The impact of informal social interaction on innovation capability in the context of buyer-supplier dyads

Xueyuan Liu[a], **Qihai Huang**[b], **Junsheng Dou**[c,*], **Xiande Zhao**[d]

[a] Economics and Management School, Wuhan University, 299 Bayi Road, Wuhan, 430072, China. Phone: +86 27 68753083 Email: x.liu@whu.edu.cn

[b] Lancaster University Management School, Lancaster, LA1 4YX, UK. Tel: +44 (0)1524 510883 Email: qihai.huang@lancaster.ac.uk

[c] School of Management, Zhejiang University, Hangzhou, 310058, China. Tel: +86 571 88206886 Email: jsdou@zju.edu.cn

[d] China Europe International Business School, 699 Hongfeng Road, Shanghai, 201206, China. Tel: +86 21 28905050 Email: xiande@ceibs.edu

*Corresponding author

Submission: August 2015

Revision: September 2016

Acceptance: December 2016

Acknowledgements

We are very grateful to the special issue editors and the anonymous reviewers for their insightful and helpful comments and advice, which helped us significantly improve the paper.

Abstract

Although many studies employ social network theory to explain firm innovation, how individual-level factors lead to a firm's collective innovation capability remains under-researched. Building on studies that use the work boundary to define formal and informal social interactions, this research aims to illuminate how informal buyer-supplier employee interactions influence buyer firms' innovation capabilities through knowledge acquisition. Integrating the literatures on absorptive capacity and social interaction, the analysis of survey data from 273 Chinese manufacturing firms suggests that employees' informal interactions are positively associated with knowledge acquisition and enhance firms' innovation capabilities. Furthermore, the indirect effects of informal interactions on innovation capability are moderated by knowledge application.

Key words: informal interaction, social networking, innovation, absorptive capacity, knowledge acquisition

1 Introduction

A firm's ability to assimilate and apply external information in creating a new product and new processes is a major determinant of its innovation capability (Cohen & Levinthal, 1990). In this regard, many studies have shown that inter-firm social networks play an important role in creating both firm value and competitive advantage (e.g., Luzzini, Amann, Caniato, Essig, & Ronchi, 2015; Ritter & Gemünden, 2003; Wu, Lii, & Wang, 2015). In particular, collaboration with their suppliers enables buyer firms to improve their business performance (Chung & Kim, 2003; Knudsen, 2007; Pérez & Sánchez, 2002; Wagner, 2010) and innovation capabilities (Gemünden, Ritter, & Heydebreck, 1996; Pittaway, Robertson, Munir, Denyer, & Neely, 2004; Tomlinson & Fai, 2013).

Network theory, which is employed to explain the link between networks and innovation, tends to focus on the possibility of and opportunities for resource access and application; by contrast, how firms transform these potential network benefits into firm innovation remains an open research question (Shu, Page, Gao, & Jiang, 2011). Even more specifically, the means by which individual-level factors help determine the collective level of a firm's innovation capability (Barney & Felin, 2013) remains under-researched. This research gap constrains the understanding of how individual employees contribute to innovation. First, as knowledge, particularly tacit knowledge, is normally held by individuals (Dhanaraj & Parkhe, 2006; Kogut & Zander, 1992), organizations gain resources that enhance their innovation capability by exploiting their members' social capital, as explicitly noted by Van Wijk, Jansen, and Lyles (2008). Second, each network involves individual people connecting or failing to connect across a social space, and these interactions are the building blocks of networks (Salancik & Burt, 1995). These interactions are defined as the networking behaviors of individual employees of buyer and supplier partners (or contacts) both within and beyond formal workplace or work-related contexts (Porter & Woo, 2015).

The networking activities of individuals help maintain existing network relationships, which can result in access to resources that are necessary for innovation (Larson, 1992; Porter & Woo, 2015; Tasselli, Kilduff, & Menges, 2015). Third, little attention has been paid to the actual processes underlying absorptive capacity with regard to innovation capability, in particular (Lane, Koka, & Pathak, 2006). More specifically, relatively little is known about how the different proposed components of absorptive capacity affect relevant outcomes, e.g., the innovation capability of individuals, their capabilities taken together and/or their capabilities arising through their interactions (Ebers & Maurer, 2014), particularly in relation to individuals' networking interactions (Volberda, Foss, & Lyles, 2010). Fourth, the previous literature has distinguished these activities as formal and informal interactions largely within the workplace and in terms of work under formal organizational structures (e.g., Pittaway, Robertson, Munir, Denyer, & Neely, 2004; Zahra & George, 2002). As a result, the previous literature tends to neglect social interactions beyond work boundaries, i.e., informal socializing relationships, defined as relationships involving "people with whom you like to spend your free time" (Mehra, Kilduff, & Brass, 2001, p. 130; Reagans & McEvily, 2003), which can also facilitate knowledge sharing. The flow of knowledge between individuals is more often a result of employees' personal initiative than of formal organizational structures (Allen, James, & Gamlen, 2007) and may occur in non-work settings.

This paper therefore aims to fill the above-mentioned gaps and to advance the understanding of how informal interactions between buyer firms' employees and their supplier counterparts beyond the workplace can influence buyer firms' innovation capabilities. As a result, it integrates the absorptive capacity and social network literatures.

Notably, this research makes two important contributions to the literature. First, it illuminates the micro-foundations of organizational social networks by investigating how individual-level social interaction can lead to organizational outcomes (Barney & Felin,

2013). Until now, this line of research has remained relatively neglected (Borgatti & Halgin, 2011; Tasselli, Kilduff, & Menges, 2015). Specifically, it examines how individual employees' informal social networking activities outside of the workplace can contribute to organizational innovation capabilities through knowledge acquisition. Second, it sheds light on the mechanism of how two different components of absorptive capacity, i.e., knowledge acquisition and knowledge application, affect innovation capability individually and through their interaction (Ebers & Maurer, 2014). Accordingly, it enhances the understanding of how the absorptive capacity process affects innovation capability (Zahra & George, 2002), which also remains under-researched (Ebers & Maurer, 2014).

In the next section, the previous research on social interaction, knowledge acquisition and innovation will be reviewed to develop the research hypotheses. Then, the research methods, followed by the research findings, will be explained. Finally, theoretical and managerial implications will be discussed, limitations will be identified, and future research directions will be proposed.

2 Literature review and hypotheses

Innovation is perceived as an interactive learning process (Lundvall, 1992) and is defined as the creation of new knowledge from the application of current knowledge, which includes knowledge acquired from an external network (Gold, Malhotra, & Segars, 2001). According to Cohen and Levinthal (1990), absorptive capacity has three elements, consisting of new external knowledge acquisition, assimilation and application. Grant (1996) argues that knowledge acquisition and creation are activities of individuals, whereas the primary role of firms is to apply existing and new knowledge to the production of goods and services. Therefore, knowledge acquisition and knowledge application are two key components and processes of absorptive capacity for innovation: knowledge acquisition is a prerequisite for knowledge application, which allows the organization to achieve its ultimate goal of

innovation. Following the above logic, this paper proposes that knowledge acquisition mediates the relationship between informal social interaction activities among employees (between buyers' and suppliers' employees, in particular) and the buyer firm's innovation capability. Such an indirect relationship is moderated by the buyer firm's knowledge application activities; in this regard, Alavi and Leidner (2001) suggest that competitive advantage involves the application of new knowledge and not the acquired knowledge itself.

Many studies highlight the benefits of inter-firm social networks in creating value and competitive advantage (Chung & Kim, 2003; Knudsen, 2007; Luzzini et al., 2015; Ritter & Gemünden, 2003; Wagner, 2010). In particular, firms working closely with strong supplier networks can perform better, including in terms of higher levels of productivity (Pérez & Sánchez, 2002). Furthermore, suppliers are valuable sources of innovation (Gemünden, Ritter, & Heydebreck, 1996; Lawson et al., 2009; Pittaway et al., 2004; Tomlinson & Fai, 2013). Perez and Sanchez (2002) highlight the integration of suppliers into the innovation process as one of the factors leading to framework-breaking innovation. Similarly, Pittaway et al. (2004) note that suppliers' involvement in a buyer's development team is the largest single differentiator between the least and most successful innovation efforts.

However, positive value creation outcomes from this inter-organizational relationship between organizations do not simply exist or emerge in a vacuum (Walter, Auer, & Ritter, 2006). In fact, each network involves individual people connecting (or failing to connect) across social spaces, and these interactions constitute the building blocks of networks. In other words, networks are constructed when individuals, whether organizations or humans, interact with one another (Salancik & Burt, 1995). As Burt (1992) notes, it is not the position of an individual in the network but instead the entrepreneurial approach of the actor that creates the benefit and turns the position into an advantage. Similarly, Gemünden et al. (1996) find that firms using particular forms of networking categorized by their relationship with

specific parties are likely to have nearly 20% more product improvements than firms that do not network. This dynamic process cannot be ignored when considering the role of networks in a theory of the organization (Salancik & Burt, 1995). Specifically, Volberda et al. (2010, p. 945) suggest that "current research never truly shows how organization level absorptive capacity is related to … the interaction of individuals …". The present research, in particular, focuses on how buyer-supplier employee interactions can improve the focal (buyer) firms' innovation capability, as described in the next section.

2.1 Informal social interaction and knowledge acquisition

Interactions consist of discrete events that are (typically) summed over a period of time, such as "talked to over the last month" (Porter & Woo, 2015) or "having lunch or dinner together" (Burt, 1992). Cousins et al. (2006) and Lawson et al. (2009) refer to interactions as socialization mechanisms and find that both formal and informal inter-organizational socialization mechanisms facilitate knowledge sharing between buyers and suppliers and lead to better product development. These formal mechanisms may include cross-functional teams, co-location, regularly scheduled meetings and conferences, or matrix-style reporting structures, which are measured by whether the buyer has formal structures in place to facilitate socialization within the inter-organizational development team. Informal mechanisms include joint benchmarking research, supplier and engineering visits to facilities, product demonstrations, etc., which are measured by those informal policies and processes implemented by the organization to facilitate buyer-supplier socialization. Although the findings of Cousins et al. (2006) and Lawson et al. (2009) are interesting and helpful, their distinction between formal and informal mechanisms might be somewhat limited. In essence, both of their "formal" and "informal" mechanisms share the same characteristics in terms of the boundaries of 'socialization' within the workplace and within the scope of work under formal organizational structures. Therefore, their studies neglect social interaction activities

that occur beyond work boundaries, which can also facilitate knowledge sharing; in fact, knowledge flows between individuals result more often from employees' personal initiatives than from formal organizational structures (Allen et al., 2007).

Shifting the focus beyond work, Mehra et al. (2001) define informal socializing ties as people spending free time together and find that employees who have a greater number of such ties with fellow employees have higher performance ratings. Clearly, going out to lunch, dinner, drinks, films, visiting one another's homes, etc. are informal social activities that occur outside of the workplace and work (Reagans & McEvily, 2003). According to Oh, Chung and Labianca (2004), in many Asian countries, such as China, Japan and Korea, such informal social relationships are common, and the social activities they engage in outside of the workplace are primarily centered on eating and drinking. Therefore, following Mehra et al. (2001) and Oh et al. (2004), informal interaction in this paper is defined as employees' networking activities occurring outside of the workplace or the work organizational structure, i.e., during employees' free time, which explicitly includes social events such as eating at local restaurants, the last item found in Lawson et al. (2009, p. 164).

Individual employees are organizational boundary spanners situated at the interface between potential external knowledge providers and their own organizations (Ebers & Maurer, 2014). Their interactions with their counterparts in other organizations can thus generate goodwill and increase such networking partners' willingness to provide useful information and resources (Porter & Woo, 2015). For example, Yli-Renko, Autio, and Sapienza (2001) find that network ties with customers facilitate firms' knowledge acquisition and internal innovation. In addition, interactions play an important role in constructing coordinating structures and in transferring information or ideas from the supplier to the buyer organization (Salancik & Burt, 1995).

Nevertheless, knowledge transfer between network partners, which is an important component of the innovation process, may be fraught with ambiguity, e.g., the tacitness of knowledge (Dhanaraj & Parkhe, 2006; Walter et al., 2006). Brown and Duguid (2001) emphasize that knowledge-intensive work is generally conducted in a manner that is removed from that prescribed by organizational charts and formal procedures. Zahra and George (2002) suggest that informal mechanisms are particularly useful in the exchange of ideas. Similarly, Allen et al. (2007) find that the knowledge flows between individuals are more often a result of employees' personal initiatives than of formal organizational structures. Pittaway et al. (2004) further suggest that informal interactions are particularly important when attempting to transmit tacit knowledge between individuals or to convert tacit knowledge into explicit knowledge. According to Gold et al. (2001), informal interactions play a more important role in mobilizing tacit knowledge between individuals and/or in decoding tacit knowledge into explicit knowledge, transforming it from the individual level to the firm level. This discussion leads to the following hypothesis:

H1. Informal interactions of employees with suppliers are positively associated with knowledge acquisition.

2.2 The mediating role of knowledge acquisition

As discussed above, innovation involves the process of applying new knowledge. Social networks and interaction activities explain only the possibilities and opportunities for innovation, e.g., knowledge sharing (Lawson et al., 2009). Similarly, Yli-Renko et al. (2001) argue that social networks provide only the basic elements for achieving benefits in the relationship, such as knowledge acquisition. In other words, knowledge acquisition can be an outcome of informal social mechanisms, but knowledge acquisition is only one process involved in innovation. Cohen and Levinthal (1990) propose that the utilization of external knowledge gathered by the organization is a major determinant of innovation capability.

Similarly, Shu et al. (2011) find that senior managers' personal networks impact firm innovation by means of knowledge exchange and knowledge combination. Following this logic, this paper proposes that knowledge acquisition will mediate the relationship between social interaction and innovation capability, leading to the following hypothesis:

H2. Informal buyer-supplier employee interactions have an indirect positive impact on a firm's innovation capability through knowledge acquisition.

2.3 The moderating role of knowledge application

A firm's innovation capability depends not only on its ability to acquire external knowledge but also, more importantly, on the firm's ability to recognize and assess the value of such knowledge and to apply such knowledge (Cohen & Levinthal, 1990). Similarly, Alavi and Leidner (2001) suggest that knowledge acquisition does not necessarily lead to enhanced organizational performance because a firm's capabilities in terms of valuing and acquiring external knowledge does not guarantee that such knowledge will be exploited (Zahra & George, 2002). However, effective knowledge application does. Knowledge application is an organization's timely response to technological change that exploits knowledge and technology to generate new products and processes (Gold et al., 2001; Song, van der Bij, & Weggeman, 2005). Camisón and Forés (2010) find that innovation capability is influenced by both external learning capacity (absorptive capacity, including knowledge acquisition) and internal learning capacity (internal knowledge creation capacity, such as knowledge application). Some firms may be able to acquire and assimilate external knowledge but may fail to transform and apply this knowledge. Consequently, it is critical for firms to have knowledge application-based processes that are oriented toward the actual use of the knowledge (Gold et al., 2001). Nevertheless, firms are likely to have different knowledge application abilities that are related to different organizational dynamic capabilities. For example, effective knowledge utilization may require that individuals occupy multiple

organizational roles that involve membership in multiple teams (Grant, 1996) and multiple knowledge application processes (Gold et al., 2001). In other words, knowledge application can affect the above-proposed relationship between knowledge acquisition and innovation capability, leading to the following hypothesis:

H3. Knowledge application positively moderates the relationship between knowledge acquisition and the firm's innovation capability.

Assuming that knowledge application moderates the association between knowledge acquisition and the firm's innovation capability, it is also likely that knowledge application will conditionally influence the strength of the indirect relationship between informal interactions and the firm's innovation capability, leading to a pattern of moderated mediation between the study variables, as depicted in Fig. 1. Because a weak (strong) relationship between knowledge acquisition and the firm's innovation capability is predicted when knowledge application is low (high), a hypothesis can be proposed as following:

H4. Knowledge application will moderate the positive and indirect effects of the informal interactions of buyer employees with suppliers on the firm's innovation capability through knowledge acquisition.

==Fig. 1. Here==

3 Research design and methodology

3.1 Questionnaire design

Based on the foregoing literature review, a survey questionnaire was designed to measure manufacturers' informal social interaction activities, knowledge acquisition, knowledge application and innovation capability. Multi-item, seven-point Likert-type scales (1="strongly disagree"; 7="strongly agree") were used to measure the constructs. The details of the measurements will be discussed below in Section 3.3, and all 21 measurement items are listed in the Appendix.

A professor originally developed the questionnaire in English, with some specific questions adapted for the Chinese context. It was then translated into Chinese after discussions with Chinese colleagues with expertise in the field. To maintain its original meaning, the Chinese version was 'back-translated' into English by another professor (Brislin, 1970) and compared with the original questionnaire. All discrepancies were resolved by reaching full consensus within the research team (Mullen, 1995).

A pilot test was conducted in 13 companies with several senior managers. The wording of the questions was modified when any confusion arose. The questionnaires were then delivered on a large scale, as described below.

3.2 Sampling and data collection

In total, 1,460 manufacturing firms were randomly selected from the database of Chinese Financial & Economics provided by the Guotaian Data Service Center (CSMAR®) within four industries, i.e., the textile and apparel, household appliances, IT and electronics, and automobile industries. Questionnaires were delivered mainly through four methods: e-mail, fax, speed posts and on-site. Based on the pilot research, in the cover letter of the survey, a chief officer or senior manager at the surveyed firm is asked to coordinate and organize those with relevant knowledge of customer relationship management and who were familiar with product development, manufacturing processes and supply chain management to complete the relevant questions in the questionnaire. Such key informants might be supply chain managers, production managers, R&D managers, marketing managers, presidents, senior executives and/or directors. Due to incorrect addresses, 133 questionnaires were returned unopened. After several rounds of telephone or email reminders, a total of 276 completed questionnaires were collected, and, of these, 273 questionnaires were usable—as three questionnaires were excluded due to missing values of the key variables—generating a

valid response rate of 18.7%. The distribution of the demographic profile of firms with regard to ownership, industry and firm size (the logarithm of total employees) is shown in Table 1.

==Table 1 here==

3.3 Variables and measures

3.3.1 Dependent variable

Subjective measurements are widely used in organizational research (Powell & Dent-Micallef, 1997). Managerial evaluations of a firm's situation are an increasingly popular means of measuring firms' resources and capabilities (Camisón & Forés, 2010). Following Subramaniam and Youndt (2005), this research measures innovation capability by asking informants to rate the firm's ability using seven questions, such as "the ability to provide new products rapidly" and "the ability to design and develop new products/services based on new technologies".

3.3.2 Independent variables

This research follows Burt (1992: 123), who asked respondents, "[T]o what extent do you go out with this person for social activities outside work such as going out to informal lunch, dinner or drinks?" Thus, informal interactions are measured in this research by asking respondents to rate the following prompt: "In order to strengthen the contact with our suppliers, our employees frequently spend their leisure time with suppliers on informal social activities (such as dinner, karaoke, sports, etc.)".

3.3.3 Mediating variable

As Grant (1996) emphasizes, the essence of organizational capability is the integration of knowledge, which includes mechanisms such as policy and procedure, through which knowledge is exploited within firms to create capabilities. Informed by the measurement of Yli-Renko et al. (2001), this research uses five items similar to those in Camisón and Forés (2010) to measure knowledge acquisition, such as "we always ask our suppliers to give us suggestions to improve our products or services" and "we have formal

practices and standard operating procedures to guide communications between employees and suppliers".

3.3.4 Moderating variable

Knowledge application is measured using an eight-item scale to assess a firm's ability to apply new knowledge, which is derived from Gold et al. (2000) and Song et al. (2006). Examples of these items include, "we have programmed mechanisms to help find new business opportunities from new knowledge" and "we have official policies and procedures to guide information release among the enterprise's internal departments". The alpha coefficients and loadings for these items are presented in Appendix 1.

3.3.5 Control variables

Conforming to current theory and empirical studies, four variables are controlled in this research. The first control is for the formal interactions of buyer employees with suppliers, which are measured by respondents' rating of the extent to which "we often invite our suppliers to our official events" (such as new product exhibitions, conferences, and trainings). These activities are consistent with the social events identified by Cousins et al. (2006) and include exhibitions, conferences and workshops. Two other controls are firm-related variables: firm size and ownership. Firm size is measured using the number of employees; specifically, the natural logarithm is used in the regression models of this research. The ownership is controlled because previous research suggests that different types of ownership have different time horizons, risk assessments, and expectations for firm strategy, which further influence firms' strategic choices and behaviors (e.g., Cyert & March, 1963; Thomsen & Pedersen, 2000), including innovation investment. More specifically, four dummies (i.e., state, collective, private, and foreign) control the influence of ownership (1= yes, 0=no). Lastly, consistent with prior research, a firm's industry is also controlled because different industries may have different innovation capabilities. Specifically, four dummies

(i.e., textiles and apparel, household appliances, IT and electronics, and automobile) are used to control the impact of industry.

Table 1 includes descriptive statistics related to the above variables and the correlation matrix.

3.4 Validation of measures

A confirmatory factor analysis was conducted to examine the convergent validity of the three self-reported scales: knowledge acquisition, knowledge application, and innovation capability. Each measurement item was linked to its corresponding construct, and the covariance among the constructs was freely estimated. The three-factor model fit indices were $\chi 2=382.58$, $p < 0.001$, df=167, CFI=0.91, SRMR=0.05, and RMSEA=0.07. Thus, the model was acceptable (Hu & Bentler, 1999), indicating convergent validity (O'Leary-Kelly, 1998). All the average variances extracted (AVE) were above the recommended value of 0.50 (ranging from 0.59 to 0.70, see Appendix 1), thereby demonstrating adequate convergent validity (Fornell & Larcker, 1981). Furthermore, all factor loadings were statistically significant, with standardized loadings ranging from .67 to .85, and each item's coefficient was greater than twice its standard error, further demonstrating convergent validity.

To assess discriminant validity, two constrained confirmatory factor analysis models are developed and their fits are compared with those of the original unconstrained three-factor model. The indices demonstrated that the model fit was significantly better for the three-factor model than with a single-factor model ($\chi 2=1205.50$, $p < .001$, df=172, CFI=0.55, SRMR=0.21, RMSEA=0.15) or a two-factor model that combined the items for knowledge acquisition and knowledge application ($\chi 2=503.86$, $p < .001$, df=169, CFI=0.86, SRMR=0.06, RMSEA=0.08). These results thus provide evidence of discriminant validity. In addition, the AVE for each construct was greater than the squared correlation between the focal construct

and other constructs, as recommended by Fornell and Larcker (1981), providing further evidence of discriminant validity.

3.5 Common method bias

Because the data were collected from a single survey, two steps were taken to address common method bias concerns. First, in the cover letter of the questionnaire, the researchers had explicitly asked that different sections of questions be answered by different people who were more knowledgeable regarding specific matters, as coordinated by the chief officers or senior managers, who had a fuller understanding of the firm's collaboration with suppliers and the firm's processes, technologies and products. Second, following Podsakoff et al. (2003), a Harman's single-factor test was conducted on the variables included in the model using exploratory factor analysis. The results show that the largest variance explained by an individual factor was 22.775% and that all the surveyed items were related to the intended factors. Moreover, the confirmatory factor analysis conducted above indicated that the single-factor model has poor fit. Therefore, it is concluded that common method bias is not likely to be a significant threat in this research.

4 Analysis and results

The study hypotheses were tested in two interlinked steps. First, a simple mediation model (Hypotheses 1 and 2) was examined. Second, the proposed moderator variable was integrated into the model and empirically tested the moderation (Hypothesis 3) and the overall moderated mediation hypothesis (Hypothesis 4). Prior to the analyses, all continuous measures were mean-centered (Aiken, West, & Reno, 1991).

4.1 Descriptive statistics

Table 1 shows the descriptive statistics and correlations for the variables used in this study. Consistent with the expectations, the correlation matrix shows significant relationships among the variables of interest, providing preliminary support for the hypotheses.

4.2 Mediation tests and results

Collectively, Hypotheses 1 and 2 suggest an indirect effects model in which the relationship between informal interaction and innovation capability is transmitted by knowledge acquisition. Tests of such mediation hypotheses are frequently guided by the multistep approach proposed by Baron and Kenny (1986). Recently, however, methodologists have identified potential shortcomings in this approach (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). Consequently, mediational analyses should be based on formal significance tests of the indirect effects *ab*, of which the Sobel (1982) test is the best known. As Preacher and Hayes (2004) argue, this approach is more powerful than the stepwise procedure proposed by Baron and Kenny (1986) because it addresses mediation directly. However, the Sobel test has its own limitations because it rests on the assumption that the indirect effects *ab* is normally distributed, which is a tenuous assumption because the distribution of *ab* is known to be non-normal, even when the variables constituting the product *ab* are normally distributed (Edwards & Lambert, 2007). Therefore, bootstrapping is recommended. Based on the application of bootstrapped confidence intervals (CIs), it is possible to avoid power problems introduced by asymmetric and other non-normal sampling distributions of an indirect effects model (MacKinnon, Lockwood, & Williams, 2004). Therefore, the mediation hypotheses (Hypotheses 2) was tested using the SPSS macro PROCESS developed by Hayes (2013), which includes both a normal theory approach (i.e., the Sobel test) and a bootstrap approach to obtain CIs, which facilitated the estimation of the indirect effects *ab*.

Table 2 presents the results for Hypotheses 1 and 2. Supporting Hypothesis 1, the informal interactions between employees of suppliers were positively associated with knowledge acquisition, as indicated by the significant unstandardized regression coefficients (B = 0.531, t = 10.08, $p < .001$; B = 0.196, t = 3.74, $p < .001$). In addition, in support of

Hypothesis 2, informal interactions of employees with suppliers were found to have an indirect effect on innovation capability; this indirect effect was positive (0.244), as hypothesized. The formal two-tailed significance test (assuming a normal distribution) demonstrated that the indirect effect was significant (Sobel z = 5.341, p < .001). The bootstrap results confirmed the Sobel test (see Table 2), with a bootstrapped 95% CI around the indirect effect not containing zero (.1534, .3491). Thus, Hypotheses 1 and 2 were supported.

==Table 2 here==

4.3 Moderated mediation tests and results

With regard to Hypothesis 3, the prediction is that knowledge application moderates the positive relationship between knowledge acquisition and innovation capability. Assuming that this moderation hypothesis receives support, Hypothesis 4 further proposes that the strength of the hypothesized indirect (mediation) effect is conditional on the value of the moderator (viz., knowledge application) or what has been termed *conditional indirect effects* (Preacher, Rucker, & Hayes, 2007), alternatively known as moderated mediation. To test Hypotheses 3 and 4, the SPSS macro PROCESS designed by Hayes (2013) was utilized again.

Table 3 presents the results for Hypotheses 3 and 4. The results indicate that the cross-product term between knowledge acquisition and knowledge application on firm innovation capability was significant (B = 0.1335, t = 3.176, p < .01). To fully support Hypothesis 3, the form of this interaction should conform to the hypothesized pattern. Therefore, conventional procedures was applied to plot simple slopes (see Fig. 2) at one standard deviation above and below the mean of the knowledge application measure. Consistent with the expectations (and supporting Hypothesis 3), the slope of the relationship between knowledge acquisition and firm innovation capability was relatively strong (and positive) for firms with a high level of knowledge application (simple slope = 0.4501, t = 4.92, p < .001), whereas the slope was

relatively weak for firms with a low level of knowledge application (simple slope = 0.1825, t = 2.01, $p < .05$).

==Table 3 here==

==Figure 2 here==

Although the results show that knowledge acquisition interacts with knowledge application to influence a firm's innovation capability, they do not directly assess the conditional indirect effects model depicted in Fig. 1 (i.e., Hypothesis 4). Therefore, the conditional indirect effects of the informal interactions with employees of suppliers on firm innovation capability (through knowledge acquisition) were examined for three values of knowledge application (see middle of Table 3): the mean (– 0.004), one standard deviation above the mean (0.998), and one standard deviation below the mean (– 1.006). Normal theory tests indicate that two of the three conditional indirect effects (based on moderator values at the mean and at +1 standard deviation) were positive and significantly different from zero. Bootstrap CIs corroborated these results. Thus, Hypothesis 4 was supported; an indirect and positive effect of the informal interactions of employees of suppliers on a firm's innovation capability through knowledge acquisition was observed when levels of knowledge application were moderate to high but not when the firm's knowledge application was low.

5 Discussion and conclusion

Much of the previous literature suggests that supplier networks are valuable sources of knowledge and innovation for buyer firms (e.g., Gemünden et al., 1996; Pittaway et al., 2004; Tomlinson & Fai, 2013). As more recent research indicates, networking activities among individuals help to maintain current network relationships, which provide access to the knowledge and resources that are necessary for innovation (Dhanaraj & Parkhe, 2006; van Wijk et al., 2008). However, there is still relatively little research on how social interactions—particularly individual-level informal interactions outside of the workplace—

can contribute to firm innovation (Porter & Woo, 2015; Shu et al., 2011; Tasselli et al., 2015). A limited number of studies have endeavored to enhance the understanding of how social interactions are related to product development (e.g., Cousins et al., 2006; Lawson et al., 2009). However, these studies tend to remain confined within the workplace context.

These findings appear largely consistent with the previous research, particularly Cousins et al. (2006) and Lawson et al. (2009). However, two key differences between this research and their research are notable. First, the measurements of knowledge sharing and acquisition are different. Cousins et al. (2006) and Lawson et al. (2009) understand knowledge sharing specifically between the development engineers of buyer and supplier firms, whereas the measurement of this research is more generic regarding overall sources of knowledge acquisition and includes questions such as 'we ask our suppliers to give us suggestions to improve our products or services'. Second, as previously discussed, in this research, informal interactions are clearly defined as those networking activities of employees that take place beyond the workplace in their free time, whereas their definition is ambiguous and includes activities such as joint benchmarking research and supplier and engineering visits to facilities, which fall within the realm of workplace 'socialization'. Therefore, this study, based on a clearly defined boundary of networking activities, extends the understanding regarding the importance and potential contribution of clearly informal interactions to organizational performance, such as innovation capability, in this case.

5.1 Theoretical contribution

This research makes two important theoretical contributions to the literature. First, it contributes to the understanding of the micro-foundations of organizational social networks by investigating how the informal social interactions of employees beyond the workplace at the individual level can contribute to organizational outcomes in the case of innovative capability. Although the previous research has connected the importance of individuals'

personal connections across organizational boundaries to the social capital of their organizations (e.g., Burt, 1992; Larson, 1992; Mehra et al., 2001; Tasselli et al., 2015; Volberda et al., 2010), there continues to be little research on how individual employees' informal activities can contribute to organizational social network development and performance. Leading scholars have thus called for more research on the micro-foundations of organization and management theory (e.g., Barney & Felin, 2013; Felin, Foss, & Ployhart, 2015). This research is a timely response to that call and shows that informal supplier-buyer employee interactions have an indirect positive impact on a buyer firm's innovation capability by means of knowledge acquisition. Therefore, the current research advances the understanding of how firms might possibly turn potential network benefits into firm innovation—a question that has remained mostly unanswered in the available research (Shu et al., 2011)—by investigating how informal individual-level employee social interaction can contribute to innovation. Furthermore, it extends the previous research on social interactions, which is largely confined to the workplace context, by focusing on how informal interactions outside of work can influence the firm's innovation capability.

Second, it sheds light on the mechanism of how different components of absorptive capacity can influence innovation capability. In the previous relevant literature, little attention has been paid to the actual processes that underpin absorptive capacity (Lane et al., 2006). More specifically, Ebers and Maurer (2014) argue that relatively little is known about how the different proposed components of absorptive capacity affect relevant outcomes, e.g., innovation capability, individually, together and/or through their interactions. The findings of this research—that the informal social interactions of employees can indirectly impact a firm's innovation capability through knowledge acquisition, where this relationship is moderated by knowledge application—enhances the understanding of how the two key components of absorptive capacity, i.e., knowledge acquisition and knowledge application,

may individually and jointly affect innovation capability. Therefore, to a certain extent, this research unpacks the process of absorptive capacity affecting innovation capability (Zahra & George, 2002). Accordingly, it also shows how organization-level absorptive capacity is related to the interaction of individuals, which is under-researched (Volberda et al., 2010).

5.2 Managerial implications

In addition to contributing to theoretical advancement, as discussed above, this research has useful managerial implications. First, these findings confirm the importance of the individual networking activities of employees for maintaining existing network relationships (Porter & Woo, 2015; Tasselli et al., 2015) and for enhancing the knowledge acquisition needed for innovation (Lawson et al., 2009). Interactions are individuals' channels for knowledge transfer (Kogut & Zander, 1992). Pittaway et al. (2004) argue that formal and informal interactions between individuals with different information, skills and values increase the chance of unforeseen novel combinations of knowledge, which can lead to radical discoveries. Organizations should thus encourage their employees to interact with other individuals, including with the employees of their collaborative partners (Gold et al., 2001). This research found that informal social networking activities during employees' free time, such as spending leisure time together, might also potentially benefit the organization through knowledge acquisition, for example, and, consequently, through innovation capability.

Second, and related to the first implication, managers must be aware of potential costs, and management implications may arise from these informal social interaction activities. Employee time spent on informal interactions outside of their work time might be compensated for, such as by offering flexible working hours. In the meantime, managers must consider how to innovatively promote collaboration and knowledge sharing using different mechanisms.

Third, on one hand, the finding on the mediating effect of knowledge acquisition between informal social interactions and a firm's innovation capability reminds the importance of knowledge acquisition from outside of the firm. On the other hand, the moderating role of knowledge application, i.e., strengthening the relationship between knowledge acquisition and innovation capability, highlights the importance of the firm's motivation to apply knowledge. Alavi and Leidner (2001) warn that the source of competitive advantage is identified with knowledge application rather than with the knowledge itself, which may also mean that the capability to apply newly acquired knowledge for new product and process development is more critical to a firm's innovation capability. In other words, the overall development of a firm's absorptive capability is important to achieving both innovation capabilities and competitive advantage (Zahra & George, 2002).

5.3 Research limitations and future research

Despite the important contributions this paper makes to the literature, it nonetheless has a number of limitations that should be addressed in future research. First, this paper is based on cross-sectional data, which may prohibit the determination of causality. In addition, survey-based data provide little indication of the quality, processes and motives involved (Porter and Woo, 2015). Future research based on data collected over a relatively long period (longitudinal research) and through mixed methods (including interviews, survey questionnaires and participant observation) may provide richness of insight and shed further light on the dynamics of these relationships. Second, the data were collected from only four industries in China. Further research may test whether the mechanisms identified in this research can be applied to other industries and other countries. As Pittaway et al. (2004) note, there is considerable ambiguity and debate within the literature regarding appropriate network configurations for successful innovation. Perhaps future research is also required on the impact of network dynamics and network configurations on innovation. Third, this

research uses only one item to measure informal social interaction. However, this item includes a wide range of activities frequently discussed in earlier research, e.g., Burt (1992) and Oh et al. (2004). Future research may develop new items or separate the activities included in the questions of this research into different items to better measure the construct.

References

Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: testing and interpreting interactions*. Newbury Park, CA: Sage.

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: conceptual foundations and research issues. *MIS Quarterly*, *25*, 107–136.

Allen, J., James, A. D., & Gamlen, P. (2007). Formal versus informal knowledge networks in R&D: a case study using social network analysis. *R & D Management*, *37*, 179–196.

Barney, J., & Felin, T. (2013). What are microfoundations? *Academy of Management Perspectives*, *27*, 138–155.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173–1182.

Borgatti, S. P., & Halgin, D. S. (2011). On network theory. *Organization Science*, *22*, 1168–1181.

Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, *1*, 185–216.

Brown, J. S., & Duguid, P. (2001). Knowledge and organization: a social-practice perspective. *Organization Science*, *12*, 198–213.

Burt, R. S. (1992). *Structural holes: the social structure of competition*. Cambridge, MA: Harvard University Press.

Camisón, C., & Forés, B. (2010). Knowledge absorptive capacity: new insights for its conceptualization and measurement. *Journal of Business Research, 63*, 707–715.

Chung, S., & Kim, G. M. (2003). Performance effects of partnership between manufacturers and suppliers for new product development: the supplier's standpoint. *Research Policy, 32*, 587–603.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly, 35*, 128–152.

Cousins, P. D., Handfield, R. B., Lawson, B., & Petersen, K. J. (2006). Creating supply chain relational capital: the impact of formal and informal socialization processes. *Journal of Operations Management, 24*, 851–863.

Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. *Englewood Cliffs, NJ, 2*.

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review, 31*, 659–669.

Ebers, M., & Maurer, I. (2014). Connections count: how relational embeddedness and relational empowerment foster absorptive capacity. *Research Policy, 43*, 318–332.

Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. *Psychological Methods, 12*, 1–22.

Felin, T., Foss, N. J., & Ployhart, R. E. (2015). The micro foundations movement in strategy and organization theory. *The Academy of Management Annals, 9*, 575–632.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*, 39–50.

Gemünden, H. G., Ritter, T., & Heydebreck, P. (1996). Network configuration and innovation success: an empirical analysis in German high-tech industries. *International Journal of Research in Marketing, 13*, 449–462.

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: an organizational capabilities perspective. *Journal of Management Information Systems, 18*, 185–214.

Grant, R. M. (1996). Prospering in dynamically-competitive environments: organizational capability as knowledge integration. *Organization Science, 7*, 375–387.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: a regression-based approach*. New York, NY: The Guilford Press.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55.

Knudsen, M. P. (2007). The relative importance of interfirm relationships and knowledge transfer for new product development success. *Journal of Product Innovation Management, 24*, 117–138.

Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science, 3*, 383–397.

Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: a critical review and rejuvenation of the construct. *Academy of Management Review, 31*, 833–863.

Larson, A. (1992). Network dyads in entrepreneurial settings: a study of the governance of exchange relationships. *Administrative Science Quarterly, 37*, 76–104.

Lawson, B., Petersen, K. J., Cousins, P. D., & Handfield, R. B. (2009). Knowledge sharing in interorganizational product development teams: the effect of formal and informal socialization mechanisms. *Journal of Product Innovation Management, 26*, 156–172.

Lundvall, B. A. Ê. (Ed.). (1992). *National systems of innovation: towards a theory of innovation and interactive learning*. London: Pinter Publishers.

Luzzini, D., Amann, M., Caniato, F., Essig, M., & Ronchi, S. (2015). The path of innovation: purchasing and supplier involvement into new product development. *Industrial Marketing Management, 47*, 109–120.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*, 83–104.

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*(1), 99-128.

Mehra, A., Kilduff, M., & Brass, D. J. (2001). The social networks of high and low self-monitors: implications for workplace performance. *Administrative Science Quarterly, 46*, 121–146.

Mullen, M. R. (1995). Diagnosing measurement equivalence in cross-national research. *Journal of International Business Studies, 26*, 573–596.

O'Leary-Kelly, S. (1998). The empirical assessment of construct validity. *Journal of Operations Management, 16*, 387–405.

Oh, H., Chung, M. H., & Labianca, G. (2004). Group social capital and group effectiveness: The role of informal socializing ties. *Academy of Management Journal, 47*, 860–875.

Pérez, M., & Sánchez, A. (2002). Lean production and technology networks in the Spanish automotive supplier industry. *Management International Review, 42,* 261–277.

Pittaway, L., Robertson, M., Munir, K., Denyer, D., & Neely, A. (2004). Networking and innovation: a systematic review of the evidence. *International Journal of Management Reviews, 5*, 137–168.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903.

Porter, C. M., & Woo, S. E. (2015). Untangling the networking phenomenon: a dynamic psychological perspective on how and why people network. *Journal of Management, 41*, 1477–1500.

Powell, T. C., & Dent-Micallef, A. (1997). PREInformation technology as competitive advantage: the role of human, business, and technology resources. *Strategy Management Journal, 18,* 375–405.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36,* 717–731.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: theory, methods, and prescriptions. *Multivariate Behavioral Research*, *42*(1), 185-227.

Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: the effects of cohesion and range. *Administrative Science Quarterly, 48,* 240–267.

Ritter, T., & Gemünden, H. G. (2003). Network competence: its impact on innovation success and its antecedents. *Journal of Business Research, 56,* 745–755.

Salancik, G. R., & Burt, R. S. (1995). WANTED: a good network theory of organization. *Administrative Science Quarterly, 40*, 345–349.

Shu, C., Page, A. L., Gao, S., & Jiang, X. (2011). Managerial ties and firm innovation: is knowledge creation a missing link? *Journal of Product Innovation Management, 29*, 125–143.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology, 13*, 290–312.

Song, M., van der Bij, H., & Weggeman, M. (2005). Determinants of the level of knowledge application: a knowledge-based and information-processing perspective. *Journal of Product Innovation Management, 22*, 430–444.

Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal, 48*, 450–463.

Tasselli, S., Kilduff, M., & Menges, J. I. (2015). The microfoundations of organizational social networks: a review and an agenda for future research. *Journal of Management, 41*, 1361–1387.

Thomsen, S., & Pedersen, T. (2000). Ownership structure and economic performance in the largest European companies. *Strategic Management Journal*, 689-705.

Tomlinson, P. R., & Fai, F. M. (2013). The nature of SME co-operation and innovation: a multi-scalar and multi-dimensional analysis. *International Journal of Production Economics, 141*, 316–326.

van Wijk, R., Jansen, J. J. P., & Lyles, M. A. (2008). Inter- and intra-organizational knowledge transfer: a meta-analytic review and assessment of its antecedents and consequences. *Journal of Management Studies, 45*, 830–853.

Volberda, H. W., Foss, N. J., & Lyles, M. A. (2010). Absorbing the concept of absorptive capacity: how to realize its potential in the organization field. *Organization Science, 21*, 931–951.

Wagner, S. M. (2010). Supplier traits for better customer firm innovation performance. *Industrial Marketing Management, 39*, 1139–1149.

Walter, A., Auer, M., & Ritter, T. (2006). The impact of network capabilities and entrepreneurial orientation on university spin-off performance. *Journal of Business Venturing, 21*, 541–567.

Wu, L.-W., Lii, Y.-S., & Wang, C.-Y. (2015). Managing innovation through co-production in interfirm partnering. *Journal of Business Research, 68*, 2248–2253.

Yli-Renko, H., Autio, E., & Sapienza, H. J. (2001). Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal, 22*, 587–613.

Zahra, S. A., & George, G. (2002). Absorptive capacity: a review, reconceptualization, and extension. *Academy of Management Review, 27*, 185–203.

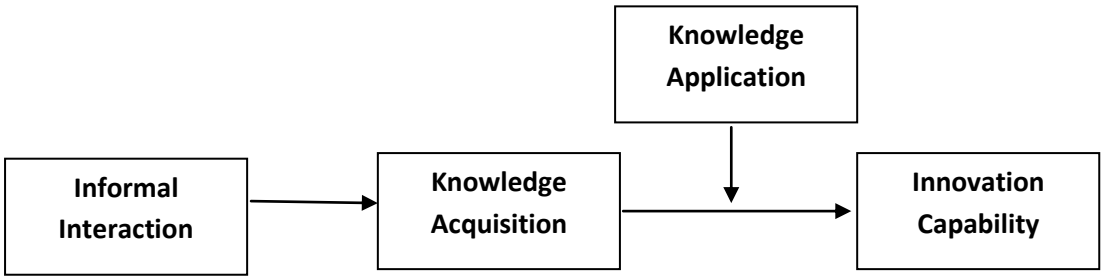

Fig. 1. The proposed conceptual model.

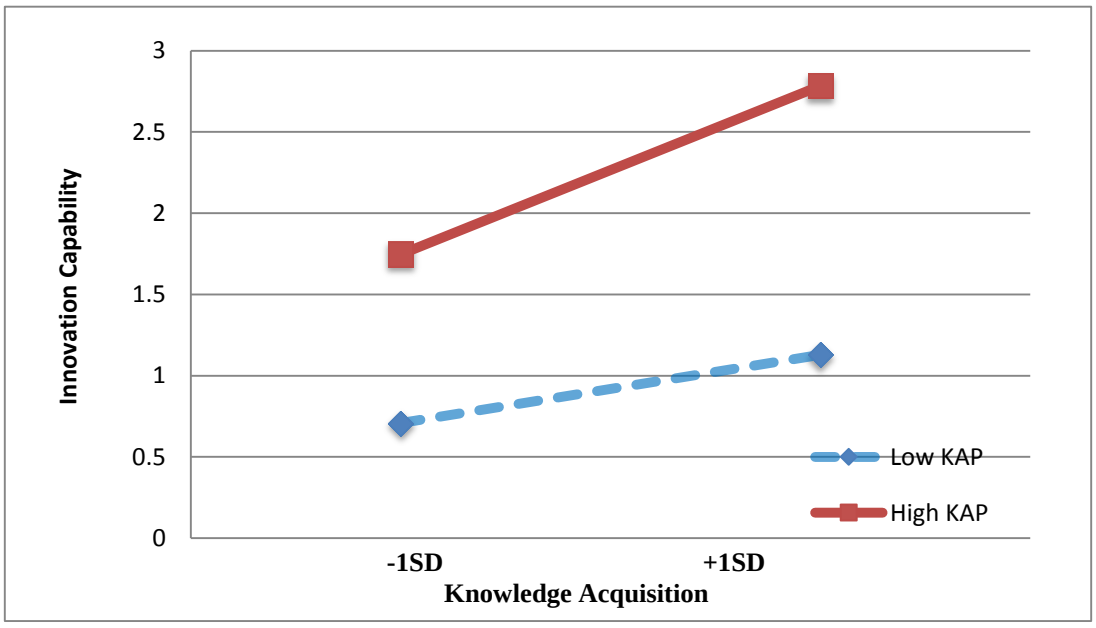

Fig. 2. The moderation of knowledge acquisition on firm innovation capability.

Table 1 Descriptive statistics and correlation matrix (N = 273)

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Innovation capability	5.115	1.045	1													
2 Knowledge acquisition	5.034	1.151	.439***	1												
3 Knowledge application	5.137	1.073	.441***	.671***	1											
4 Informal interaction	4.546	1.620	.152*	.418**	.328**	1										
5 Textile and apparel	.223	.417	.019	.051	.020	-.083	1									
6 Household appliance	.088	.284	-.057	.031	.004	.015	-.167***	1								
7 IT and electronics	.421	.495	-.036	.030	.010	.010	-.458***	-.265***	1							
8 Automobile	.260	.439	.054	-.083	-.024	.058	-.318***	-.184**	-.506***	1						
9 State-owned	.194	.396	-.097	.001	-.026	-.005	-.152*	-.087	.013	.195**	1					
10 Collective ownership	.018	.134	-.131*	-.161**	-.148*	.005	-.008	.054	-.061	.044	-.067	1				
11 Privately owned	.443	.498	.078	.064	.086	-.055	.194**	.062	-.029	-.176**	-.438***	-.122*	1			
12 Foreign-owned	.187	.390	-.035	-.070	-.060	-.005	-.054	.017	.162**	-.134*	-.235***	-.065	-.428***	1		
13 Firm size	4.139	2.279	-.002	.013	.012	-.010	-.226***	.066	.029	.140*	.263***	-.128*	-.375***	.111	1	
14 Formal interaction	5.037	1.502	.274***	.614***	.495***	.453**	-.048	-.042	.029	.052	.000	-.058	-.041	-.037	.019	1

*, **, and *** indicate $p < 0.10$, $p < 0.05$, $p < 0.01$, and $p < 0.001$ respectively

Table 2 Regression results for simple mediation

	B	***SE***	***t***	***p***	***LLCI***	***ULCI***
Direct and total effects						
Knowledge acquisition regressed on informal interactions[§]	.196	.052	3.736	.000	.093	.299
Innovation capability regressed on knowledge acquisition, controlling for informal interactions [χ]	.459	.073	6.328	.000	.316	.602
Innovation capability regressed on informal interactions, controlling for knowledge acquisition [χ]	-.049	.063	-.778	.438	-.173	.075
			Value	***SE***	***z***	***p***
Indirect effects and significance using normal distribution						
Sobel			.244	.046	5.341	.000
			M	**SE**	***LLCI***	***ULCI***
Bootstrap results for indirect effects						
Effect			.244	.050	.153	.349

Note. N = 273 firms. Unstandardized regression coefficients are reported. Bootstrap sample size = 5,000. LLCI = lower limit of 95% confidence interval; ULCI = upper limit of 95% confidence interval.
[§] R = .671, R^2 = .450, F = 19.391, p = .000. All control variables are included in the regression models as explained in the text, only the first two industry dummies (i.e., textile and apparel and household appliance) are significant at the 0.1 level, and the dummy of collective ownership is significant at the 0.05 level.
[χ] R = .480, R^2 = .230, F = 6.482, p = .000. All control variables are included in the regression models; only the dummy of state-owned ownership is significant at the 0.1 level.

Table 3 Regression results for conditional indirect effects[ж]

	B	***SE***	***t***	***p***	***LLCI***	***ULCI***
Knowledge acquisition (KAC)	.317	.081	3.917	.000	.158	.476
Informal interactions	-.072	.061	-1.187	.236	-.192	.048
Knowledge application (KAP)	.298	.073	4.110	.000	.155	.441
KAC × KAP	.134	.042	3.176	.002	.051	.216
Knowledge application	***Boot indirect effects***		***Boot SE***	***Boot LLCI***	***Boot ULCI***	
Conditional indirect effects at KAP = M ± 1 SD						
-1 SD (-1.006)	.097		.058	-.030	.199	
M (-.004)	.168		.055	.065	.280	
+1 SD (.998)	.239		.070	.118	.392	
Mediator	Index		SE(Boot)	Boot LLCI	BootULCI	
Index of moderated mediation						
Knowledge acquisition	.071		.032	.002	.129	

[ж] *Note. n* = 273 firms. Unstandardized regression coefficients are reported. Bootstrap sample size = 5,000. R = .541, R^2 = .292, F = 7.614, p = .000. All control variables are included in the regression model; only the dummy of state-owned ownership is significant at the 0.1 level.

Appendix 1. Measurement items.

Variables and Items	Factor loading
Informal Interaction	
To strengthen contact with our suppliers, our employees often spend their leisure time with suppliers' employees on informal social activities (such as dinner, karaoke, sports, etc.)	
Knowledge Acquisition α=0.871 AVE= 0.66	
1. Our employees often go to visit our suppliers	0.680
2. We always investigate our suppliers to obtain suggestions to improve our products or services	0.811
3. We regularly have special meetings with our suppliers (such as focus groups, brainstorming) to discuss how to develop products or services that may be needed in the future	0.770
4. We have procedures and methods to obtain real-time suppliers' operation information (such as production plans, inventory levels)	0.774
5. We have formal practices and standard operating procedures to guide communications between employees and suppliers	0.771
Knowledge Application α=0.902 AVE= 0.59	
1. We have programmed mechanisms to help find new business opportunities from new knowledge	0.682
2. We have official policies and procedures to guide the information released among the enterprise's internal departments	0.665
3. We regularly evaluate and adjust our long-term forecasts according to market trends, technological developments and other new knowledge	0.715
4. We have a systematic program applying new technology to develop new products	0.822
5. We have a systematic program applying new technology to improve and/or develop processes	0.826
6. We have been thinking about how to use new knowledge to improve existing operations' efficiency and effectiveness	0.713
7. We have special procedures and practices to help staff digest new knowledge and combine it with existing knowledge	0.722
8. We have special organizations responsible for improving the ability to apply new knowledge (such as technology centers, R&D centers)	0.678
Innovation Capability α=0.927 AVE= 0.70	
1. The ability to provide new products rapidly	0.786
2. The ability to improve existing products/services gradually	0.823
3. The ability to change existing products/services completely	0.849
4. The ability to improve the existing process flow gradually	0.844
5. The ability to change existing process flow completely	0.748
6. The ability to design and develop new products/services according to new technology	0.826
7. The ability to enhance competitive advantage through innovation	0.775