reflect the relative importance of the competences, technological competence has the greatest impact on innovation performance ($r=0.334$, $p < 0.01$). Surprisingly, we found that the impact of technology management competence on innovation performance ($r=0.313$, $p < 0.01$) is larger than that of network competence ($r=0.285$, $p < 0.01$). The results show the importance of treating these three types of competences as an explanation of innovation performance, whose promotion depends as much on technological competence as on network competence and technology management competence.

We also examined the impacts between the competences, both network competence ($r=0.367$, $p < 0.01$) and technology management competence

Table 2. Results of reliability and validity

Construct	Indicator	Factor loading		Cronbach's α
Technological Competence	Technological Collaboration Reasons (TCR)	TCR1	0.853	0.713
		TCR2	0.766	
		TCR3	0.794	
		TCR4	0.789	
	Technological Expertise (TE)	TE1	0.894	
		TE2	0.907	
		TE3	0.834	
Technology Management Competence	Resources management competence (RMC)	TE4	0.749	0.812
		RMC1	0.857	
		RMC2	0.822	
	Organization management competence (OMC)	RMC3	0.766	
		OMC1	0.889	
		OMC2	0.824	
Network Competence	Network Management Task Execution (NMT)	NMT1	0.876	0.804
		NMT2	0.821	
		NMT3	0.683	
		NMT4	0.644	
		NMT5	0.629	
		NMT6	0.604	
		NMT7	0.585	
Innovation Performance	Network Management Qualifications (NMQ)	NMQ1	0.870	0.791
		NMQ2	0.865	
	Product innovation performance (TIP)	TIP1	0.820	
		TIP2	0.833	
	Process innovation performance (SIP)	SIP1	0.593	
	SIP2	0.938		

Table 3. Results of regression

	Dependent variable			
	Innovation Performance		Technological Competence	
	Coefficients	S.E.	Coefficients	S.E.
Intercept	0.369	0.205	0.598	0.166
Technological Competence	0.334***	0.087		
Technology Management Competence	0.313***	0.076	0.389***	0.057
Network Competence	0.285***	0.075	0.367***	0.056

Note: * p<0.1 **p<0.05 ***p<0.01

($r=0.389$, $p<0.01$) have a strong positive impact on technological competence, this shows that the three types of competences are not isolated. Apart from the direct impact, network competence and technology management competence have indirect positive impact on innovation performance through contributing development of technological competence, the indirect path coefficients are 0.123 (0.367×0.334) and 0.13 (0.389×0.334).

Based on the model as a whole, the following

explanation can be given: both network competence and technology management competence are important for the promotion of innovation performance, they can exert a significant direct impact on innovation performance, besides, they can support technological competence development, which, in turn, leads to the promotion of innovation performance. Surprisingly, both the direct and indirect impacts of technology management competence on innovation performance are more important than that of network competence.

CONCLUSIONS, MANAGERIAL IMPLICATIONS AND FURTHER RESEARCH

The results and conclusions drawn from the theoretical analysis and empirical study have two major implications for companies' management.

Firstly, apart from internal technological competence, both network competence and technology management competence have a significant positive impact on innovation performance. The results show that technological competence is not only an important factor for promoting a company's innovation performance, it is important for a company to consider the three types of competences as an explanation of innovation performance, which depends as much on internal technological competence as on the ability to intensify its external relationships to access the technological resources of others and strengthen technological resources management. Past research only emphasized technological competence as the core of innovation competence, this viewpoint is unreasonable, as the impact of network competence and technology management competence shouldn't be neglected, especially the technology management competence, whose impact is even larger than that of network competence. This conclusion can explain why lots of Chinese corporations with high level of technological competence fail to achieve high innovation performance, as they neglect the development of network competence and technology management competence. In the network economy, relationships and networks exist and a company is embedded into a network, so companies should pay increasing attention to the ability to interact with external relationships. Through this, the company's strategic flexibility will be expanded to its outside resources, which is efficient given the fast pace of development in today's network economy. Besides, as technology management competence can enable a company to improve the efficiency of technological resource utilization and then promote its innovation performance, the company should strive to develop its technology management competence through strengthening technology personnel and equipment management, information management and organization management. Especially the Chinese companies should learn from developed countries to pay increasing attention to their technology management activities, and promote their level of technology management competence, through which, technological resources can be managed and activated effectively and efficiently.

Secondly, the three types of competences are not isolated, of which technological competence is positively correlated with the level of network competence and technology management competence. This result highlights the importance of network competence and technology management competence on the development of technological competence. Network competence can expand the boundaries of companies

and help them to acquire extensive technological resources, i.e., more man power, a larger pool of technological facilities, increased quantity, and increased quality of information, which are the basic components of technological competence. Through strengthening technology management, technological competence can be activated to the maximum extent and technological resources waste can be avoided. Thus, companies are advised to analyze the coordinate development of the three types of competences in order to find out potential areas for improvements. If the network competence is the "bottleneck", companies need to build up and increase their network competence through initiating, handling and using the portfolio of external relationships. If the technology management competence falls behind technological competence, strengthening technology management needs to move upwards on the agenda list and be regarded as an important activity. A clearly formulated strategy for development of innovation competence will include the importance of the three types of competences coordinate development, as well as making sure that contributing factors are in place. For example, to promote network competence access to resources, network-oriented human resource management, integrated communication structures and an open corporate culture are required (cf. Ritter, 1998; Ritter and Gemünden, 1998).

Compared with the past research, we incorporate network competence and technology management competence in the basic model describing the impact of technological competence on innovation performance. This highlights the importance of considering three types of competences as an explanation of innovation performance promotion. However, this study just looks at the impact of competences on innovation performance, the focus of our analysis being on the sources of innovation in terms of competence factors. Other factors also play a role in a company's innovation performance, such as R&D network, social capital and modularity in product design. A broader frame of reference need to be developed by including these factors, which would allow further insights into the mechanisms that trigger higher innovation performance. Besides, environmental characteristics were not included in our model. There is evidence that technology and market dynamics can affect a company's competence development as well as moderate the impact of competences, further research could examine the moderate function of these environmental factors.

Our study combines technological competence and managerial competence including network competence and technology management competence that are proposed to have a positive impact on innovation performance. Through the empirical study of manufacturing companies in China, we were able to show that both network competence and technology management competence play an important role in development of technological competence and promotion of

innovation performance. Given the increasing pace of the complexity of today's technologies and great change in today's markets, the dynamics of innovation competence development will become a major managerial concern and an academic challenge in the future.

REFERENCES

- Assis AB (2003). External linkages and technological innovation: Topical issues. *Int. J. Entrep. Innov. Manage.*, 3(2/3):151–175.
- Badawy MK (1998). Technology management education: alternative models. *California. Manage. Rev.*, 40(4): 94–116.
- Bao G-M, Yang J (2004). The role of technological management in technological innovation: based on the enterprises in Zhejiang. *Stud. Sci. Sci.* 22(5):546–551.
- Bell M (2003). Knowledge resources, innovation capabilities and sustained competitiveness in Thailand. Final report to NSTDA, SPRU, Brighton.
- Bhaskar C (2004). The role of adoption networks in the success of innovations: a strategic perspective. *Technol. Society.*, 26(2): 469–482.
- Biemans WG (1992). *Managing innovation within networks*. London: Routledge.
- Cooper RG (1997). The dimensions of industrial new product success and failure. *J. Mark.*, 43:93–103.
- Cotec T (1998). *A Guide to Technology management and innovation for companies*. EC Funded Project, Brussels.
- DeBresson C, Amesse F (1991). Networks of innovators: a review and introduction to the issue. *Res Policy.*, 20(5): 363–380.
- Dilek C, Robert P, David P (2009). Understanding technology management as a dynamic capability: A framework for technology management activities. *Technovation.*, 29: 237–246
- Gaynor GH (1991). *Achieving the competitive edge through integrated technology management*. New York: McGraw-Hill.
- Hao S-B, Yu B, Wu W-W (2009). Research on coupling degree evaluation of the enterprise's network capacity and technology capacity. *Stud. Sci. Sci.*, 2: 250–254.
- Hidalgo A, Albors J (2008). Innovation management techniques and tools: a review from theory and practice. *Res. Dev. Manage.*, 38 (2):113–127.
- Jin J, Zedtwitz M (2008). Technological capability development in China's mobile phone industry. *Technovation.*, 28: 327–334.
- Kuen-HT (2004). The impact of technological capability on firm performance in Taiwan's electronics industry. *J. High. Technol. Manage. Res.*, 15: 183–195.
- Lall S (1990). *Building Industrial Competitiveness in Developing Countries*. OECD, Paris.
- Lawson B, Samson D (2001). Developing innovation capability in organizations: a dynamic capabilities approach. *Intl. J. Technol. Manage.*, 5(3):377–400.
- Levin DZ, Barnard H (2008). Technology management routines that matter technology managers. *Int J Technol. Manag.*, 41(1–2):22–37.
- Li T, Calantone RJ (1998). The impact of market knowledge competence on new product advantage: conceptualization and empirical examination. *J. Mark.*, 62:13–29.
- Malerba F, Marengo L (1995). Competence, innovative activities and economic performance in Italian high-technology firms. *Intl. J. Technol. Manage.*, 10(4/5/6):461–477.
- NRC/National Research Council (1987). *Management of technology: the hidden competitive advantage*. National Academy Press, Washington, DC.
- Ortt. RJ (2008). Innovation management: different approaches to cope with the same trends. *Intl. J. Technol. Manage.*, 34 (3/4): 296–318.
- Phaal R, Farrukh CJP, Probert DR (2004). A framework for supporting the management of technological knowledge. *Intl. J. Technol. Manage.*, 27(1):1–15.
- Praest M (1998). Changing technological capabilities in high-tech firms: a study of the telecommunications industry. *J. High. Technol. Manage. Res.*, 9: 175–193.
- Ritter T, Gemünden HG (2003). Network competence: its impact on innovation success and its antecedents. *J. Bus. Res.*, 56: 745–755.
- Ritter T, Gemünden HG (2004). The impact of a company's business strategy on its technological competence, network competence and innovation success. *J. Bus. Res.*, 57: 548–556.
- Rogério C, Calia F, Guerrini M, Gilnei LM (2007). Innovation networks: From technological development to business model reconfiguration. *Technol. Innov.*, 27(8): 426–432.
- Rush H, Bessant J, Hobday M (2007). Assessing the technological capabilities of firms: developing a policy tool. *Res. Dev. Manage.* 37(3):221–36.
- Scott GM (2000). Critical technology management issues of new product development in high-tech companies. *J. Prod. Innov. Manage.*, 17:57–77.
- Wang C-H, Lu I-Y, Chen C-B (2008). Evaluating firm technological innovation capability under uncertainty. *Technovation.*, 28 (6):349–363.
- Wu W-W, Deng Q, Yu B (2010). The impact of technological capability on new product development performance: the moderating role of technology management. *Stud. Sci. Sci.*, 28(3): 429–435.
- Xing X, Tong Y (2007). Study on the relationship between the enterprise's network competence and technological capability in perspective of innovation. *Sci. Sci. Manage. Sci. Technol.*, 12: 182–186.
- Zhao X-Q, Xu Q-R (2006). On spiral process of technological capability's building paths. *Sci. Res Manage.*, 1: 40–46.

APPENDIX

Technological competence (1=strongly disagree, 5=strongly agree)

Technological Collaboration Reasons (TCR)

TCR1 Because we are the only firm with whom such products and processes can be developed.

TCR2 Because we are the only firm which can use the results of this development project.

TCR3 Because we have excellent technological know-how.

TCR4 Because we are known for successful innovations.

Technological Expertise (TE)

TE1 We are very satisfied with the exclusiveness of our technological know-how.

TE2 Our production processes are highly complex.

TE3 Our products are highly complex.

TE4 Considerable user know-how is required to use our products.

2. Technology management competence (1=strongly disagree, 5=strongly agree)

Resources management competence (RMC)

RMC1 We develop the scientific equipment management system

RMC2 We carry out various forms of training and education on technical personnel

RMC3 We can acquire both the internal and external technical information timely

Organization management competence (OMC)

OMC1 We set up the specialized technology development and innovation department

OMC2 Organizational culture fits the technology strategy objective

3. Network competence

Network Management Task Execution (1=not at all, 5=very intensive)

To what extent are the following activities performed?

NMTE1 Planning

NMTE2 Organization

NMTE3 Staffing

NMTE4 Controlling

NMTE5 Initiation

NMTE6 Exchange

NMTE7 Coordination

Network Management Qualifications (1=not at all, 5= to a very high degree)

To what extent do the people performing the above activities have the following qualifications?

NMQ1 Special qualifications

NMQ2 Social qualifications

4. Innovation performance (1=strongly disagree, 5=strongly agree)

Product innovation performance (TIP)

TIP1 Compared with our competitors, our product modifications and innovations have a better market response

TIP2 Our products are of state-of-the-art technology

Process innovation performance (SIP)

SIP1 We have very modern production facilities.

SIP2 Our production facilities are more advanced than those of our competitors.