Management and Organization Review 9:3, November 2013, 437–463
doi: 10.1111/more.12037

External Knowledge Search Strategies in China's Technology Ventures: The Role of Managerial Interpretations and Ties

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ABSTRACT Drawing on the threat-rigidity hypothesis, we examine how managerial opportunity and threat interpretations of external environments affect a technology venture's choice of external knowledge search strategies in an emerging market. Results from a sample of 141 technology ventures in China reveal that opportunity interpretation directly and positively influences both the breadth and depth of external search, whereas threat interpretation directly and negatively influences only external search depth. Furthermore, managerial ties strengthen the positive relationship between opportunity interpretation and external search breadth but weaken the positive relationship on external search depth. Managerial ties weaken the negative relationship between threat interpretation and external search breadth but strengthen the negative relationship on external search depth. Implications for both research and practice are offered.

KEYWORDS external knowledge search, managerial interpretations, managerial ties, search breadth, search depth

中国技术创业型企业的外部知识搜索策略：管理者解释和纽带的作用

摘要

凭借威胁刚性假设，我们探讨管理者对外部环境的机会解释和威胁解释如何影响新兴市场中技术创业型企业选择外部知识搜索策略。基于中国141个技术创业型企业的研究样本，我们发现：机会解释直接正向影响外部知识搜索的广度和深度，威胁解释直接负向影响外部直搜索的深度。而且，管理者纽带增强机会解释与外部知识搜索广度的正向关系，但是减弱机会解释与外部知识搜索深度的正向关系。管理者纽带减弱威胁解释与外部知识搜索广度的负向关系，但是增强威胁解释与外部知识搜索深度的负向关系。我们提供了这些发现的研究意涵和实践意涵。

关键词：外部知识搜索，管理者解释，管理者纽带，搜索广度，搜索深度

INTRODUCTION

In emerging markets such as China's, firms are increasingly adopting external knowledge search strategies for innovation to keep up with a dynamic market with high-velocity changes (Brown & Eisenhardt, 1998; Chesbrough, 2003; Zhang & Li, 2010). This is especially important for China's technology ventures that typically lack the internal resources and capabilities necessary to produce successful streams of innovation (Li & Atuahene-Gima, 2002; Zhang & Li, 2010). Scholars consider external knowledge search, through which firms adapt and reinvent themselves in changing technology and market environments, to be among the most salient organizational actions (Katila & Ahuja, 2002). Ample theoretical and empirical studies suggest that external knowledge search fosters firms' innovative performance (Laursen & Salter, 2006; Levinthal & March, 1981; Zhang & Li, 2010). In fact, two key managerial roles are to provide meaningful interpretations of the increasing complexity and dynamics of external environments and to take adaptive strategic actions based on external knowledge search to respond to opportunities and threats (Daft & Weick, 1984; Thomas, Clark, & Gioia, 1993).

Despite the importance of external knowledge search, we have a poor understanding of the managerial factors that influence a firm's choice of external knowledge search strategies. Drawing on the threat-rigidity hypothesis (Ocasio, 1997; Staw, Sandelands, & Dutton, 1981), we argue that managerial interpretations of opportunities and threats in external environments and managerial ties can help us understand the joint drivers of external knowledge search strategies in technology ventures. We focus specifically on China, the world's largest emerging-market setting.

Two important motivations fuel our study. First, organizations are interpretation systems (Daft & Weick, 1984). Managers' opportunity and threat interpretations are often seen as critical factors influencing organizations' strategic action alternatives and subsequent outcomes (Dutton & Duncan, 1987; Thomas et al., 1993). In particular, both interpretations can affect the level of risk-taking, involvement, and commitment associated with strategic issues (Dutton & Jackson, 1987). We thus assume that opportunity and threat interpretations affect a technology venture's choice of external knowledge search strategies in different ways. However, little is known about these influencing mechanisms.

Second, external knowledge search does not take place in a vacuum but is closely embedded in networks and ties of interpersonal relations (Uzzi, 1997). Managerial ties are prevalent in the *guanxi*-based Chinese commercial environment (Chen, Chen, & Huang, 2013; Luo, Huang, & Wang, 2012; Tsui & Farh, 1997). Resource and capability deficiencies, institutional voids, and structural obstacles in China's transition economy (Acquaah, 2012) force managers to build ties with managers at other firms (i.e., business ties) and with government officials (i.e., political ties) (Li & Zhang, 2007; Luo et al., 2012; Peng & Luo, 2000). Representing a unique type

https://doi.org/10.1111/more.12037 Published online by Cambridge University Press

of managerial resource in China's emerging market, managerial ties help firms gain access to scarce external resources and information and reduce uncertainty (Li & Atuahene-Gima, 2001; Li, Poppo, & Zhou, 2008; Luo et al., 2012). Moreover, scholars have argued that opportunity and threat interpretations affect the range of solutions considered in an organization and the amount of organizational resources committed to a specific strategic action (Thomas & McDaniel, 1990). For these reasons, we propose that the effects of opportunity and threat interpretations on external knowledge search strategies are contingent on managerial ties in China's emerging market.

Using a sample of 141 technology ventures in China, we elucidate the relationships between opportunity and threat interpretations and a technology venture's external knowledge search strategies. We also examine how managerial ties moderate these relationships. This study contributes to knowledge search research by offering a better understanding of the joint effects of managerial interpretations and ties on an organization's external knowledge search strategies in an emerging market where managerial ties are important.

THEORETICAL BACKGROUND AND HYPOTHESES

Managerial Interpretations and External Knowledge Search Strategies

External knowledge search can be defined as an organization's problem-solving activities that involve the creation and recombination of specific external knowledge about users, technologies, and markets (Katila & Ahuja, 2002; Laursen & Salter, 2006). In this study, broad external search and deep external search represent two strategies adopted by technology ventures to achieve and sustain innovation. Broad external search is more likely to generate breakthrough ideas, highly novel insights, and solutions (Cohen & Levinthal, 1990; Schilling & Green, 2011). A technology venture's external knowledge search breadth refers to the number of external knowledge sources on which it relies in its innovative activities (Laursen & Salter, 2006). Deep external search, in contrast, is more likely to 'result only in incremental advancements, while decreasing the likelihood of highly novel or radical solutions' (Schilling & Green, 2011: 1323). A technology venture's external knowledge search depth refers to the extent to which the technology venture draws deeply from different external knowledge sources (Laursen & Salter, 2006).

Both types of search are crucial for the long-term survival and prosperity of China's technology ventures because the internal knowledge space of these technology ventures is limited (Zhang & Li, 2010). Most prior studies have concentrated on the impact both types of search have had on performance (e.g., Katila & Ahuja, 2002; Laursen & Salter, 2006). It has been suggested that a firm's use of different knowledge sources is partly shaped by external environmental characteristics such as the availability of market and technological opportunities and the degree of envi-

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ronmental turbulence (Cohen & Levinthal, 1990; Laursen & Salter, 2006). Research also suggests that firms' external knowledge search is constrained by resources (Laursen, 2012). However, our current knowledge about how specific managerial factors drive both types of search in technology ventures remains underdeveloped.

Managers in different organizations often have different interpretations of external environments (Thomas & McDaniel, 1990). Managerial interpretations in this study refer to managers' appraisals of China's business environment, and whether they promise opportunities or threats (Staw et al., 1981). Both interpretations imply a sense of urgency, difficulty, and high stakes, and are thus likely to evoke some form of action (Chattopadhyay, Glick, & Huber, 2001). Opportunity interpretation refers to managers' perceptions of positive external environments offering likely gains and reasonable control. Threat interpretation, in contrast, refers to managers' perceptions of negative external environments offering likely losses and relatively little control (Dutton & Jackson, 1987). In general, both interpretations systematically impact strategic actions directed toward different targets and of different magnitudes.

The threat-rigidity hypothesis has dominated organizational scholarship concerning managerial responses to opportunities and threats (George, Chattopadhyay, Sitkin, & Barden, 2006). It posits that, in the face of threats, organizations tend to pursue routine activities 'rigidly' (George et al., 2006; Staw et al., 1981). By adhering to these well-established routines, managers attempt to regain control over what seems to be uncontrollable. In contrast, since recognition and focus on opportunities are associated with a sense of mastery over the situation, opportunities for gaining control allow organizations to go beyond their usual routines, thus promoting greater risk-taking (George et al., 2006). Following this line of reasoning, we argue that, by affecting managers' perceived degree of controllability over external environments and potential resource commitments, opportunity and threat interpretations influence broad and deep external search in technology ventures.

Note that we treat external search breadth and external search depth as two separate though interdependent constructs (Schilling & Green, 2011). A technology venture may simultaneously engage in broad and deep external search in response to opportunities and threats. An emphasis on either broad or deep external search reflects the trade-offs made to accommodate managerial and organizational limitations. Trade-offs can result from constraints in allocating limited organizational resources and managerial attention to these two search strategies and from the challenges associated with managing paradoxical cognition and inconsistent organizational routines (Ocasio, 1997; Smith & Tushman, 2005). Given the limitation of organizational resources and managerial attention, a technology venture may justifiably emphasize broad or deep external search under certain conditions. Adopting such a contingent view of organizational trade-offs, we propose separate hypotheses for external search breadth and external search depth. Our model is summarized in Figure 1.

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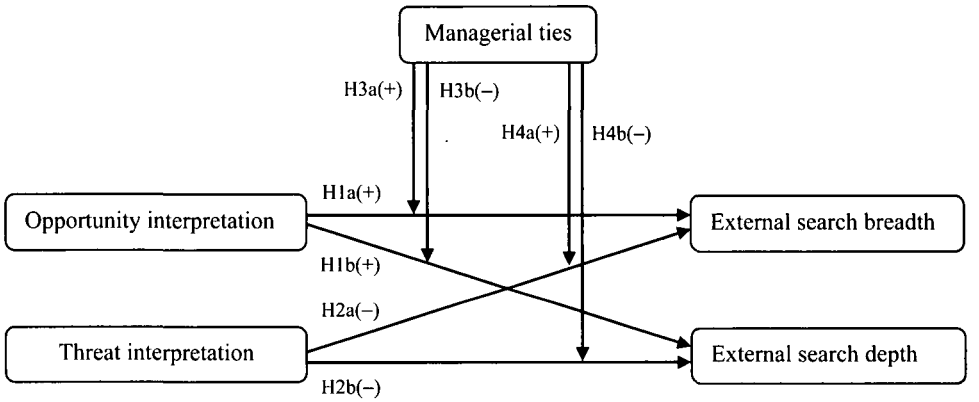

Figure 1. The model of the effects of managerial interpretations on external knowledge search strategies

Opportunity interpretation. Opportunity interpretation is associated with positive outcomes and expectations of gain (Jackson & Dutton, 1988) and hence has a psychologically powerful impact on managers. In general, opportunity framing provides a positively glossed future. Opportunity interpretation increases managers' positive cognition and motivation and serves both to heighten their perceptions of control and suppress the psychological effects of perceived threats (Dutton, 1993). In particular, opportunity interpretation enhances managers' confidence in their control over uncertainties and in their ability to achieve the desired outcome (Thomas et al., 1993).

Empirical evidence also supports a propensity to respond more intensely when managers interpret a situation as an opportunity (White, Varadarajan, & Dacin, 2003). For example, a positive relationship was found between managers' labelling of a situation as controllable and product and service changes in their businesses (Thomas et al., 1993). Thus, managers with opportunity interpretation are more likely to be predisposed to greater resource commitment (White et al., 2003).

Managers with opportunity interpretation are also more likely to pursue externally directed organizational actions (Dutton & Duncan, 1987). Thus, a technology venture is more likely to engage in both broad and deep external search when its managers interpret external environments as opportunities. Generally, opportunity framing creates paradoxical cognition allowing managers to effectively embrace and manage contradictions and tensions embedded in broad and deep search for external knowledge, thereby facilitating a technology venture's broad and deep external search (Smith & Tushman, 2005).

In effect, both broad and deep external search are time consuming, costly, uncertain, and difficult (Schilling & Green, 2011). As such, a technology venture will not facilitate both types of search unless its managers perceive external environments as opportunities.[1] Based on this logic, we argue that managers with

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opportunity interpretation are more likely to push a technology venture to increase both broad and deep external search. Hence, we hypothesize:

Hypothesis 1a: Opportunity interpretation will positively relate to external search breadth.

Hypothesis 1b: Opportunity interpretation will positively relate to external search depth.

Threat interpretation. Perceived threats induce psychological stress and anxiety among managers. Threat interpretation elicits withdrawal, constriction of control, conservation of resources, and restriction of information processing such as narrowing the field of attention, simplifying information codes, or reducing the number of channels used (Staw et al., 1981). Under threat interpretation, managers face the risk of negative outcomes and relatively little control over the situation. To offset these negative perceptions, they are more likely to respond to domains promising greater organizational control (Chattopadhyay et al., 2001).

Since perceived threats make risks more salient, managers tend to become risk averse (Atuahene-Gima & Yang, 2008; Chattopadhyay et al., 2001) and strictly follow narrow, familiar, or well-established actions. An opposing argument is that threatening environments make managers seek risks and make significant changes because they have little to lose (Lant, Milliken, & Batra, 1992; Tushman & Romanelli, 1985). This argument is consistent with the prediction that threat interpretation results in smaller rather than greater responses.[2] Risk-seeking behaviour initiated by failure-induced threats is often associated with a narrowing of attention and an increased reliance on well-established routines in organizations (Ocasio, 1995).

Threat interpretation also intensifies concerns about efficiency, manifested in cost cutting, budget tightening, and activity restriction (Thomas et al., 1993). Threat interpretation thus triggers managers' defensive mindset, which in turn largely reduces the commitment of resources to both broad and deep external search (Dutton & Jackson, 1987). Additionally, managers with threat interpretation are more likely to pursue internally directed organizational actions because they perceive such actions to be associated with higher levels of control and lower levels of risk than externally directed actions (Dutton & Jackson, 1987). Organizational actions are more likely to be internally directed in response to control-reducing threats (Chattopadhyay et al., 2001). Therefore, a technology venture is less likely to engage in both broad and deep external search when its managers interpret external environments as threats; on the contrary, it is more likely to promote internal knowledge search for innovation. This is especially true for technology ventures in China's emerging market that have limited organizational resources and managerial attention and face great pressure for survival (Eisenhardt & Schoonhoven, 1990; Ocasio, 1997).

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Following this logic, we argue that managers under threat interpretation are more likely to propel technology ventures to restrain broad and deep search for external knowledge. Therefore, we hypothesize:

Hypothesis 2a: Threat interpretation will negatively relate to external search breadth.

Hypothesis 2b: Threat interpretation will negatively relate to external search depth.

Moderating Role of Managerial Ties

Managerial ties represent 'executives' boundary-spanning activities and their associated interactions with external entities' (Geletkanycz & Hambrick, 1997: 654). Managers cultivate both business and political ties. China has a long tradition of using such ties as a conduit to nurture business transactions (Luo, 2003). Managerial ties are crucial for organizations in China because market mechanisms and market-supporting institutions are underdeveloped or under-enforced (Guo & Miller, 2010; Luo, 2003; Luo et al., 2012). Furthermore, managerial ties exert informational and social influences on strategic choice (Geletkanycz & Hambrick, 1997), organizational actions (Chen et al., 2013; Farh, Tsui, Xin, & Cheng, 1998; Luo et al., 2012), and resource allocation (Lau, 2011). Managerial ties are sources of competitive advantage and superior financial and market performance among Chinese firms (Chen et al., 2013; Luo et al., 2012; Xin & Pearce, 1996). It is generally accepted that managerial ties enable a firm operating in China's business environment not only to seize opportunities but also to respond to threats (Luo, 2003; Luo et al., 2012). We thus argue that managerial ties underpin managers' perceived controllability of a situation and potential resource commitments by helping a technology venture acquire institutional support, scarce resources, and informational and control benefits, and to counteract risks and uncertainties posed by external environments. Based on this argument, we expect managerial ties to moderate the relationships between opportunity and threat interpretations and subsequent external knowledge search strategies in different ways.

Moderating role of managerial ties on the positive relationships between opportunity interpretation and external search strategies. Managerial ties provide a technology venture with several major benefits such as critical institutional support and access to scarce resources and important information (Li et al., 2008; Li, Yao, Sue-Chan, & Xi, 2011; Li & Zhang, 2007; Luo et al., 2012). Managerial ties thus increase managers' perceived controllability of external environments. They also help a technology venture reduce the risks and uncertainties inherent in searching broadly for external knowledge. Therefore, managerial ties enable a technology venture to sense and then seize all possible opportunities to search broadly for external knowledge,

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thereby reducing its motivation to search deeply within a limited number of external knowledge sources.[3]

Opportunities are more likely to make salient the potential gains rather than the risks involved (March & Shapira, 1987). When managers perceive external environments as opportunities, managerial ties are more likely to enable them to divert attention from deep external search to focus instead on more risky, broad external search with potentially high payoffs.

Moreover, resource constraints often force technology ventures to emphasize one search strategy over the other at any particular time (Gupta, Smith, & Shalley, 2006; Schilling & Green, 2011; Zhang & Li, 2010). Meanwhile, managers must 'concentrate their energy, effort and mindfulness on a limited number of issues and tasks' (Ocasio, 1997: 203) to achieve successful search strategies for external knowledge. Accordingly, when managerial ties are strong, managers' opportunity interpretation is more likely to motivate a technology venture to commit significant resources to broad external search and, conversely, is less likely to motivate a technology venture to commit scarce resources to deep external search.

Following that reasoning, we argue that managerial ties enhance the positive effect of opportunity interpretation on external search breadth and, conversely, that they dampen the positive effect of opportunity interpretation on external search depth. Hence, we propose:

Hypothesis 3a: The positive relationship between opportunity interpretation and external search breadth will strengthen as managerial ties increase.

Hypothesis 3b: The positive relationship between opportunity interpretation and external search depth will weaken as managerial ties increase.

Moderating role of managerial ties on the negative relationships between threat interpretation and external search strategies. In addition to enhancing a technology venture's internal resources and capabilities, managerial ties also counteract the risk and uncertainty of China's business environment (Li & Sheng, 2011; Li & Zhang, 2007; Luo et al., 2012; Peng & Luo, 2000). As such, managerial ties improve a technology venture's environmental fit and hence help managers reduce the perceptions that external environments are uncontrollable. Managerial ties may also increase their perceptions that they can control threats such as risk and unpredictability associated with searching broadly for external knowledge.

Acting as an important catalyst fueling a technology venture's strategic actions (Geletkanycz & Hambrick, 1997), managerial ties propel the technology venture to initiate new strategic postures in response to environmental threats. Political ties stimulate a firm to conduct trial-and-error experimentation by granting it access to financial resources (Kotabe, Jiang, & Murray, 2011). In fact, it is safest for a firm

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to engage in broad external search when government officials approve of this search strategy (George et al., 2006). Managerial ties convey more confidence in longer-term investments and more aggressive strategic actions (Lau, 2011). Moreover, in a transition economy managers are more ready to innovate and take risks when they are buffered from uncertainty (Tan, 2003). Thus, managerial ties are more likely to cause managers facing threats to loosen controls on broad external search to facilitate adaptation to future environmental changes and strengthen their competitive position (Chen & Miller, 2007). Conversely, managerial ties may cause managers facing threats to tighten controls on deep external search because this search strategy usually leaves the technology venture's strategic position largely unchanged (Katila & Ahuja, 2002).

Moreover, as noted, limited organizational resources and managerial attention cause technology ventures to emphasize one search strategy over the other at any particular time (Gupta et al., 2006; Ocasio, 1997; Zhang & Li, 2010). Therefore, when managerial ties are strong, managers facing threats are more likely to engage in broad external search rather than in deep external search (Katila & Shane, 2005; Leiponen & Helfat, 2010) because it is too risky for a technology venture with strong managerial ties to focus on only a few external knowledge sources for deep search.[4] The technology venture will therefore fail to explore breakthrough ideas and radical innovations in emerging fields, thereby missing important future business opportunities with extremely damaging consequences (Laursen, 2012; Leiponen & Helfat, 2010).

Overall, when managerial ties are strong, threat interpretation is less likely to stimulate a technology venture to reduce resource commitments to broad external search and, conversely, is more likely to stimulate a technology venture to decrease resource commitments to deep external search. For these reasons, we argue that managerial ties mitigate the negative effect of threat interpretation on external search breadth and, conversely, that they aggravate the negative effect of threat interpretation on external search depth. Therefore, we propose:

Hypothesis 4a: The negative relationship between threat interpretation and external search breadth will weaken as managerial ties increase.

Hypothesis 4b: The negative relationship between threat interpretation and external search depth will strengthen as managerial ties increase.

METHOD

Sample and Data Collection

For our sample, we randomly selected 600 technology ventures in China (100 each in Zhejiang, Beijing, Shanghai, Jiangsu, Guangdong, and Hunan provinces), by using these regions' directories of technology-based businesses. We first sent letters

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to CEOs or general managers of the selected technology ventures, explaining the purpose of the study and inviting them to participate, and then we sent two questionnaires to each of the technology ventures and asked each of two key informants to complete a questionnaire independently and anonymously. Similar to the sampling approach taken by Atuahene-Gima and Yang (2008), we selected CEOs, vice presidents, research and development (R&D) managers, marketing managers, and engineering managers as our key informants. After several rounds of phone, email, and personal follow-ups, we obtained data from 182 technology ventures, thus achieving a participation rate of 30.3 percent. We then eliminated questionnaires with excessive missing data and technology ventures with a single respondent to reduce single response bias. Our final sample included 141 technology ventures (33 from Zhejiang, 19 from Beijing, 18 from Shanghai, 21 from Jiangsu, 26 from Guangdong, and 24 from Hunan). Each had two completed responses for a response rate of 23.5 percent (141 out of 600 firms).

Following the OECD's (2009) classification of manufacturing industries based on technology intensity, the technology ventures in our final sample represented three industry categories: 47.5 percent were from high-technology industries (including pharmaceuticals; office, accounting, and computing machinery; radio, TV, and communications equipment; and medical, precision, and optical instruments); 39.7 percent were from medium-to-high-technology industries (including electrical machinery and apparatus; and motor vehicles, trailers, and semi-trailers); and 12.8 percent were from medium-to-low-technology industries (including ship and boat building and repair; and rubber and plastics products). Of the responding technology ventures, the average venture age was 11.96 years (SD = 4.75), and the average venture size was 650.16 employees (SD = 535.39). Seventy-eight percent of key informants were male, and 48.2 percent of these were top managers. A *t*-test for non-response bias showed no significant differences between the firms of the respondents and non-respondents for several variables such as venture size and venture age. Early and late respondents did not significantly differ on these measures either. In addition, a one-way analysis of variance test showed no significant differences between the technology ventures of the six regions for external search breadth ($F = 0.90$, n.s.) and external search depth ($F = 1.17$, n.s.).

Measures

We developed the questionnaire following the conventional and well-accepted back translation process (Brislin, 1986). The questionnaire was originally designed in English and then translated into Chinese by two management scholars competent in both languages and with substantial research experience in the subject area in China. To avoid cultural bias and to ensure validity, two language professionals translated the Chinese version back into English independently, paying special attention to detecting misunderstandings arising from translation. The question-

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naire was then pilot-tested through in-depth interviews with 12 managers in six technology ventures. These pilot tests helped clarify some of the ambiguous measures and improve their relevance and face validity in the Chinese context.

External search breadth and depth. To measure the breadth and depth of external knowledge search, we adopted Laursen and Salter's (2006) measures. Chiang and Hung (2010) used these measures with a sample of Taiwanese electronic product manufacturing companies. The measures consist of 16 external knowledge sources for innovation activities.[5] We asked the respondents to indicate on a four-point scale the extent to which their technology ventures use each knowledge source. A rating of 0 indicates a technology venture does not use this source at all, and a rating of 3 indicates it uses the source to a high extent. We used this set of ratings to code the breadth and depth of external knowledge search. In measuring external search breadth, we coded each of the 16 sources with 1 when the respondents gave ratings of 1, 2, or 3, and 0 when they gave a rating of 0. Subsequently, we calculated the sum of all the coded values on the 16 sources to achieve a score of the technology venture's external search breadth for each given respondent. We used the average score of the two respondents as a value of the variable 'external search breadth'. External search breadth had a minimum value of 0 when no sources were used and a maximum value of 16 when all sources were used. In measuring external search depth, we coded each of the 16 sources with 1 when the respondents gave a rating of 3 and 0 when they gave ratings of 0, 1, or 2. Subsequently, we calculated the sum of all the coded values on the 16 sources to achieve a score of the technology venture's external search depth for each given respondent. We used the average score of the two respondents as a value of the variable 'external search depth'. External search depth had a minimum value of 0 when no sources were used to a high extent and a maximum value of 16 when all sources were used to a high extent.

Opportunity and threat interpretations. Consistent with previous research (Julian & Ofori-Dankwa, 2008), we treated opportunity and threat interpretations as two distinct but related constructs and not merely ends of a continuum. We asked managers to focus on the business environment in which their technology ventures operated in China when measuring opportunity and threat interpretations. We adapted the eight-item measures from Atuahene-Gima and Yang (2008), which borrowed the measures of White et al. (2003) and added an item reflecting the perceived degree of environmental control to each construct to reflect Dutton and Jackson's (1987) definitions. The items are presented in Table 1. Each item was measured on a seven-point Likert scale, ranging from 1 = small extent to 7 = great extent.

Managerial ties. Following Li et al. (2008), we adopted the widely used six-item measures of managerial ties developed by Peng and Luo (2000). We treated

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Table 1. Construct items and results of confirmatory factor analysis of measures

Construct and source	*Construct measurement items*	*Standardized factor loading*
Opportunity interpretation (Atuahene-Gima & Yang, 2008; White et al., 2003)	Consider China's business environment. Please indicate the extent to which your firm:	
	1. Describes the overall business environment as an opportunity.	0.81
	2. Labels the business environment as something positive.	0.89
AVE = 0.68, CR = 0.89	3. Feels the future looks promising for your firm because of the business environment.	0.80
	4. Sees the overall business environment as controllable.	0.79
Threat interpretation (Atuahene-Gima & Yang, 2008; White et al., 2003)	Consider China's business environment. Please indicate the extent to which your firm:	
	1. Describes the overall business environment as a threat.	0.76
	2. Labels the business environment as something negative.	0.62
AVE = 0.57, CR = 0.84	3. Feels the business environment has negative implications for the future of your firm.	0.87
	4. Sees the overall business environment as uncontrollable.	0.74
Managerial ties (Peng & Luo, 2000)	Please indicate the extent to which managers at your firms have utilized personal ties, networks, and connection during the past three years with:	
AVE = 0.65, CR = 0.92	1. Top managers at buyer firms.	0.89
	2. Top managers at supplier firms.	0.74
	3. Top managers at competitor firms.	0.75
	4. Political leaders in various levels of the government.	0.78
	5. Officials in industrial bureaus.	0.84
	6. Officials in regulatory and supporting organizations such as tax bureaus, state banks, commercial administration bureaus, and the like.	0.83
Organizational slack (De Luca & Atuahene-Gima, 2007)	Please indicate the extent to which you agree with each of the following statements:	
	1. Our firm has uncommitted resources that can be used to fund strategic initiatives at short notice.	0.86
AVE = 0.72, CR = 0.91	2. Our firm has a large amount of resources available in the short run to fund our initiatives.	0.85
	3. Our firm will have no problems obtaining resources at short notice to support new strategic initiatives.	0.86
	4. Our firm has a large amount of resources at the discretion of management to fund new strategic initiatives.	0.82
Market uncertainty (Atuahene-Gima & Murray, 2007)	Please indicate the extent to which you agree with each of the following statements:	
	1. Our business and customers' product preferences change quite rapidly.	0.88
AVE = 0.75, CR = 0.90	2. Our customers tend to look for new products all the time.	0.90
	3. New customers tend to have product needs that are different from existing customers.	0.83
Technology uncertainty (Atuahene-Gima & Li, 2004)	Please indicate the extent to which you agree with each of the following statements:	
	1. The technology in our industry was changing quite rapidly.	0.87
AVE = 0.75, CR = 0.92	2. Technological changes provided big opportunities in our industry.	0.90
	3. A large number of new product ideas have been made possible through technological breakthroughs in our industry.	0.85
	4. There have been major technological developments in our industry.	0.83

Model fit indices: χ^2 (df = 260) = 414.31, $p < 0.001$; RMSEA = 0.07; SRMR = 0.06; TLI = 0.92; CFI = 0.93.
Notes: All the standardized factor loadings are significantly different from zero at the 0.001 level (two-tailed tests).
AVE, average variance extracted; CR, composite reliability.

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managerial ties as a composite factor consisting of business and political ties. The items are presented in Table 1. Each item was measured on a seven-point Likert scale, ranging from 1 = small extent to 7 = great extent.

Control variables. Consistent with prior studies, we controlled for several variables when testing our hypotheses. First, the availability of organizational slack resources is likely to influence organizational actions in response to opportunities and threats from external environments (Chattopadhyay et al., 2001), and thus we controlled for organizational slack. We used the four-item scale developed by De Luca and Atuahene-Gima (2007) to measure organizational slack. The items are presented in Table 1. Each item was measured on a seven-point Likert scale, ranging from 1 = strongly disagree to 7 = strongly agree. Second, to capture the impact of environmental uncertainty, we controlled for market uncertainty and technology uncertainty. Market uncertainty reflects the speed of change in customer demand, product preferences, and emergence of new customer segments in the industry (Atuahene-Gima & Murray, 2007); technology uncertainty reflects the perceived speed and magnitude of change and uncertainty in technology and the variety of new product introductions afforded by changing technology in the industry (Atuahene-Gima & Li, 2004). We adopted Atuahene-Gima and Murray's (2007) three-item scale and Atuahene-Gima and Li's (2004) four-item scale to measure market uncertainty and technology uncertainty, respectively. The items are presented in Table 1. Each item was measured on a seven-point Likert scale, ranging from 1 = strongly disagree to 7 = strongly agree. Third, we controlled for venture age and venture size. We measured venture age as the number of years the technology venture had been operating, and venture size as the logarithm of the number of full-time employees. Fourth, we controlled for the venture region in which a technology venture was located. As noted above, our sample consisted of technology ventures across six regions (i.e., Zhejiang, Beijing, Shanghai, Jiangsu, Guangdong, and Hunan provinces), and thus we effect-coded variables for the first five regions to control for the effects of region characteristics. Fifth, we controlled for industry type in our model. As indicated above, our sample consisted of technology ventures in three industries (i.e., high-, medium-to-high-, and medium-to-low-technology industries), and thus we effect-coded variables for the first two industries.

As noted earlier, our data were gathered from two informants from each technology venture via two identical questionnaires. We therefore aggregated all variables (except venture age, venture size, venture region, and industry type) to the technology venture level by averaging the scores of the two respondents on the items. To test the suitability for data aggregation, we calculated the within-group agreement index – $r_{wg(j)}$ (James, Demaree, & Wolf, 1984) – with a slight skew null distribution (Biemann, Cole, & Voelpel, 2012). Although no strict decision rules exist for the $r_{wg(j)}$ statistic, a common rule of thumb suggests that the $r_{wg(j)}$ value

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should be no less than 0.70. As shown in Table 2, the lowest value in the median $r_{wg(j)}$ for the constructs was 0.79, suggesting adequate inter-rater agreement for the aggregation.

To assess the model's goodness of fit, we used confirmatory factor analyses (CFAs) and the following goodness-of-fit indices: the chi-square goodness-of-fit statistic (χ^2), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the Tucker-Lewis index (TLI), and the confirmatory fit index (CFI). The upper bounds for good fit for the RMSEA and the SRMR are considered to be 0.08 and 0.10, respectively, and the lower bound of good fit for the TLI and the CFI is considered to be 0.90 (Vandenberg & Lance, 2000). We used maximum likelihood-based parameter estimates to conduct CFAs in our study. As shown in Table 1, the fit indices showed that the measurement model fit the data reasonably well ($\chi^2(df = 260) = 414.31$, $p < 0.001$; RMSEA = 0.07; SRMR = 0.06; TLI = 0.92; CFI = 0.93). As shown in Table 1, the minimum value in composite reliability (CR) for the constructs was 0.84, which is greater than the commonly acceptable threshold value of 0.70, thus providing evidence of internal consistency.

We assessed convergent validity of the constructs with factor loadings. As shown in Table 1, all the standardized factor loadings were significantly different from zero at the 0.001 level, and all items loaded substantively on their corresponding latent constructs, thereby providing evidence of convergent validity (Anderson & Gerbing, 1988). We evaluated discriminant validity of the constructs using two methods. First, we found that no confidence interval of the intercorrelation between two constructs in our study included 1.0 (Anderson & Gerbing, 1988). Second, the square of the intercorrelation between two constructs was less than the average variance extracted (AVE) values of the two constructs for all pairs of constructs in our study (Fornell & Larcker, 1981). Taken together, these findings offer evidence of discriminant validity.

Assessing Common Method Variance

The use of perceptual measures for both independent and dependent variables in this study may raise concerns of common method variance. We took several precautions to minimize the magnitude of common method variance by following the procedures recommended by Podsakoff, MacKenzie, and Lee (2003). First, we used two informants rather than a single informant from each technology venture for data collection. Second, we assured respondents that their answers were confidential to reduce socially desirable responses and to increase respondent candidness. We also assured the respondents that there were no right and wrong answers to decrease evaluation apprehension. Finally, we restricted the recall timeframe to three years or less to minimize the respondent burden with retrospective data collection.

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Table 2. Descriptive statistics and correlation matrix

	Mean	*SD*	$r_{wg(j)}$	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
1. Opportunity interpretation	4.80	0.77	0.79																
2. Threat interpretation	3.88	0.76	0.87	−0.21															
3. Managerial ties	4.26	0.93	0.91	0.14	−0.05														
4. External search breadth	12.82	1.51	0.86	0.26	−0.07	0.20													
5. External search depth	3.53	1.49	0.86	0.25	−0.25	0.15	0.06												
6. Organizational slack	4.91	0.99	0.88	0.07	−0.05	0.19	0.18	0.31											
7. Market uncertainty	5.14	1.21	0.96	−0.03	−0.04	0.11	0.07	0.15	0.34										
8. Technology uncertainty	5.07	0.93	0.85	−0.00	−0.15	0.20	−0.01	0.07	0.23	0.17									
9. Venture age	11.96	4.75		−0.02	0.04	0.16	−0.16	0.18	0.06	0.01	−0.11								
10. Venture size	6.17	0.82		0.00	−0.08	−0.05	0.12	0.04	0.06	0.08	−0.08	0.19							
11. Zhejiang	0.06	0.63		−0.08	0.12	−0.38	−0.06	−0.12	−0.36	−0.20	−0.40	−0.04	0.24						
12. Beijing	−0.04	0.55		0.05	−0.03	−0.36	−0.09	−0.16	−0.27	−0.24	−0.30	−0.04	0.10	0.50					
13. Shanghai	−0.04	0.55		0.03	−0.07	−0.37	−0.04	−0.17	−0.31	−0.31	−0.39	−0.24	−0.11	0.50	0.56				
14. Jiangsu	−0.02	0.57		0.15	−0.01	−0.36	0.05	−0.11	−0.30	−0.24	−0.37	−0.04	0.05	0.48	0.55	0.55			
15. Guangdong	0.01	0.60		−0.08	−0.03	−0.26	0.03	−0.06	−0.10	0.02	−0.19	−0.08	0.04	0.45	0.52	0.53	0.51		
16. High-technology	0.35	0.70		−0.02	−0.01	−0.21	0.02	−0.09	−0.14	−0.11	−0.24	−0.10	0.13	0.39	0.50	0.43	0.13	0.09	
17. Medium-to-high-technology	0.27	0.67		0.07	−0.06	−0.10	0.19	−0.04	0.03	0.11	−0.02	−0.12	−0.03	−0.04	0.14	0.21	0.52	0.56	0.07

Notes:

Correlations above |0.17| are significant at the 0.05 level; correlations above |0.23| are significant at the 0.01 level; correlations above |0.30| are significant at the 0.001 level (two-tailed tests). n = 141.

Venture size is log-transformed.

To examine the influence of common method bias in our current data, we conducted a post hoc examination with the statistical test that controlled for the effects of a single unmeasured latent method factor (Podsakoff et al., 2003). Using CFAs, we first estimated a one-factor model with 25 items from the six constructs in Table 1. Then we estimated a full measurement model with six correlated factors (i.e., the six constructs) and their own items. Finally, we estimated a third model that added a seventh latent variable to represent an uncorrelated method factor, and allowed all 25 items to load on this method factor. The one-factor model did not fit the data ($\chi^2(df = 275) = 1989.33$, $p < 0.001$; RMSEA = 0.21; SRMR = 0.21; TLI = 0.19; CFI = 0.26). As shown above, the full measurement model fit the data well ($\chi^2(df = 260) = 414.31$, $p < 0.001$; RMSEA = 0.07; SRMR = 0.06; TLI = 0.92; CFI = 0.93). The third model with an added uncorrelated method factor also fit the data well ($\chi^2(df = 235) = 320.13$, $p < 0.001$; RMSEA = 0.05; SRMR = 0.05; TLI = 0.95; CFI = 0.96); in fact, it fit better than the full measurement model without the method factor ($\Delta\chi^2(25) = 94.18$, $p < 0.01$). The third model allowed us to estimate the percentage of variance explained by trait, method, and random error components (Podsakoff et al., 2003; Williams, Cote, & Buckley, 1989). Partitioning the variance in this way showed that the six 'trait' factors (i.e., the six constructs) explained 58.3 percent of the variance, 29.3 percent was due to error, and 12.4 percent was due to the method factor. This level of method variance is much lower than 25 percent, which is the median value of method variance observed by Williams et al. (1989).[6] The results of these analyses suggest that, although inclusion of a method factor improved the overall model fit, this method factor accounted for little variance in the responses. We thus believe that common method variance did not largely affect the results.

RESULTS

Table 2 reports the correlation matrix and descriptive statistics of measures. We used moderated regression analyses to test the hypotheses. We mean-centred the predictor variables prior to the creation of interaction terms to reduce multicollinearity (Aiken & West, 1991). The variance inflation factors associated with each of the regression coefficients ranged from 1.15 to 4.92, which are below the recommended ceiling of 10. Table 3 shows the results of moderated regression analyses. We present the results with external search breadth as the dependent variable in Models 1a, 2a, and 3a, and the results with external search depth as the dependent variable in Models 1b, 2b, and 3b.

We entered the control variables in Models 1a and 1b, and these control variables together explained a marginally significant share of the variance in both external search breadth and external search depth (Model 1a: $R^2 = 0.13$, $p < 0.10$; Model 1b: $R^2 = 0.14$, $p < 0.10$). The addition of predictor variables of opportunity interpretation, threat interpretation, and managerial ties in Model 2a increased R^2

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Table 3. The results of moderated regression analyses

Variables	*External search breadth*			*External search depth*		
	Model 1a	*Model 2a*	*Model 3a*	*Model 1b*	*Model 2b*	*Model 3b*
Constant	11.43 (1.52)***	11.77 (1.49)***	11.73 (1.46)***	0.80 (1.49)	1.96 (1.44)	2.56 (1.40)†
Controls						
Organizational slack	0.25 (0.15)†	0.21 (0.14)	0.28 (0.14)*	0.41 (0.14)**	0.37 (0.14)**	0.25 (0.13)†
Market uncertainty	−0.05 (0.12)	−0.04 (0.11)	−0.06 (0.11)	0.06 (0.12)	0.04 (0.11)	0.04 (0.10)
Technology uncertainty	−0.14 (0.16)	−0.15 (0.15)	−0.16 (0.15)	0.03 (0.15)	−0.05 (0.15)	−0.03 (0.14)
Venture age	−0.07 (0.03)*	−0.07 (0.03)*	−0.06 (0.03)*	0.05 (0.03)	0.05 (0.03)†	0.03 (0.03)
Venture size	0.28 (0.17)†	0.27 (0.16)†	0.23 (0.16)	−0.04 (0.16)	−0.12 (0.16)	−0.11 (0.15)
Zhejiang	−0.23 (0.36)	−0.07 (0.45)	0.11 (0.34)	−0.18 (0.35)	0.01 (0.34)	−0.10 (0.32)
Beijing	−0.55 (0.41)	−0.54 (0.39)	−0.65 (0.38)†	−0.54 (0.40)	−0.64 (0.38)†	−0.59 (0.36)
Shanghai	−0.26 (0.40)	−0.25 (0.39)	−0.22 (0.38)	−0.27 (0.39)	−0.50 (0.38)	−0.62 (0.36)†
Jiangsu	0.45 (0.46)	0.38 (0.45)	0.28 (0.43)	0.54 (0.45)	0.36 (0.43)	0.44 (0.41)
Guangdong	0.16 (0.45)	0.28 (0.44)	0.24 (0.42)	0.44 (0.44)	0.60 (0.42)	0.73 (0.41)
High-technology	0.27 (0.30)	0.29 (0.29)	0.30 (0.27)	0.26 (0.29)	0.30 (0.28)	0.27 (0.26)
Medium-to-high-technology	0.18 (0.38)	0.15 (0.36)	0.16 (0.35)	−0.46 (0.37)	−0.47 (0.35)	−0.50 (0.33)
Predictors						
Opportunity interpretation (OI)		0.42 (0.17)*	0.41 (0.16)*		0.44 (0.16)**	0.48 (0.16)**
Threat interpretation (TI)		−0.01 (0.17)	−0.15 (0.17)		−0.43 (0.16)**	−0.34 (0.16)*
Managerial ties		0.34 (0.15)*	0.26 (0.15)†		0.01 (0.14)	0.11 (0.14)
Interactions						
OI × Managerial ties			0.38 (0.17)*			−0.60 (0.17)**
TI × Managerial ties			0.57 (0.16)**			−0.43 (0.16)**
R^2	0.13	0.23	0.30	0.14	0.25	0.34
Adjusted R^2	0.05	0.13	0.21	0.06	0.16	0.24
F	1.65†	2.43**	3.13***	1.80†	2.83**	3.66***
ΔR^2		0.10	0.07		0.11	0.09
ΔF		4.93**	6.75**		6.10**	7.66**

Notes:

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed tests).

Unstandardized regression coefficients are reported with standard errors in parentheses.

n = 141.

Venture size is log-transformed.

by 10 percent ($p < 0.01$) over the explained variance in Model 1a. In Model 3a, the interaction terms of opportunity interpretation and threat interpretation with managerial ties increased R^2 by 7 percent ($p < 0.01$). The addition of the predictor variables in Model 2b increased R^2 by 11 percent ($p < 0.01$) over the variance explained in Model 1b. In Model 3b, the interaction terms increased R^2 by 9 percent ($p < 0.01$).

In Model 2a, opportunity interpretation is positively related to external search breadth ($b = 0.42$, $p < 0.05$), and threat interpretation is unrelated to external search breadth ($b = -0.01$, n.s.). In Model 2b, opportunity interpretation is positively related to external search depth ($b = 0.44$, $p < 0.01$), and threat interpretation is negatively related to external search depth ($b = -0.43$, $p < 0.01$). Therefore, Hypotheses 1a, 1b, and 2b are supported, and Hypothesis 2a is not supported. The interaction term of opportunity interpretation and managerial ties has a significant positive relationship with external search breadth in Model 3a ($b = 0.38$, $p < 0.05$), supporting Hypothesis 3a, and has a significant negative relationship with external search depth in Model 3b ($b = -0.60$, $p < 0.01$), supporting Hypothesis 3b. The interaction term of threat interpretation and managerial ties has a significant positive relationship with external search breadth in Model 3a ($b = 0.57$, $p < 0.01$), supporting Hypothesis 4a, and has a significant negative relationship with external search depth in Model 3b ($b = -0.43$, $p < 0.01$), supporting Hypothesis 4b.

To advance further interpretations, we plotted these interaction effects for two levels of managerial ties, defining the low level as −1 standard deviation from the mean and the high level as +1 standard deviation from the mean. We also performed a simple slope analysis (Aiken & West, 1991) for each regression line to test whether its slope was significantly different from zero. Figure 2 shows a significant positive relationship between opportunity interpretation and external

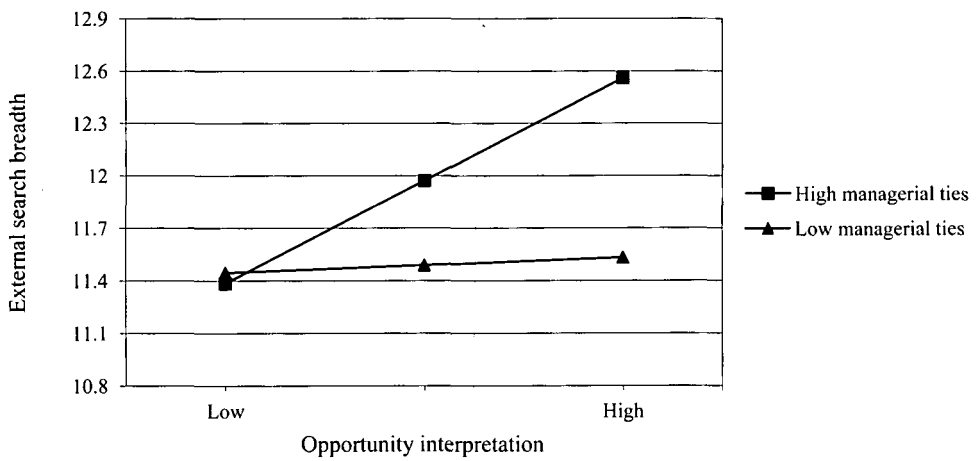

Figure 2. The moderating role of managerial ties on the relationship between opportunity interpretation and external search breadth

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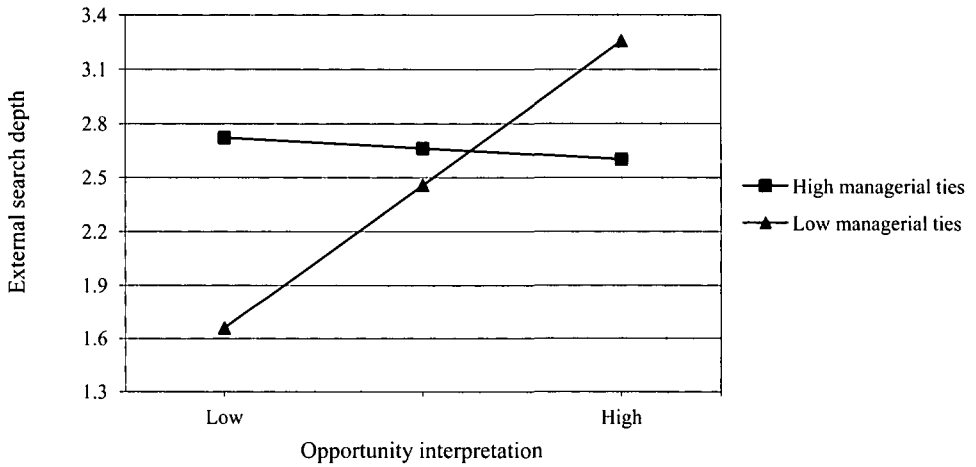

Figure 3. The moderating role of managerial ties on the relationship between opportunity interpretation and external search depth

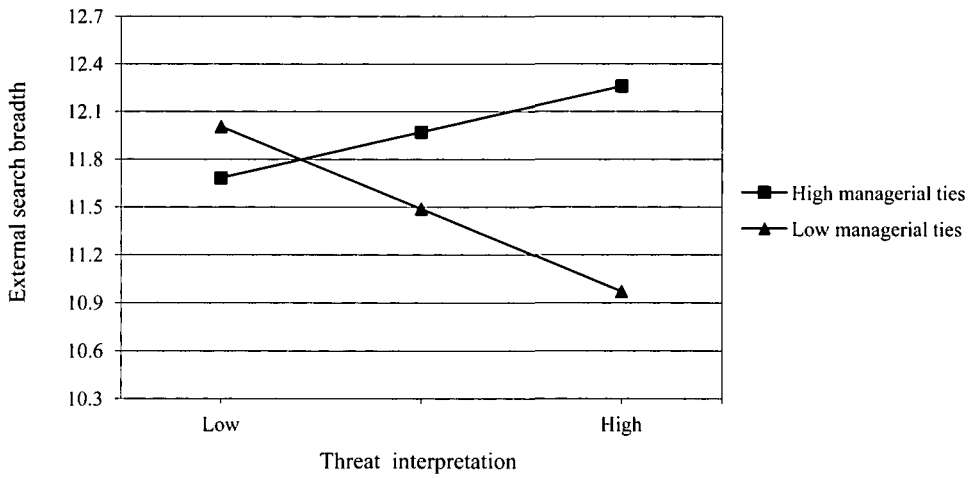

Figure 4. The moderating role of managerial ties on the relationship between threat interpretation and external search breadth

search breadth when managerial ties are high (simple slope: $b = 0.76$, $p < 0.001$), but this relationship is not significant when managerial ties are low (simple slope: $b = 0.06$, n.s.). As shown in Figure 3, opportunity interpretation has a significantly positive relationship with external search depth when managerial ties are low (simple slope: $b = 1.04$, $p < 0.001$), but this relationship becomes insignificant when managerial ties are high (simple slope: $b = -0.08$, n.s.). These findings provide further support for Hypotheses 3a and 3b.

Figure 4 shows a significant positive relationship between threat interpretation and external search breadth when managerial ties are high (simple slope: $b = 0.38$,

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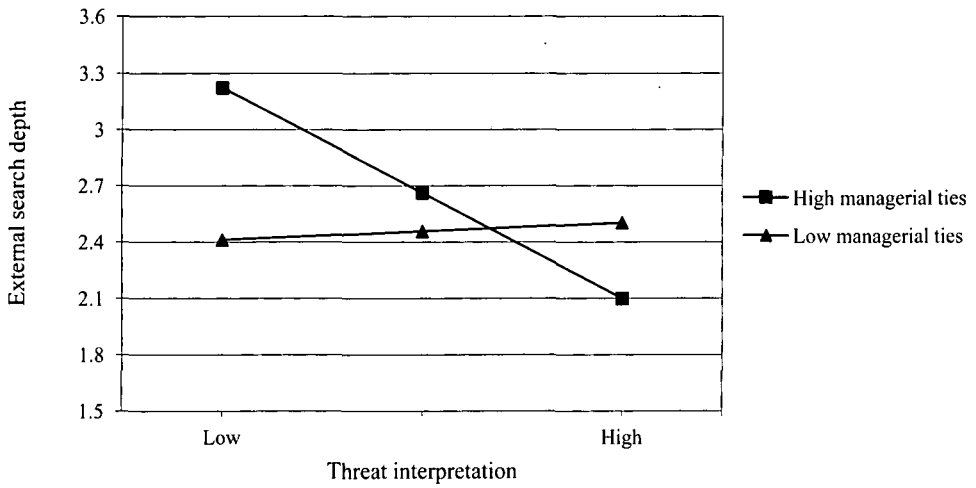

Figure 5. The moderating role of managerial ties on the relationship between threat interpretation and external search depth

$p < 0.05$), and this relationship becomes significant and negative when managerial ties are low (simple slope: $b = -0.68$, $p < 0.01$). As shown in Figure 5, threat interpretation has a significantly negative relationship with external search depth when managerial ties are high (simple slope: $b = -0.74$, $p < 0.001$), but this relationship becomes insignificant when managerial ties are low (simple slope: $b = 0.06$, n.s.). These findings further support Hypotheses 4a and 4b.

DISCUSSION

Theoretical Implications

Our study has three major theoretical implications. First, we offer a richer understanding of the role of opportunity and threat interpretations in stimulating the breadth and depth of external knowledge search in technology ventures. Previous studies have emphasized the importance of external knowledge search, but they have largely focused on its link to performance (e.g., Chiang & Hung, 2010; Laursen & Salter, 2006). While insightful, these studies do not provide fine-grained insight into the managerial and organizational antecedents of the breadth and depth of external knowledge search. Adopting the micro–macro link approach (Porter, 1996), we find that opportunity interpretation is positively related to external search breadth and depth. Our findings contradict other findings that control-enhancing opportunities are not related to externally directed organizational actions (Chattopadhyay et al., 2001). This inconsistency may be attributed to two factors. On one hand, the unique features of new knowledge may be stronger drivers of organizational responses to opportunities. On the

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other hand, such exploitation of opportunities may involve both internally and externally directed actions (Chattopadhyay et al., 2001). We also find that threat interpretation is negatively related to external search depth but not to external search breadth. This finding is partially consistent with earlier findings that control-reducing threats are more likely related to internally directed organizational actions (Chattopadhyay et al., 2001). One reason that threat interpretation is not negatively related to external search breadth could be that threat interpretation does not lead technology ventures to immediately suspend the ongoing projects of broad search when the projects have large sunk costs for investments in both R&D and human capital. These results also provide empirical support for suggesting that managers with opportunity interpretation are more likely to promote externally directed organizational actions (Dutton & Duncan, 1987). In summary, this study contributes to external knowledge search and managerial information processing research by empirically demonstrating the different roles of managers' opportunity and threat interpretations in determining technology ventures' broad and deep search for external knowledge.

Second, this study adds to managerial social networking research by exploring the critical contingent effects of managerial ties on the relationships between two types of managerial interpretation and two external knowledge search strategies. Little was uncovered about this contingency in prior research. In this study, we theorized and argued that the role of opportunity and threat interpretations on the breadth and depth of technology ventures' external search varies with managerial ties. Our results reveal that managerial ties exert an intricate moderating role. On one hand, managerial ties strengthen the positive relationship between opportunity interpretation and external search breadth, but they also weaken the positive relationship between opportunity interpretation and external search depth. On the other hand, managerial ties weaken the negative relationship between threat interpretation and external search breadth, but they strengthen the negative relationship between threat interpretation and external search depth.

Third, this study advances knowledge search research in emerging markets by offering a more nuanced understanding of how managerial interpretations and ties jointly drive the breadth and depth of external knowledge search in China's technology ventures. Our study demonstrates that the choice of external knowledge search strategy is affected by managerial interpretations of China's business environment. Our study further reveals a determining role of managerial ties in influencing how managerial interpretations impact a technology venture's external knowledge search strategy in the context of China's poorly developed formal institutional infrastructures. This is consistent with the fact that China's emerging market is characterized by resource and capability deficiencies, institutional voids, structural obstacles, and competition intensity.

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Managerial Implications

This study also has important implications for managing external knowledge search strategies in emerging market firms, particularly for technology ventures in China. First, managers need to gather information comprehensively from external environments, interpret the information, and recognize the constraints and opportunities that external environmental conditions impose on their firms, and then act on the interpretations by strategically selecting broad and deep search for external knowledge. Second, managers need to cultivate and build strong business and political ties to achieve search strategies for external knowledge because managerial ties can potentially substitute for institutional voids and critical resources and capabilities, and reduce the uncertainty of the business environment in transition economies. Finally, when increasing the breadth and depth of external knowledge search, managers need to utilize business and political ties appropriately in response to opportunities and threats in external environments.

Limitations and Future Research Directions

This study has limitations that should be addressed in future research. First, the direction of causality is a concern in cross-sectional studies. We based the arguments tested in this study on theoretical logic, but the possibility of reverse causality might exist. Following Landis and Dunlap (2000), we performed additional analysis to rule out the possibility that external search breadth and depth affect opportunity and threat interpretations. Specifically, using opportunity interpretation and threat interpretation respectively as the dependent variables, we used external search breadth and external search depth in turn as independent variables, and managerial ties as a moderator. We find no significant reverse interaction effects, thereby alleviating concerns about reverse causality. Even so, we encourage future research to use longitudinal data to examine the relationships between managerial interpretations and choice of external knowledge search strategies because longitudinal data may provide additional insights concerning timing issues for external search breadth and depth.

Second, we adopted primarily perceptual measures following previous research (see, e.g., Atuahene-Gima & Yang, 2008; Laursen & Salter, 2006; Peng & Luo, 2000). Extensive use of perceptual measures in micro-organizational analysis and the practical difficulties of data collection in China necessitated this approach (Peng & Luo, 2000). Since the soft nature of managerial interpretations and ties will probably continue to warrant the use of perceptual measures, obtaining relative objective measures for external search breadth and depth from archival sources may improve the rigour of the results in future theory development and empirical research.

Finally, a potential limitation stems from the study's sample, which might limit the generalizability of results. We sampled technology ventures in China's high-,

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medium-to-high-, and medium-to-low-technology industries, and thus our results might not generalize to nontechnology ventures or other settings. For this reason, future research using samples from different settings and different industries is needed to ascertain generalizability.

CONCLUSION

This study has empirically examined whether and how managerial interpretations of external environments have a beneficial or detrimental effect on technology ventures' choice of external knowledge search strategy in an emerging market. Our results shed light on the important contingent effects of managerial ties on the role of opportunity and threat interpretations in affecting the breadth and depth of external knowledge search in China's technology ventures. We have thus begun to uncover some of the mechanisms through which managers jointly use their opportunity and threat interpretations and external ties as drivers of external knowledge search strategy. Future studies utilizing the theoretical arguments and empirical findings presented in this research are likely to be fruitful in further revealing the complexity of the role of opportunity and threat interpretations in influencing the breadth and depth of firms' external knowledge search.

NOTES

We are grateful for the thoughtful and insightful comments from Editor-in-Chief Anne S. Tsui, Action Editor Yan Zhang, and the three anonymous reviewers. We also thank Haibin Yang and Chuck Eesley for their helpful comments on earlier drafts of this paper. This research was partially supported by the General Program of National Natural Science Foundation of China (Grant no. 70602016) and the Key Program of National Natural Science Foundation of China (Grant nos. 71132007 and 71232012).

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[1] We are grateful to the action editor for this point.
[2] We are grateful to an anonymous reviewer for this insight.
[3] We are grateful to the action editor for this point.
[4] We are grateful to the action editor for this point.
[5] The 16 external knowledge sources include suppliers of equipment, materials, components, and software; clients or customers; competitors; consultants; commercial laboratories/R&D enterprises; universities or other higher education institutes; government research organizations; other public sectors; private research institutes; professional conferences or meetings; trade associations; technical/trade press and computer databases; fairs or exhibitions; technical standards; health and safety standards and regulations; and environmental standards and regulations (Laursen & Salter, 2006).
[6] Williams et al. (1989) found that the method variance values of previous studies ranged from 16 percent to 42 percent.

https://doi.org/10.1111/more.12037 Published online by Cambridge University Press

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https://doi.org/10.1111/more.12037 Published online by Cambridge University Press

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Manuscript received: April 16, 2011
Final version accepted: September 23, 2013
Accepted by: Yan (Anthea) Zhang

https://doi.org/10.1111/more.12037 Published online by Cambridge University Press