

# Entrepreneurial firms' network competence, technological capability, and new product development performance

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**Abstract** Successfully developing new products is critical to an entrepreneurial firm's continued success. Based on the resource management model, this study aims to answer the key research question: how entrepreneurial firms leverage network competence and technological capability to enhance their new product development (NPD) performance in a turbulent environment. Using data collected from 134 entrepreneurial firms in China, we investigate the performance effects of network competence and technological capability, and the moderating effects of technological turbulence and market turbulence. Our findings show that network competence has a positive impact on NPD performance and technological capability plays a mediating role between network competence and NPD performance. Technological turbulence enhances the performance effects of network competence and technological capability; market turbulence advances the performance effect of network competence, but fails to exert significant

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negative impact on that of technological capability. We discuss managerial implications of our findings and offer directions for future research.

**Keywords** Network competence · Technological capability · Technological turbulence · Market turbulence · New product development (NPD) performance

New product development (NPD) is necessary for firms' growth and the maintenance of competitive advantage (Ahlstrom, 2010; Christensen & Raynor, 2003). In today's environment, most firms face major problems related to NPD due to increasing technology complexity, shortening of the product cycles, and increasing innovation cost. In this context, antecedents of NPD performance have lately received much attention. Researchers can be roughly divided into two camps: one group is looking into the firm-internal factors of NPD performance by, for example, analyzing team stability, strategic orientation, intellectual capital, and organizational learning (Akgün & Lynn, 2002; Hsu & Fang, 2009; Jeong, Pae, & Zhou, 2006; Li, Chu, & Lin, 2010). The other group is examining firm-external factors of NPD performance, such as market dynamics and supplier involvement (Lynn, Abel, Valentine, & Wright, 1999; Song & Di Benedetto, 2008). Most studies have been done in the context of large established firms and provide relatively little guidance to entrepreneurial firms, which face different and perhaps even more challenging circumstances when developing new products. Moreover, meta-analyses of the extant literature identify internal resources, external resources, supply chain management, and team characteristics as universally important precursors to firms' NPD performance. Very few studies try to identify the capability factors of entrepreneurial firms' NPD performance and analyze whether these factors have the same importance depending on the environmental turbulence perceived by the managers.

We expect NPD initiatives by entrepreneurial firms to be different from those by large established firms. Entrepreneurial firms refer to start-up firms that engage in product innovation, undertake somewhat risky ventures, and are among the first to come up with proactive innovations. These firms' new products are often developed in resource-constrained organizational settings, in contrast with large established firms where there are approved budgets for NPD projects (Song & Parry, 1997; Teece, Pisano, & Shuen, 1997). Since entrepreneurial firms are resource constrained, they need to acquire external resources to complement their relatively limited marketing and R&D resources, which may be the most important contributor to the success of their NPD. Pangarkar and Wu (2013) posited that start-up firms occupying a more central position in the network will gain access to more timely and useful information as well as an inside-track to exploit the opportunities provided by the environment.

Network competence refers to a firm's ability to manage its network of relationships effectively, and it also allows a firm to develop and use its network to acquire significant resources for innovation (Ritter, 1999). Thus, network competence is important for an entrepreneurial firm's NPD (Ahlstrom & Bruton, 2002). Technological capability is treated as the core of innovation capability, and firms with high level of technological capability can achieve greater innovation success (Ritter & Gemünden, 2003). Though the performance effects of network competence and

technological capability have been examined with data collected from large established firms (Ortega, 2010; Ritter & Gemünden, 2003; Tsai, 2004), few studies have examined those of entrepreneurial firms' network competence and technological capability. There is evidence that technology and market dynamics can affect a firm's capability development as well as moderate the effects of capabilities. Therefore, this study attempts to investigate the effects on NPD performance of entrepreneurial firms' network competence and technological capability, and examine the moderating role of environmental turbulence.

This study aims to answer the following questions: how and to what extent do entrepreneurial firms' network competence and technological capability affect NPD performance? Whether and how does technological capability mediate the relationship between network competence and NPD performance? How do technological turbulence and market turbulence moderate the performance effects of network competence and technological capability? Most NPD existing studies have been conducted in the context of developed countries (North America, Japan, etc.) and newly industrialized countries and regions (Korea, Taiwan, etc.) (Song, Montoya-Weiss, & Schmidt, 1997; Song & Parry, 1997), few studies have investigated NPD in emerging economies such as China. Given China's growing importance in the world economy over the coming decades, there is an urgent, practical need to shed further light on NPD practices in this major, emerging market (Bruton, Ahlstrom, & Obloj, 2008). This study investigates these research questions with data collected from Chinese entrepreneurial firms.

This study contributes to the literature on entrepreneurship and NPD in several ways: First it develops and tests a framework analyzing antecedents of entrepreneurial firms' NPD performance from a dynamic capabilities perspective; second, it studies the moderating effects of environmental turbulence on the relationships between dynamic capabilities and NPD performance; finally, the paper tests, by means of empirical analysis, the relationships among dynamic capabilities not studied previously.

## Theory and hypotheses

### Resource management model

The resource-based view (RBV) argues that competitive advantage is primarily driven by a firm's valuable, rare, inimitable, and non-substitutable resources (Barney, 1991). However, merely possessing such resources does not guarantee the development of competitive advantages (Barney & Arkan, 2001; Priem & Butler, 2001). To maintain sustainable competitive advantage, firms must accumulate, combine, and exploit resources (Grant, 1991; Sirmon & Hitt, 2003). Therefore, the RBV requires further elaboration to explain the link between the management of resources and the competitive advantage. To fully understand this linkage, Sirmon, Hitt, and Ireland (2007) developed the resource management model: the components of the model include structuring the resource portfolio, bundling resources to build capabilities, and leveraging capabilities to gain a competitive advantage. Structuring the resource portfolio involves using acquiring, accumulating, and divesting processes to obtain the resources. Bundling refers to the stabilizing, enriching, and pioneering processes used to integrate resources to form capabilities. Leveraging

involves the processes used to exploit capabilities to take advantage of specific environmental opportunities (Sirmon et al., 2007).

This study focuses on entrepreneurial firms' leveraging network competence and technological capability to develop new products. Leveraging involves the mobilizing, coordinating, and deploying processes. Mobilizing refers to the process of identifying capabilities; coordinating reflects integrating capabilities into effective capability configurations; deploying refers to using capabilities appropriately to respond to external environments. Coordinating and deploying are the two modes of leveraging capabilities, and mobilizing is the foundation of them (Sirmon et al., 2007). Thus, this study highlights the coordinating and deploying of entrepreneurial firms' network competence and technological capability in order to assess how they can be successfully leveraged to enhance NPD performance in turbulent environment.

### Network competence and NPD performance

Network competence refers to a firm's ability to initiate, handle, use, and exploit network relationships (Ritter, 1999). It helps a firm to improve its overall position in a network, and thus enables a firm to acquire significant resources from its network partners. Deng, Hofman, and Newman (2013) suggested that access to sources of external resources has a positive impact on product innovation of Chinese small and medium-sized enterprises. Entrepreneurial firms are resource constrained, they need network competence to establish and use relationships with their network partners to get significant resources to develop new products. Network competence captures the level of network management task performance and the network management qualifications possessed by the people handling a firm's relationships (Ritter, 1999; Ritter & Gemünden, 2004). Network management activities can help entrepreneurial firms collaborate with customers to understand their potential needs and benefits, and then search for new product ideas that will meet these potential needs. Network management qualifications are useful for successful completion of internal NPD processes as those require social interaction and managerial skills as well. Thus, entrepreneurial firms with a high level of network competence will effectively gather information about their customers' needs, follow more realistic and more market-oriented NPD paths, and establish better relationships with channel members for selling their new products. These arguments lead to our first hypothesis:

**Hypothesis 1** Network competence has a positive impact on NPD performance.

### Mediating effect of technological capability

Technological capability reflects a firm's ability to employ various technological resources (Afuah, 2002). A firm with strong technological capability tends to understand and recognize the value of technological development, which in turn provides insights into how to exploit current knowledge and skills (Cohen & Levinthal, 1990). Accordingly, a high level of technological capability facilitates great exploitation of existing resources and know-how. Network competence enables a firm to manage its network relationships efficiently to gain access to complementary assets such as manufacturing

and marketing resources in order to develop and commercialize new products. With technological capability to facilitate high levels of exploitative activities, the resources acquired through network competence can be transmitted to NPD effectiveness as expected. We argue that the value of network competence to NPD performance can be partially achieved through technological capability.

The knowledge view also highlights the close relationship between network competence and technological capability. Zhao and Xu (2006) stated that the accumulation of technological capability is an alternating spiral process of both internal and external ways: the internal way is to increase the stock of technical knowledge through investing substantial resources in R&D, and the external way is to acquire technical knowledge from other organizations. Network competence determines the scope and depth of entrepreneurial firms' connection with other organizations, and limits the intensity and frequency of knowledge transfer, thus it can inevitably affect entrepreneurial firms' absorbing efficiency of new technical knowledge from outside, which, in turn contributes technological capability. Network competence allows entrepreneurial firms to acquire and accumulate technical knowledge, technological capability enables entrepreneurial firms to exploit technical knowledge to develop highly innovative products. We posit that network competence promotes technological capability, which, in turn, enhances entrepreneurial firms' NPD performance. Therefore, we hypothesize:

**Hypothesis 2** Technological capability mediates the positive impact of network competence on NPD performance.

### Moderating effects of environmental turbulence

The success of NPD is not independent of the environment in which the firm functions, and the elements of the environment are important factors when analyzing the performance effects of a firm's capabilities. Researchers have stated that the value of a firm's capabilities is contingent on environmental turbulence (Lin, 2009; Song, Dröge, Hanvanich, & Calantone, 2005; Zhan & Chen, 2013). Thus, it is critical to investigate how environmental turbulence affects the effects on NPD performance of network competence and technological capability. Since different types of environmental turbulence, technological turbulence, and market turbulence function differently (Jaworski & Kohli, 1993), their moderating effects on performance implications of network competence and technological capability should be investigated respectively.

When technological turbulence is high, there are frequent and significant technological changes (Kohli & Jaworski, 1990). The dominant mission under this context is to track technological changes and to exploit new technologies (Han, Kim, & Srivastava, 1998). Entrepreneurial firms with strong network competence can manage technological-oriented relationships effectively, facilitate good links with network partners, and thus acquire new technologies and respond to technological changes quickly. For example, with the supplier involvement, entrepreneurial firms can acquire the new technologies of materials, components, and systems; having a good link with consultants aids entrepreneurial firms in getting innovative concepts and structuring the new process; having a good relationship with universities and R&D institutions allows entrepreneurial firms to get more information about new

technology development and predict the technological changes. Overall, network competence enables entrepreneurial firms to exploit new technologies in their NPD process to adapt to technological turbulence effectively. In relatively stable technological environments, the positive effect of network competence on NPD performance becomes less distinct. Therefore, we hypothesize:

**Hypothesis 3** The higher the technological turbulence, the greater the positive impact of network competence on NPD performance.

Market turbulence refers to the rate of change in the composition of customers and their preferences (Kohli & Jaworski, 1990). We argue that the impact of market turbulence on the relationship between network competence and NPD performance is positive. When market turbulence is high, frequent and significant changes in customers' preferences occur. Entrepreneurial firms with a high level of network competence can effectively manage their network of relationships, including the relationships with their customers and competitors. Managing the relationship with customers effectively helps entrepreneurial firms to get more information about customers' demands and preferences and follow more customer-oriented NPD paths. Creating and managing durable relationships with customers and channel members enable entrepreneurial firms to establish better relationship marketing strategies for selling their new products. In addition, managing the relationship with competitors effectively aids entrepreneurial firms in tracking competitors' activities and responding. Overall, network competence enables entrepreneurial firms to effectively adapt to market turbulence and further improve their NPD performance. Conversely, when market turbulence is low, the response of network competence to market turbulence becomes less significant. Therefore, we hypothesize:

**Hypothesis 4** The higher the market turbulence, the greater the positive impact of network competence on NPD performance.

Technological capability reflects a firm's skills and abilities to deploy and utilize various technical resources and know-how (Anderson & Tushman, 1990; Song et al., 2005). It is the foundation for absorbing new technologies (Cohen & Levinthal, 1990; Zahra & George, 2002). In a high technologically turbulent environment, technological capability enables entrepreneurial firms to track technological changes rapidly and exploit new technologies well to develop new products. Thus, the performance effect of technological capability is distinct. In contrast, when technological turbulence is low, the demand on the firm to respond to technological changes is not so great (Jaworski & Kohli, 1993; Zhou, 2006), the performance effect of technological capability is not as significant as that in a high technologically turbulent context. Therefore, we hypothesize:

**Hypothesis 5** The higher the technological turbulence, the greater the positive impact of technological capability on NPD performance.

Concerning the moderating effect of market turbulence on the relationship between technological capability and NPD performance, we argue that it is negative for two reasons. First, when the market turbulence is high, there are constant changes in

customers' product preferences, which can accelerate the obsolescence of the products (Calantone, Garcia, & Dröge, 2003). The shortened life cycles of the products impede the performance effect of technological capability (Su, Peng, Shen, & Xiao, 2013). In contrast, in a low market turbulence environment, the stability in customers' preferences allows a longer life cycle for products (Calantone et al., 2003), which advances the performance effect of technological capability. Second, although entrepreneurial firms can exploit technological capability to develop new products to meet customers' new preferences, in a turbulent environment, customers' product preferences change so rapidly that there is a time lag between the emergence of new preferences and the development of new products. By the time the firm develops new products, there may have already been further changes in the customers' preferences (Slater & Narver, 1994), which also impair the value of technological capability (Su et al., 2013). These arguments lead to the following hypothesis:

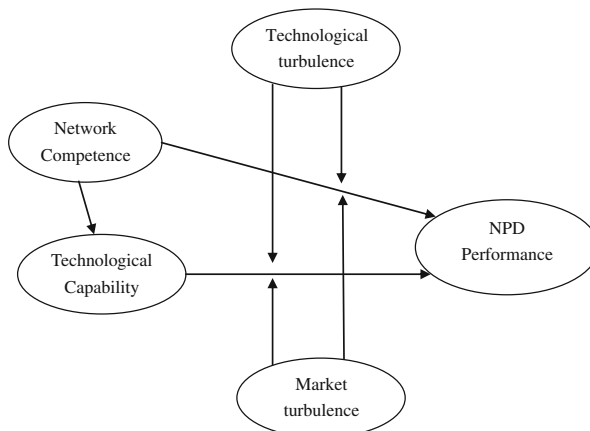
**Hypothesis 6** The higher the market turbulence, the weaker the positive impact of technological capability on NPD performance.

We summarize the above hypotheses and develop the conceptual framework, which is shown in Fig. 1. The conceptual framework considers the crucial roles of network competence and technological capability that act as an effective deployment mechanism enhancing entrepreneurial firms' NPD performance. The framework is also consistent with the main principles of contingency theory which advocate the proper co-alignment between a firm's capabilities and the context in which they are deployed.

## Methods

### Sample and data collection

To gain insight into the situation of NPD in Chinese entrepreneurial firms and pretest the questionnaire, a series of field interviews were carried out before collecting data.



**Fig. 1** Theoretical framework

In-depth personal interviews with senior managers were conducted in three entrepreneurial firms in Harbin in northeast China. Through field interviews, the literature-based conceptualization of network competence and technological capability in developing new products was confirmed. That is, the Chinese managers interviewed consistently emphasized the importance of network competence and technological capability in developing new products in their organizations. We first developed the questionnaire following previous studies, then the managers and academic experts from one prominent Chinese university were asked to assess a list of the constructs and corresponding measures in terms of the content adequacy, and also to suggest additional items. The original English-language version of the questionnaire was translated into Chinese and back translated into English by a third party to ensure accuracy. Following minor revisions after this exercise, the final questionnaire was prepared.

We contacted 200 entrepreneurial firms located in Beijing and in two provinces to the north (Liaoning and Heilongjiang provinces) to ask them to participate in this study. Of these, 134 firms agreed and were successfully interviewed, giving a response rate of 67 %. In each firm, we interviewed one respondent with an overview of the firm, the network, NPD, and environmental conditions. Most of the respondents were CEOs, and others were the managers of the R&D and market departments. The interviewers were PhD students or teachers in Chinese universities, and most of them had interview survey experience. We started the survey in December 2010 and finished in May 2011.

Our sample frame is defined by identifying the entrepreneurial firms with successful NPD experience, and their new products must have been commercialized and launched into the marketplace for at least 6 months. These firms are in the entrepreneurial stage and have been in operation less than 8 years. The sample represents a variety of high-tech industries including: telecommunications (20.9 %), computers and electronics (29.9 %), biomedicine (22.4 %), new materials (14.9 %), and new energy equipment manufacturing (11.9 %).

## Measures

The variables of this study are measured with multiple-item scales, which are adapted from previous studies to suit the context of the relationship among entrepreneurial firms' network competence, technological capability, and NPD performance.

Network competence refers to a firm's ability to manage its network of relationships effectively, and it is conceptualized as a construct comprising network management task execution and network management qualifications (Ritter, 1999). Network management task execution is measured by a four-item scale adapted from Ritter and Gemünden (2003), which captures four important facets of network management. Network management qualifications are measured by a two-item scale developed by Ritter and Gemünden (2003), which assesses the qualifications, skills, and knowledge that are needed in order to perform management tasks.

Technological capability captures a firm's inherent technological potential and strength, comprising four facets: level of human resources, level of production equipment and testing means, advanced degree of information and intelligence, and organizational coordination and adaptation ability (Fransman, 1989). Technological



capability is measured by an eleven-item scale adapted from Wei (2000) and Zhao and Xu (2001), which assesses four dimensions of technological capability: human resources capability, equipment capability, information capability, and organization capability.

Environmental turbulence is conceptualized as a moderator comprising technological turbulence and market turbulence. Technological turbulence is measured by the three-item scale adapted from Slater and Narver (1994). The scale assesses the magnitude of changes and breakthrough in technology. Market turbulence is measured by the three-item scale adapted from Slater and Narver (1994), which assesses the changes in consumers' needs, demands, and preferences for products as changes occur in the marketplace.

NPD performance is measured by the four-item scale adapted from Jeong et al. (2006). The scale assesses the profit, customer acceptance, and commercialization time of new products. To account for the effects of extraneous variables, we take firm age and firm size as control variables. Firm age equals the number of years the firm has been in operation. We use the logarithm of the number of employees to measure firm size.

Appendix A provides a detailed description of the scales used to measure each of the variables. Cronbach's alpha and factor loadings are shown in Appendix A as well.

### Reliability and validity analysis

Before doing any further analysis, the reliability and validity of the constructs are tested. Reliability is tested through Cronbach's alpha coefficients (Appendix A shows Cronbach's alpha for each construct). Alpha coefficients of five constructs range from .74 to .88, and all exceed the .70 threshold for acceptable reliability, which suggests that the measure is internally consistent (Nunnally, 1978). To test convergent validity of the scales, we conduct factor analysis and, as shown in Appendix A, the factor loadings all exceed .5. Thus, convergent validity is obtained. We perform the confirmatory factor analysis (CFA) to estimate the measurement model, the results indicate that the model has good model fit indices (GFI = .91; CFI = .92; RMSEA = .05). We assess discriminant validity by running chi-square difference tests for all the constructs in pairs to determine whether the restricted model (correlation fixed as 1) is significantly worse than the freely estimated model (correlation estimated freely). All the chi-square differences are highly significant (e.g., technological capability vs. network competence:  $\Delta\chi^2(2) = 19.31, p = .000$ ), in support of discriminant validity (Anderson & Gerbing, 1988).

## Results

Table 1 shows construct-level correlation matrix and descriptive statistics. This study uses variance inflation factors (VIFs) to check multicollinearity. All VIFs range from 1.13 to 2.20, which fall within acceptable limits (Hair, Anderson, Tatham, & Black, 1998), suggesting no need for concern with respect to multicollinearity.

Table 2 presents the regression results regarding the effects of network competence on NPD performance. Model 1 in Table 2 is the base model that includes the control

**Table 1** Means, standard deviations, and correlations

	1	2	3	4	5	6	7
1.Firm age	1						
2.Firm size	.30**	1					
3.Technological turbulence	.15	.09	1				
4.Market turbulence	.05	-.04	.27**	1			
5.Technological capability	.02	-.03	.53**	.37**	1		
6.Network competence	.01	.09	.35**	.32**	.56**	1	
7.NPD performance	.01	.07	.32**	.31**	.51**	.44**	1
Mean	6.10	2.72	3.29	3.45	3.07	3.06	3.01
Standard deviations	.79	.27	.79	.62	.70	.69	.75

\*  $p < .05$ , \*\*  $p < .01$

variables and technological turbulence and market turbulence. Model 2 shows the direct effect of network competence on NPD performance. It is significant at the  $p < .001$  level ( $R^2 = .23$ ) and explains an additional 11 % of variance over what the base model explains. The coefficient of network competence is positive and significant for NPD performance ( $r = .35, p < .001$ ). The result supports Hypothesis 1, which states that network competence has a positive impact on NPD performance.

We follow Baron and Kenny's (1986) procedure to examine the mediating effect of technological capability between network competence and NPD performance. The first step is to examine the relationship between the independent variable and the dependent variable. As Model 2 in Table 2 shows, network competence relates significantly to NPD performance. The second step is to examine the relationship between the mediator and the independent variable. The result of Model 6 in Table 3 indicates that network competence has a positive and significant impact on technological capability ( $r = .36, p < .001$ ). The third step is to examine the relationship between the mediator and the dependent variable. Model 3 in Table 2 shows that technological capability has a significant and positive effect on NPD performance ( $r = .42, p < .001$ ). The fourth step is to include the mediator, technological capability, in the model to examine whether it reduces the effect of network competence to be less significant. As Model 4 in

**Table 2** Regression results of NPD performance

	Model 1	Model 2	Model 3	Model 4
Firm age	-.06	-.03	-.03	-.03
Firm size	.21	.12	.28	.21
Technological turbulence (TT)	.25**	.16*	.03	.04
Market turbulence (MT)	.30**	.20*	.17*	.15*
Network competence (NC)		.35***		.19*
Technological capability (TC)			.42***	.23**
Adjusted $R^2$	.12	.23	.25	.28

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

**Table 3** Regression results of technological capability

	Technological capability	
	Model 5	Model 6
Firm age	-.05	-.02
Firm size	-.14	-.26
Technological turbulence (TT)	.35***	.23***
Market turbulence (MT)	.26**	.13**
Network competence (NC)		.36***
Adjusted $R^2$	.32	.53

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

Table 2 shows, the coefficient of technological capability is still positive and significant, indicating the direct effect of technological capability on NPD performance. Further, technological capability significantly reduces the effect of network competence on NPD performance (from  $r = .35, p < .001$  to  $r = .19, p < .05$ ). Thus, technological capability plays a mediating role between network competence and NPD performance, supporting Hypothesis 2.

To examine the moderating effects of environmental turbulence, we employ hierarchical regression. Table 4 presents the regression results. Model 7 is the base model. Models 8 and 9 capture the moderating effects of technological turbulence and market turbulence on the relationship between network competence and NPD performance, and the coefficients indicate that both technological turbulence and market turbulence positively impact the relationship between network competence and NPD performance ( $r = .08, p < .1$  and  $r = .12, p < .01$ , respectively). Thus, Hypotheses 3 and 4 are supported.

Model 10 shows technological turbulence has a positive impact on the relationship between technological capability and NPD performance ( $r = .11, p < .01$ ), suggesting Hypothesis 5 is supported. As Model 11 shows, the negative impact of market turbulence on the performance effect of technological capability is not significant. Thus, Hypothesis 6 stating that market turbulence has a negative impact on the performance effects of technological capability is not supported. The result shown in Model 12 (the full model) is consistent with those of the separate models, indicating the robustness of the results.

## Discussion

### Contributions

This study makes theoretical, empirical, and practical contributions to work on new product development. Theoretically, we investigate the effects on NPD performance of entrepreneurial firms' network competence and technological capability, and the results suggest that these two types of capabilities are significant precursors of NPD performance. Our findings complement the extant literature that highlights the importance of resources factors to NPD

**Table 4** Regression results of moderating effects of environmental turbulence

	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Firm age	-.03	-.05	-.06	-.02	-.03	-.02
Firm size	.21	.29*	.31*	.18*	.24*	.20
Technological turbulence (TT)	.04	-.09	-.45*	-.16*	.27	.11
Market turbulence (MT)	.15*	-.07	.18**	.15**	.15**	-.44*
Network competence (NC)	.19*	.13**	.12***	.19**	.16**	.12
Technological capability (TC)	.23***	.22*	.21**	.14*	.25***	.26*
NC × TT		.08†				.13†
NC × MT			.12**			.17**
TC × TT				.11**		.20**
TC × MT					-.06	-.23†
Adjusted $R^2$	.25	.27	.29	.28	.26	.34
$\Delta R^2$		.02	.04	.03	.01	.09

†  $p < .1$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

performance. The second contribution of this study entails the examination of the mediating role of technological capability in the relationship between network competence and NPD performance. Network competence and technological capability do not function independently; network competence positively relates to technological capability, which, in turn, exerts a positive impact on NPD performance. This mediational evidence provides a more complete understanding of how network competence might be related to performance and enriches the extant literature that focuses on the interaction of capabilities. We confirm empirically that market turbulence has a positive moderating impact on the performance effect of network competence, whereas technological turbulence positively moderates the performance effects of technological capability and network competence. Our findings fill the gap in the previous literature by showing the moderating effects of environmental turbulence on the relationships between dynamic capabilities and NPD performance.

Empirically, extant literature suggests that future research should concentrate on the identification of “dynamic capabilities” that firms can use to adapt, integrate, and reconfigure their resources in response to changing environments and provide more empirical evidence (Eisenhardt & Martin, 2000; Lavie, 2006). Using data collected from Chinese entrepreneurial firms, we empirically test the direct and indirect performance effects of network competence, as well as the moderating effects of environmental turbulence, then find that network competence and technological capability are two types of critical capabilities for entrepreneurial firms to respond to the changing environment. Moreover, Sirmon et al. (2007) developed the resource management model and suggested that more empirical research is needed to validate the model. This study empirically tests the issue of leveraging capabilities of that model and illustrates how entrepreneurial firms coordinate and deploy network competence and technological capability to enhance NPD performance.

Practically, the findings of this study aid entrepreneurial firms in understanding the performance effects of network competence and technological capability and realizing how to leverage these capabilities to enhance their NPD performance in turbulent

environment. The results that both network competence and technological capability have a positive impact on NPD performance can help explain why many Chinese entrepreneurial firms with high level of technological capability fail to achieve high NPD performance, as they may ignore the importance and development of network competence. In the network economy, relationships and networks exist and a firm is embedded into a network, so entrepreneurial firms should pay increasing attention to the ability to develop and manage external relationships. Through this, entrepreneurial firms can access outside resources, which are critical to their NPD. Our results highlight the mediating role of technological capability in the performance effect of network competence. To facilitate the link of network competence and NPD performance, entrepreneurial firms first need to recognize the importance of technological capability. Then they should utilize network relationships to develop a better level of technological capability which in turn will result in favorable NPD performance. A clearly formulated strategy for developing innovation capability of entrepreneurial firms should include the coordinated development of network competence as well as technological capability (Ahlstrom & Bruton, 2002; Grant, 2013).

Moreover, the results about environmental turbulence provide entrepreneurial firms with guidance for better utilizing network competence and technological capability. When market turbulence is high, entrepreneurial firms should recognize that devoting resources to promoting network competence is preferable to promoting technological capability. To respond to market turbulence, entrepreneurial firms should make sure that the contributing factors of network competence such as resources, network-oriented human resource management, integrated communication structures, and an open corporate culture are in place. When technological turbulence is high, technological capability is critical to NPD performance, and entrepreneurial firms should have large equipment expenses, make more resources available to R&D, employ more highly qualified personnel and create a corporate culture amenable to learning and creativity to promote technological capability.

One more practical contribution of this study entails the new research context: the emerging economy of China. As the largest emerging economy of the world, China shares many characteristics with other emerging economies (Peng, 2003). Findings based on Chinese entrepreneurial firms therefore provide important direct implications for entrepreneurial firms operating in other emerging economies.

#### Limitations and future research directions

This study is only a small first step towards a better understanding of the “black box” between entrepreneurial firms' capabilities and NPD performance. We recognize that there are some limitations. First, network competence and technological capability are only two of the most important antecedents of entrepreneurial firms' NPD performance, and other capability factors may also be included in the model, which would allow further insights into the mechanisms that trigger entrepreneurial firms' higher NPD performance. Second, although we tried to collect data in the comprehensive way, it did not include all entrepreneurial firms. We included only Chinese high-tech industries in our empirical analysis, so we cannot generalize our findings to other industries and other countries. Though we believe our findings are applicable to other emerging economies, replication in other industries and country settings would provide us with a more

complete understanding of the relationships and identify differences that are caused by differing cultural or business environments.

## Conclusion

How and to what extent do entrepreneurial firms' network competence and technological capability influence their NPD performance? How does environmental turbulence moderate the performance effects of network competence and technological capability? Our answers are that both network competence and technological capability have a significant positive impact on entrepreneurial firms' NPD performance, moreover, network competence can exert indirect impact on NPD performance through supporting the development of technological capability. Technological turbulence enhances the performance effects of network competence and technological capability; market turbulence advances the performance effect of network competence, but fails to exert significant negative impact on that of technological capability. Network competence or a firm's ability to manage its network of relationships is particularly crucial for entrepreneurial firms in China, and this important capability should not be neglected.

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## Appendix A Study measures

The Cronbach's alpha of constructs and factor loadings of the items are shown in parentheses.

1. *Network competence* (Cronbach's alpha = .82)
  - Network management task execution (1 = not at all, 5 = very intensive)
  - To what extent are the following activities performed?
    - NMTE1 Planning (.79)
    - NMTE2 Organization (.60)
    - NMTE3 Controlling (.64)
    - NMTE4 Coordination (.75)
  - 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 (.83)
    - NMQ2 Social qualifications (.78)

2. *Technological capability* (1 = very low, 5 = very high, Cronbach's alpha = .88)
  - Human resources capability
    - HC1 Number of scientific and technical personnel (.78)
    - HC2 Number of senior technicians (.61)
    - HC3 Cultural level of employees (.64)
  - Equipment capability
    - EC1 Number of equipment at international advanced level (.76)
    - EC2 Soundness of the current equipment (.64)
  - Information capability
    - IC1 Level of information network (.73)
    - IC2 Number of technical files (.74)
    - IC3 Degree of technical file meets R&D demand (.69)
  - Organization capability
    - OC1 Quality and experience of management (.83)
    - OC2 Number of agencies at all levels engaged in R&D (.84)
    - OC3 R&D funding availability (.73)
3. *Technological turbulence* (1 = strongly disagree, 5 = strongly agree, Cronbach's alpha = .78)
  - TT1 The technology in our business is changing rapidly (.76)
  - TT2 Technological changes provide big opportunities in our industry (.87)
  - TT3 Many product ideas are made possible from technological breakthroughs (.86)
4. *Market turbulence* (1 = strongly disagree, 5 = strongly agree, Cronbach's alpha = .74)
  - MT1 In our business, customer's product preferences change a lot over time (.70)
  - MT2 Our customer tends to look for new product all the time (.83)
  - MT3 We see demand for our products and services from new customers (.76)
5. *NPD performance* (1 = highly dissatisfied, 5 = highly satisfied, Cronbach's alpha = .81)
  - NPD1 Contribution of new products to overall profit margin (.79)
  - NPD2 Attaining profitability goals (.83)
  - NPD3 Customer acceptance of new products (.78)
  - NPD4 Time from specs to full commercialization (.79)

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