

The contingent roles of market turbulence and organizational innovativeness on the relationships among interfirm trust, formal contracts, interfirm knowledge sharing and firm performance

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Abstract

Purpose –Prior research on interfirm collaborations has demonstrated that trust and contract are two central governance mechanisms that influence a firm’s knowledge sharing decision and the subsequent effect on performance. However, we know little about how effective these mechanisms are in different market conditions and levels of organizational innovativeness. This study seeks to advance the literature on interfirm knowledge sharing by exploring these contingencies and by providing an alternative explanation of the contradictory effects of knowledge sharing on firm performance.

Design/methodology/approach – We collected 156 firms’ relationships with their suppliers in two batches from 300 firms in the 2017 list of Statistics in the Zhejiang province in China. We used unstructured interviews and formal questionnaires to collect data from these firms.

Findings – Market turbulence served as a boundary condition for the effect of interfirm trust and formal contracts on knowledge sharing. Both interfirm trust and formal contracts, as governance mechanisms, are effective in raising interfirm knowledge sharing only when the firms operate in high turbulent markets. On the other hand, knowledge sharing negatively affected firm performance when firms exhibit low organizational innovativeness. Moreover, a three-way interaction among market turbulence, organizational innovativeness, and knowledge sharing revealed that when market turbulence and organizational innovativeness were both low, interfirm knowledge sharing was detrimental to firm performance.

Practical implication – Based on the results, this study recommends managers consider external (market turbulence) and internal (organizational innovativeness) when firms decide to share knowledge and benefit from such activities.

Originality/value – This study extends prior research on the determinant of knowledge sharing and clarifies the inconsistent findings of knowledge sharing on firm performance. Thus, strategic organizational leaders need to pay attention to when they need to share information with suppliers to best benefit from those collaborations.

Keywords Interfirm knowledge sharing, Market turbulence, Organizational innovativeness, Trust, Contracts, Firm performance

Paper type Research paper

1. Introduction

Trust and contract are two dominant governance modes that affect interfirm collaboration (Li *et al.*, 2010). These two exchange governance mechanisms, usually in dyads (Charterina *et al.*, 2018; Gulati and Nickerson, 2008), have been identified as important determinants for knowledge acquisition and decisive factors for achieving the efficiency of knowledge sharing (Lo *et al.*, 2021). A trusting relationship enables firms to conduct interfirm activities such as knowledge sharing under less formal arrangements because having a high level of trust can effectively reduce the governance cost of knowledge exchange and sharing (Gulati and Nickerson, 2008; Mungra and Yadav, 2020). Meanwhile, formal contracts provide an explicit form of agreements to bind both parties to cooperate and guard against opportunistic behavior (Schepker *et al.*, 2014). Contracts promote better supplier performance and knowledge acquisition. With explicit contracts, firms and their suppliers are more likely to be satisfied with their partners (Zhang *et al.*, 2020).

Scholars have focused on the paradox between trust and contract to see how they jointly determine performance (e.g., Cao and Lumineau, 2015). They primarily investigate whether trust and contract can be substitutes, complements, or both in impacting knowledge sharing and organizational outcomes. However, the existing empirical results are inconclusive. Despite the plenty of knowledge on the main effects of trust and contracts on knowledge sharing, we still do not know if these effects exist and are still positive when external factors (such as market turbulence) are taken into consideration. That is, extant studies offer little insight on how trust and contract interact with the external environment where firms are embedded. On top of this shortcoming, scant has been done on how trust and contract interact with the external environment which may influence the decision of a firm to share knowledge with suppliers. The

search for this answer provides important insights into the boundary conditions of trust and contract mechanisms where they may demonstrate separate strength under different market conditions. Indeed, there have been calls for more research on when relational and governance mechanisms obviate the need for each other (Schepker *et al.*, 2014). Therefore, results of this research provide theoretical and practical support on the understanding of the dynamics of trust and contract on interfirm knowledge sharing by delineating *when and if* such relationships exist, providing clarity to theory and practice. Specifically, drawing on the contingency theory, we identify market turbulence as an imperative environmental contingency factor in the trust/contract—knowledge sharing relationship because not only do the changing market demands create substantial pressure for firms to align resources with their alliance partners (Keszei, 2018), but also it is a critical condition for firms to make collaborative decisions (Anderson and Tushman, 2001). While prior studies have emphasized the contingency factors that enhance a firm's knowledge sharing activities (Yacoub *et al.*, 2020), we argue that contingency factors may impose more constraints on the firm's knowledge sharing and influence firm's operationalization of knowledge into performance measures. Practically, this study provides insights to strategic leaders on when they should share more knowledge with key suppliers.

Moreover, past studies have found an inconsistent relationship between knowledge sharing and firm performance, such as a positive relationship (Abbas *et al.*, 2019, 2020; Spencer, 2003), a curvilinear relationship (Zhang *et al.*, 2019), and a negative one (Gold *et al.*, 2001). These mixed findings create a dilemma for senior executives since firms may be hesitant to share knowledge for fear of adverse performance outcomes. The conflicting results deserve a call for research on reviewing the paradoxical effect of knowledge sharing on firm performance by

adopting a contingency perspective. Specifically, internal (innovativeness) and external (market turbulence) contingencies play a critical role in linking interfirm knowledge sharing to firm performance.

We advance the extant literature of interfirm knowledge sharing in several ways. First, since the trust/contract paradox is one of the most critical predictors in the knowledge sharing process, it is imperative to clarify *when* these predictors work and when they do not. In doing so, our study digs deeper into the impact of the two mechanisms on knowledge sharing by studying the contextual condition (the turbulent environment), which provides clarity to the theory and practice. Second, since interfirm knowledge sharing plays an increasingly crucial role in the current knowledge-intensive economy and it is a critical process for firms to acquire resources (Cannella *et al.*, 2008), the examination of interfirm knowledge sharing and firm performance provides a fine-grained and contingent view on the conditions under which knowledge sharing can be more beneficial for firm performance. Specifically, we posit that maintaining a firm's internal strength in terms of organizational innovativeness enables the firm to transfer knowledge sharing activities into positive performance outcomes effectively. Third, we provide an alternative explanation of the inconclusive link of knowledge sharing to firm performance. Finally, with market turbulence and organizational innovativeness as contingent conditions, we provide practical guidance to business managers on when it is critically important to invest in trust-based and contract-based relationships to affect knowledge sharing and achieve the desired firm performance. Moreover, since sharing knowledge is salient for firms to access imperative capability and keep firm continuity (Alavi and Leidner, 2001), understanding the risks of knowledge sharing is also crucial to managers. Maintaining a good "fit" between a firm's

external environment and knowledge sharing is vital so that firms do not miss opportunities to absorb critical resources and capabilities or get harmed by the knowledge spillover effect.

2. Literature review

2.1 Market Turbulence as a Moderator of the Interfirm Trust/Contract and Knowledge Sharing Relationship

Environmental contingencies can influence the dynamics of the relationships between trust/contracts and knowledge sharing. For example, when market uncertainty is high, firms are more likely to adopt a principle of exclusivity in selecting partners for exchange (Gulati and Nickerson, 2008). These selection criteria include previous collaboration experience and partner status, to name a few. Moreover, the best way to handle market turbulence for firms is to act now (Connor, 2007). One of the actions taken is that firms may obtain and build up their knowledge or capabilities toward their competitive environment by reaching out to other firms (Abbas *et al.*, 2019), including competitors (Botelho, 2018). The level of market turbulence will thus exert an impact on a firm's behavior of sharing knowledge. In turbulent markets, firms are more likely to engage in activities that help them share knowledge with trustworthy partners and get more protection from contracts.

Since the appropriate firm activity depends on the nature of the firm's environment (Dolucan *et al.*, 2018), we posit that market turbulence is a necessary contingency that will interact with trust and contract in interfirm knowledge sharing in which firms are expected to have differentiated responses toward diverging market turbulence. Specifically, firms may make proactive organizational changes to adapt to environmental challenges. For example, Howard *et al.* (2017) found that firms conduct knowledge management by creating director interlocks because, in such an approach, a co-opted director can help to manage uncertainty around

resource exchange within the external environment. Emphasizing the vital role of market turbulence in changing a firm's uncertainty and risk analysis, we posit that firms seek to share knowledge with their suppliers, partly, due to external environmental factors (Ayala *et al.*, 2017).

Since inter-organizational knowledge sharing is embedded in the exchange relationship with partners, trust has been shown to facilitate knowledge flow between two exchange partners (Alshwayat *et al.*, 2021). Trust is considered a critical mechanism for explaining firms' interpretation and behavior toward each other (Bode *et al.*, 2011). Researchers have considered trust as a substitute or complement to opportunism (Lado *et al.*, 2008; Lazzarini *et al.*, 2008; Woolthuis *et al.*, 2005), efficiently reducing transaction costs that arise from conflicts between exchange partners (Dyer and Chu, 2003). We propose that the positive linkage between trust and knowledge sharing is contingent on market conditions.

Market turbulence reflects the unpredictability of changes in customer tastes, demand, and the scope of competition in the firm's principal industries (Mubeen *et al.*, 2021, 2022). Examining market turbulence can yield valuable clues for understanding the rationale behind interfirm knowledge sharing. Market turbulence increases organizational risk because it brings a higher level of uncertainty to firms, and the firms may find it very difficult to respond to the necessary changes on time (Palmer and Wiseman, 1999). Risk tolerance and trust are positively related to each other. In a trustworthy relationship, the risk tolerance is higher (Becerra *et al.*, 2008), and firms are more willing to bear vulnerability (Fulmer and Gelfand, 2012). In an uncertain environment, firms adopt an exploratory approach to seeking new knowledge to minimize the threat of technological obsolescence (Jansen *et al.*, 2006). Under such circumstances, organizations often engage in external links to respond to increased environmental uncertainty (Boyd, 1990). Hence, on the one hand, under a highly turbulent

environment, firms facing a high risk will rely more on knowledge sharing with their suppliers as a necessary means of collecting external information. On the other hand, uncertainty increases risks and opportunism, which makes the trusting relationship even rarer. That is, trust becomes more valuable when the market is highly turbulent. Specifically, in a turbulent environment, trust acts as a shield against any misconduct of the exchange partner (Bode *et al.*, 2011).

Moreover, trust, described as expectations for partners' fulfillment of commitment and action with good intention, is essential to determine the interdependency between exchange partners (Ireland and Webb, 2007). As market turbulence increases, the interdependency between firms increases because firms switch their priority from organizational efficiency to organizational effectiveness by drawing knowledge from other firms (Keum, 2020). With increased market turbulence, firms are likely to explore broadly and conduct more exchange activities to survive in a turbulent environment. Thus, having a relationship based on trust in such a turbulent environment increases knowledge sharing because firms are more likely to walk out of their existing expertise, and trust can reduce more risks under such circumstances. On the other hand, when market turbulence is low, the need for the effectiveness of trust as a driver of knowledge sharing might be reduced because firms may only need to rely on their internal resources to compete in the industry effectively (Lee and Cavusgil, 2006). Therefore, we anticipate that market turbulence positively moderates the relationship between interfirm trust and interfirm knowledge sharing.

H1. Market turbulence positively moderates the relationship between interfirm trust and interfirm knowledge sharing.

Contracts, as written legal agreements about the reciprocal obligations of both parties (Li *et al.*, 2010), clarify both parties' specific rights and responsibilities, establish a clearer picture of power distribution between firms, and align them with their expectations. In a collaborative

interfirm relationship, formal contracts legally bind firms to cooperate with other parties on agreed terms and conditions (Schepker *et al.*, 2014). In firm-supplier relationships, a formal contract protects a firm from the risky actions of other parties to harm its interests. Such a formal contract also ensures a firm can fairly exchange market information and access to knowledge and resources from the contractual partners.

However, formal contracts are sensitive to external contingencies (Qian *et al.*, 2016), such as environmental uncertainty. Specifically, formal contracts are susceptible to the frequency and unpredictability of environmental changes (Carson *et al.*, 2006), such as market turbulence. First, as noted above, in highly turbulent markets, the risk of opportunism and the cost of safeguarding escalates (Wang *et al.*, 2015). In such a turbulent market environment, a firm may deal with this external contingency using formal contracts, which protect the interests of a firm from the risky and opportunistic actions of others which may cause a threat to the firm (Wang *et al.*, 2015). Owing to the protection of formal contracts, managers can use their discretion to manage the exchange of valuable market information, share knowledge, and borrow critical resources from the contractual partners (Hillman *et al.*, 2009). Second, since market turbulence intensifies market competition and aggrandizes the unpredictable timing for technical emergence, it impacts the effectiveness of resource deployment (Vorhies *et al.*, 2009). In this case, having a formal contract between partners will enhance fair and easy access to complementary resources which are external to organizations. Third, formal contracts may restrict one party from shifting all the risks to the other side of contractual partners. Due to the protection and obligation of a formal contract, a firm may feel secure to share its knowledge and exchange market information with the contractual partners in return for an expectation of gain from accessing complementary resources (Luo, 2003).

On the other hand, in a context of low market turbulence, firms may have more choices other than formal contracts for sharing knowledge (Lee and Cavusgil, 2006). That is, firms may depend on other means of exchange mechanisms for facilitating the exchange of knowledge. For example, firms may use their market power to attract new partners to cooperate with the firms, which may reduce the effectiveness and attractiveness of formal contracts. Accordingly, a firm may adjust its organizational activity to better fit with the less turbulent market environment. Overall, we suggest that high market turbulence enhances the impact of formal contracts on interfirm knowledge sharing, while low market turbulence relieves the strain on using the formal contract mechanism to manage the flow of interfirm knowledge sharing. Thus, we hypothesize the following:

H2. Market turbulence positively moderates the relationship between formal contract and interfirm knowledge sharing.

2.2 Organizational Innovativeness as a Moderator of the Interfirm Knowledge Sharing and Firm Performance Relationship

Knowledge sharing creates opportunities for firms to maximize organizational resources and capabilities while leveraging external resources and capabilities to generate solutions and efficiencies that enhance competitiveness (Darroch, 2005; Spencer, 2003). Sharing knowledge across a firm's boundaries is an effective way to improve knowledge about competitors and the industry and accelerate product development (Gold *et al.*, 2001). Knowledge sharing activities on a firm's supply chain are also proven to enhance a firm's green business growth (Abbas *et al.*, 2019). Prior empirical evidence supports the positive relationship between knowledge sharing and firm performance in that a firm's knowledge management routines, including knowledge dissemination and knowledge sharing, help enhance its superior financial performance (Darroch, 2005). Specifically, the quality and the scope of information exchange enhances firm

competence (Gulati and Sytch, 2007). Since knowledge sharing is an organizational activity highly embedded in interactions between partners, we propose that a firm's internal innovativeness climate critically affects the efficiency of knowledge sharing.

Reflecting a firm's tendency to support new ideas, novelty, experimentation, and creative processes, organizational innovativeness facilitates launching new products, services, and technologies (Ruvio *et al.*, 2014). Organizational innovativeness depicts a firm's internal climate on tolerance of failure and the fluidity of information flow (Bock *et al.*, 2005). As an important organizational climate, innovativeness regulates behavior and generates common expectations from all individuals. Under such a climate, firms usually possess higher innovation capabilities where organizational processes were built to perform innovative activities related to offerings, operations, management, and marketing to generate new customer value propositions (Wang *et al.*, 2015). We consider organizational innovativeness an essential moderator to influence the effectiveness of knowledge sharing, leading to higher firm performance.

Also, converting knowledge sharing to tangible benefits usually requires substantial organizational effort (Wang *et al.*, 2016). In a context of a buyer-supplier relationship, firms need to collaboratively work within organizations to creatively understand the product knowledge and market information they obtained through the knowledge sharing process to convert such knowledge to performance. In the setting of firm-supplier relationships, Song *et al.* (2020) recognized that firms with more outstanding capabilities of absorbing external knowledge would trigger higher learning activities inside the firm and thus enhance the firm's performance in green innovation. A high degree of organizational innovativeness suggests that the firm proactively welcomes new ideas, methods, and practices. Such new inputs provide insights to the firm in renovating the existing products/services. It also indicates that firms are more open to

conducting an external search for resources (like information) that improve their industry position (Laursen and Salter, 2006). Interactions between members from different sources can also lead to an enriched understanding of knowledge, especially when there is a tangible object for the interaction where participants can illustrate a problem with examples (Bechky, 2003). Specifically, in cases of higher organizational innovativeness, managers actively engage in the firm's decision-making and implementation, which supports the institutionalization of organizational knowledge creation, leading to higher performance.

Moreover, when organizational innovativeness is high, firms are likely to take the risk during the knowledge sharing process. While knowledge sharing may make a firm subject to opportunistic behavior by their counterpart firms (Wu *et al.*, 2012) and a risk-avoidance approach by being protective of their knowledge may impede knowledge sharing outcomes (Simonin, 2004), the promotion of a high organizational innovativeness increases the likelihood of a firm breaking the rules to achieve its goals (Morrison, 2006). In addition, when firms are oriented toward high innovativeness, they are more open to borrowing ideas from other firms (Bock *et al.*, 2005). Furthermore, having an innovative organizational climate helps firms disseminate and absorb knowledge from the interconnectedness between firms. According to the contingency perspective, the context of organizational innovativeness determines how firms access complementary resources to reap the benefits of the buyer-supplier relationship (Wagner and Bukó, 2005). To sum up, firms with a high innovativeness climate are more likely to benefit from knowledge sharing and transform knowledge effectively into positive firm performance.

Therefore, we predict the following relationship:

H3. Organizational innovativeness moderates the relationship between interfirm knowledge sharing and firm performance.

2.3 Three-way Interaction among Market Turbulence, Organizational Innovativeness and Interfirm Knowledge Sharing on Firm Performance

Contingency theory states that the fit between the external environment, organizational climate, and strategy determines firm performance (Donaldson, 2001). In this study, we also examine the interaction among an organizational climate (i.e., organizational innovativeness), an external environment (i.e., market turbulence), and a business strategy (information sharing) in order to fully understand the linkage between interfirm knowledge sharing and firm performance. Specifically, we advance with a three-way interaction hypothesis to fully utilize the contingency perspective and better understand the conditions under which knowledge sharing leads to higher firm performance.

In hypothesis 3, we noted that different routines and norms are established to transfer, translate and transform knowledge across different organizations' boundaries in firms with active knowledge sharing (Carlile, 2004). We further predict that turbulent markets may play an additional role in the moderating effect of organizational innovativeness on the relationship between interfirm knowledge sharing and firm performance. The turbulent market is inherently more unpredictable, and there will be a higher need for organizational innovativeness sponsorship to facilitate a more accessible approach to knowledge acquisition. Rapid technological changes show an impact on resource deployment effectiveness (Vorhies *et al.*, 2009). The interaction of organizational innovativeness and market turbulence is positively associated with firm performance because the benefits of organizational innovativeness are enhanced when coupled with a turbulent market requiring constant updates on new ideas, products, and services (Jansen *et al.*, 2006). Whereas, in a stable market environment where

customer needs are transparent, and technology is mature, there is less benefit captured from knowledge sharing and having an innovative climate inside organizations.

Furthermore, knowledge sharing has, at least over the long-term, performance pay-offs and it strengthens and reinforces a firm's competitiveness by establishing knowledge connections with alliance partners (Zhang *et al.*, 2019). Such benefits manifest quickly in volatile market conditions and when there is high organizational innovativeness because firms rely more on leveraging external resources and capabilities to update their competitiveness (Darroch, 2005; Dyer and Nobeoka, 2000; Spencer, 2003). On the contrary, when market turbulence is low, firms can benefit more from attention to their existing resources and capabilities internally instead of benefiting from external knowledge sharing. However, in such instances, firms may miss the opportunity to benefit from their partners' resources (Hillman *et al.*, 2009) or reshape the institutional environment, such as establishing industry standards and priorities (Spencer, 2003). In short, market turbulence increases the benefit of having high organizational innovativeness when firm performance is promoted via interfirm knowledge sharing, suggesting the following hypothesis:

H4. The interactive effect of organizational innovativeness and interfirm knowledge sharing on firm performance is contingent upon market turbulence.

3. Methodology

3.1 Sampling and Procedures

Data were collected in two batches from 300 firms in the 2017 list of Statistics in the Zhejiang province in China. We carefully followed the data collection procedures recommended by Gerbing and Anderson (1988). First, we conducted six unstructured interviews with senior managers of the industrial sectors of chemicals/pharmaceuticals, textiles/clothing, and furniture manufacturing. Next, questionnaire items were translated from English to Chinese by a research

assistant with research experience in strategic management and bilingual translation. The items were then back-translated from Chinese to English by two other professional translators to check for any inconsistencies of items (Chidlow *et al.*, 2014). Lastly, the questionnaires were pilot tested in 20 firms with 40 managers (two each). After gathering feedback from these managers, we refined the instruments with more explicit instructions and items. Human Resources Managers of participating firms assign managers to represent the firm to participate in this research. These managers signed consent letters to voluntarily participate in this research. The interviewers (local professors and Ph.D. students from one of the top-ranking universities in China) contacted the managers in their office to fill in the questionnaires and immediately collected completed questionnaires.

The managers provided ratings on interfirm trust, formal contract, market turbulence, organizational innovativeness, interfirm knowledge sharing, and firm performance and demographics. A total of 170 pairs of usable responses were returned. Nevertheless, we excluded 14 pairs due to missing data on many of the study variables. The final sample of 156 pairs, representing 156 firms in the manufacturing industry. Non-response bias test comparing those who participated and those that did not participate did not show any significant differences in key firm characteristics, such as firm age, number of employees, and type of ownership. Although we collected data from firms in two batches, we did not find any differences between the two groups on all studied variables. Out of the 156 firms, 20.5% had less than 50 employees, 20.5% had 51-100 employees, 21.2% had 101-150 employees, 19.9% had 150-400 employees, and 17.9% had 401 employees or above. Of the 156 firms, 118 were privately-owned, 17 were joint ventures, eight were wholly-owned foreign subsidiaries, seven were state-owned, and six were collectively-owned. Among the informants, 136 were middle managers, such as purchasing

managers, sales managers, and R&D managers, 13 senior managers, such as Chairmen, managing directors, deputy managing directors, and 7 had missing data.

3.2 Measures

Unless stated otherwise, all scales were originally measured using a 7-point Likert scale, ranging from 1 (“strongly agree”) to 7 (“strongly disagree”). However, we reverse-coded all the scales for consistency in reporting purposes.

Interfirm knowledge sharing was assessed using five items. Three items were adopted from Malhotra, Gosain, and Sawy (2005), and the other two items were taken from Li et al., (2005). An example of item is, “We share proprietary information with our main suppliers”. The Cronbach alpha for the measure was 0.87.

Firm performance was measured with five items adopted from Tippins and Sohi (2003). We asked two representatives of each firm how well their firms performed relative to all other direct competitors in terms of financial indicators, such as profit and return on investment in the past three years. We adopted a two-respondents approach in our survey since using single source data for a dependent variable is prone to increase common method bias (Conway and Lance, 2010). An example item is, “Relative to your competitors in the industry, how did your firm perform in the immediate past three years with overall performance, sales growth rate, market growth rate, profit growth rate, and returns on investment.” Cronbach alpha is 0.92.

Interfirm trust was measured with five items, three taken from Li et al. (2010) and two taken from McEvily and Marcus (2005). An example item is, “This supplier is trustworthy.” The Cronbach alpha for this measure was 0.89.

Formal contract was assessed with three items from Liu, Luo, and Liu (2009). An example item is, “We have specific, well-defined agreements with our main suppliers”. The Cronbach alpha for the scale was 0.86.

Market turbulence was measured with four items adopted from Jaworski and Kohli (1993). An example item is, “Our customers tend to look for new products all the time.” The Cronbach alpha for the scale was 0.81.

Organizational innovativeness was measured with four items, three items adopted from Bock et al. (2005), and one item was taken from Fey and Birkinshaw (2005). An example item is, “Our company encourages suggesting ideas for new opportunities.” The Cronbach alpha for the scale was 0.71.

Control variables: At the firm level, we controlled for firm age, firm size, total sales, R&D intensity, procedural fairness, ownership types, and industry types. *Firm Age* is measured using the number of years since the firm was established. *Firm Size* is measured using the total number of employees. *Total sales* are controlled using the firm’s total sales. We controlled *R&D intensity* by dividing the R&D expenditure by total sales over the past three years and normalized the ratio. *Procedural fairness* is controlled because previous studies indicated that the procedures used in governing knowledge sharing and contract negotiation could significantly impact knowledge sharing (Luo, 2008). An example reads, “The procedures used to govern resource sharing between two parties are impartial and fair.” The Cronbach alpha for the scale was .82. The *ownership* dummy is created to represent different ownership types, including private (baseline), SOE, collective, joint ventures, and subsidiaries. *Industry type* dummies are created to distinguish industry effects from textile clothing, automotive machinery, chemical pharmacy,

and electronic semiconductor industries (other industries as baseline). We normalized the *Firm Age*, *Firm Size*, *R&D intensity*, and *Total Sales* in the regression model.

We conducted several analyses to validate variable selection and variable reliability, including conducting confirmatory factor analyses (CFA) and calculating the average variance extracted (AVE). We used ordinary least squares (OLS) regression to test our hypotheses. We also mean-centered all predictors to create interaction terms. We entered each group of predictors separately in different models.

4. Results

First, we conducted CFA using EQS (Version 6.4) to examine the factor structure of the study variables. The hypothesized six-factor model comprised of interfirm trust, formal contract, market turbulence, organizational innovativeness, interfirm knowledge sharing, and firm performance¹ showed a fair fit to the data ($\chi^2 = 568.663$, d.f. = 284; CFI = 0.880; RMSEA = 0.082). The model also suggested error covariances between two items of knowledge sharing as well as two items of firm performance. When we added the respective two error covariances, the model fit well with the data ($\chi^2 = 494.586$, d.f. = 282; CFI = 0.910; RMSEA = 0.071). We also compared this model with a one-factor one ($\chi^2 = 1558.327$, d.f. = 297; CFI = 0.467; RMSEA = 0.168), The one-factor model had a poorer ($\Delta\chi^2 = 1063.741$, Δ d.f. = 15, $p < 0.001$) fit.

 Insert Table 1 about here

¹ We noted earlier that we collected data on firm performance from two sources. To run CFA, we used the average of corresponding items from both informants.

Hypotheses 1 predicted market turbulence as a moderator in the relationship between interfirm trust and knowledge sharing. First, as shown in Table 2 (Model 1), interfirm trust is positively related to interfirm knowledge sharing ($B = 0.24$, $SE = 0.10$, $p < 0.05$). In addition, Model 2 shows that the interaction between interfirm trust and market turbulence is significant ($B = 0.16$, $SE = 0.06$, $p < 0.01$). Figure 1a shows that the effect of interfirm trust on knowledge sharing is positive when market turbulence is high, but the relationship is slightly negative when market turbulence is low, proving support for hypothesis 1.

Hypothesis 2 proposed that the relationship between formal contract and interfirm knowledge sharing would be moderated by market turbulence. Table 2 (Model 3) shows that formal contract has a direct and significant relationship with interfirm knowledge sharing ($B = 0.24$, $SE = 0.08$, $p < 0.01$). Model 4 also shows that the interaction between market turbulence and formal contract is significant ($B = 0.11$, $SE = 0.05$, $p < 0.05$). Figure 1b shows that the relationship between formal contract and interfirm knowledge sharing is positive when market turbulence is high, but it is flat when market turbulence is low. These results provide support for hypothesis 2.

Hypothesis 3 predicted that organizational innovativeness would moderate the relationship between interfirm knowledge sharing and firm performance. Table 2 (Model 5) shows that interfirm knowledge sharing does not have a significant direct correlation with firm performance ($B = 0.02$, $SE = 0.07$, $p > 0.10$). Model 6 shows that the interaction between organizational innovativeness and interfirm knowledge sharing on firm performance is significant ($B = 0.12$, $SE = 0.06$, $p < 0.05$). Figure 2 shows that the relationship between interfirm knowledge sharing and firm performance is slightly positive when organizational

innovativeness is high, but slightly negative when it is low. Overall, these results provide support for hypothesis 3.

Finally, hypothesis 4 predicted a three-way interaction among interfirm knowledge sharing, organizational innovativeness, and market turbulence on firm performance. Table 2, Model 7, shows that this interaction effect is significant and negative ($B = -0.08$, $SE = 0.04$, $p < 0.05$). In addition, Figure 3 shows that when either both organizational innovativeness and market turbulence or one of these moderators is high, interfirm knowledge sharing is slightly positively related to firm performance; however, when both organizational innovativeness and market turbulence are low, interfirm knowledge sharing is negatively associated with firm performance. Overall, these results provide partial support for hypothesis 4.

 Insert Table 2 and Figures 1a, 1b, 2, and 3 about here

5. Discussion

The role of knowledge sharing within and across firms has been of interest to many researchers. Indeed, prior research has shown that firms engaging in knowledge sharing achieve a competitive advantage over their competitors (Wagner and Bukó, 2005). Despite such an emphasis, there has been little focus on the contingencies under which firms have more or less knowledge sharing, and although prior research has examined the role of knowledge sharing on firm performance, it delivered an inconsistent relationship. In this study, adopting the contingency perspective, we proposed and empirically confirmed that market turbulence is an external environmental contingency factor in moderating the effect of interfirm trust and formal contract on interfirm knowledge sharing. In addition, we investigated the interfirm knowledge sharing-firm performance linkage with organizational innovativeness as a moderator and the

three-way interaction effect of market turbulence, organizational innovativeness, and interfirm knowledge sharing on firm performance.

Consistent with our prediction, the results provide strong support for all the hypotheses. As predicted, market turbulence did moderate the effects of both interfirm trust and formal contracts on knowledge sharing. Market turbulence necessitates firms to share information for minimizing technological obsolescence (Jansen *et al.*, 2006), to “buy-in uncertainty” (Botelho, 2018), and to acquire market capabilities (Zhou *et al.*, 2019). The results suggest that when the market is highly turbulent, adopting either trust or contract mechanisms is instrumental in helping to promote interfirm knowledge sharing. Specifically, consistent with prior research (Chen *et al.*, 2014; Gulati and Nickerson, 2008), we showed that interfirm trust increases firms’ tendency to share information because the presence of trust reduces the cost of conflicts and other transaction costs between partners (Dyer and Chu, 2003). Moreover, our results imply that interfirm trust minimizes information asymmetry (Bell and Zaheer, 2007; Geyskens *et al.*, 1996) as a less formal mechanism (Gulati and Nickerson, 2008), which motivates firms to share more critical knowledge with suppliers. Formal contracts legally bind the firm and the suppliers to share information in an exchange relationship, protecting these two parties’ interests. When both parties have confidence in each other, this facilitates the amount and frequency of sharing knowledge. Consistent with prior studies, the current study also demonstrated that contractual arrangements secured the firms to share valuable information with the suppliers (Schepker *et al.*, 2014) and promote knowledge sharing with suppliers (Ayala *et al.*, 2017).

Our study also demonstrated that trust and contract on knowledge sharing are more complementary than substitutive when interacting with the environment. Previous studies on the effect of trust and contract on knowledge sharing are not conclusive. Some scholars contend that

contracts can be interpreted as a type of distrust (Lumineau, 2014). The active use of contracts may be detrimental to trust because it emphasizes opportunism and potential conflicts (Malhotra and Murnighan, 2002). Other scholars maintain that the effect of trust or contract as an effective mechanism is contingent on other factors, such as the nature of assets involved in alliance collaborations (Hoetker and Mellewigt, 2009). Instead, other scholars proposed combining flexible contracts with trust to achieve a higher knowledge exchange and shared value creation (Schepker *et al.*, 2014). According to our results, both interfirm trust and formal contract exert complementary effects on interfirm knowledge sharing between the firm and its suppliers.

The current study also reinvestigated the role of interfirm knowledge sharing in firm performance. Prior research showed conflicting effects of interfirm knowledge on performance (Gold *et al.*, 2001; Inkpen, 2000). In our study, although there is a positive relationship between interfirm knowledge sharing and firm performance, it demonstrated that the moderation effects of organizational innovativeness and market turbulence are equally essential. Specifically, while interfirm knowledge sharing positively affected firm performance, the effect is contingent on organizational innovativeness. That firm's internal climate of supporting innovative attempts and tolerating failure is critical to absorbing and transforming knowledge into executable organizational outcomes. Our study demonstrated that the firm needs to cultivate an internal organizational climate of innovativeness, which is critical to supporting solid organizational learning. Knowledge recipients' ability and motivation to absorb and share knowledge are, thus, keys to successful knowledge sharing (Zahra and George, 2002).

Finally, we argued that the effect of interfirm knowledge sharing on firm performance is contingent on the interactions of organizational innovativeness and market turbulence. Specifically, when a firm is in a stable market and its organizational climate is not set towards

sponsoring innovativeness, conducting more knowledge sharing would be detrimental to firm performance. Our study extends the finding of Liu et al. (2021) that high market turbulence can create opportunities for firms with low organizational innovativeness because they can catch up quickly through more knowledge sharing. Finally, surprisingly when firms are adept at organizational innovativeness and are embedded with high market turbulence, they do not benefit much from knowledge sharing. A possible reason is that firms with high organizational innovativeness may divert the knowledge transfer to an outward direction, which causes the knowledge to flow to partnering firms unidirectionally and quickly under turbulent environments (Caner *et al.*, 2014). These phenomena are particularly intriguing given mixed results in prior research. For example, Zhang et al. (2019) found an inverted U-shaped relationship between R&D alliance networks and innovative performance. Moreover, Lin (2007) concluded that no clue is drawn from the role of knowledge sharing in innovation performance. However, researchers (Darroch, 2005; Dyer and Nobeoka, 2000; Spencer, 2003) found positive relationships between knowledge sharing and performance that firms might share knowledge with partners at a moderate to a high level. While these are possible explanations, our study provides a new explanation of the relationship between interfirm knowledge sharing and firm performance from the contingency perspective.

5.1 Theoretical implications

Overall, in the current study, we shed light on previous literature in several aspects. First, this study extends our understanding of the knowledge sharing literature. Specifically, interfirm knowledge sharing provides a potential mechanism of linking a formal contract and interfirm trust to firm performance. Our study uses a firm-supplier context and assesses the interfirm knowledge sharing effect across two firm boundaries, focusing on deepening the understanding

of the embeddedness of knowledge sharing. Thus, we responded to research calls on investigating the complex dynamics of interfirm knowledge sharing, clarifying when interfirm trust/formal contracts are critically important. We exhibited that market turbulence acts as a necessary external contingency for knowledge sharing and transits knowledge sharing to firm performance. Alternatively, organizational innovativeness serves as another salient internal contingency in determining the benefits of knowledge sharing.

Second, this study enriches knowledge sharing studies on clarifying the inconsistent relationship between interfirm knowledge sharing and firm performance. Given that the central goal of firms in knowledge sharing is to achieve a competitive advantage in the form of firm performance, our results “completed” the research model by answering the question of “so what?” on identifying internal (organizational innovativeness) and external (market turbulence) contingency condition of linking interfirm knowledge sharing to firm performance. This study was also motivated by the central yet conflicting role of knowledge sharing in influencing firm performance (Zhang et al. 2019). As such, our findings indicate that the relationship between interfirm knowledge sharing and firm performance cannot be interpreted solely on its correlation. Rather, this relationship largely depends on the three-way interactions of external environmental factors and the internal innovation climate as well as interfirm knowledge sharing.

Third, the current study used contingency theory to untangle why and which internal and external contingencies firms need to consider to strengthen the beneficial relationship between knowledge sharing and firm performance. Particularly, market turbulence is regarded as an external contingency which has been rarely considered in the past knowledge sharing studies.

5.2 Practical implications

Our study also provides practical implications for the firm's knowledge sharing, offering a new and valuable perspective for firms to manage the knowledge flow in their supplier relationship. To achieve the ultimate firm performance, managers should coordinate knowledge sharing based on external market conditions and find the best "fit" of the environment to the firm's internal climate. This "fit" is crucial because our study shows that matching contingencies on a firm's external environment and internal organizational innovativeness climate directly affect firm performance. We solve the dilemma between the positive effect of knowledge sharing and the negative effect of knowledge spillover by exploring organizational innovativeness as an essential internal impetus. To maintain a positive linkage between interfirm knowledge sharing and firm performance, managers of firms need to focus on building a favorable internal innovation climate and paying attention to the changing external market conditions. An innovative firm can take better advantage of the knowledge shared with both buyers and suppliers. In addition, it is shown that interfirm trust can enhance interfirm knowledge sharing in turbulent markets. Hence, it is strongly advised that managers should make greater efforts in building interfirm trust and strengthening their firm's trusting relationships with both buyers and suppliers, especially in turbulent environments. As a result, both buyers and suppliers are more likely to share much-needed, invaluable knowledge in turbulent environments. Finally, it is found that a formal contract is equally important for interfirm knowledge sharing in a turbulent environment. Therefore, it is highly recommended that in turbulent environments, managers should not only build and maintain trust with both buyers and suppliers but also need to work out a formal contract diligently and avoid legal loopholes whenever possible. Consequently, with a trusting relationship aided by a formal contract, much-needed knowledge would be forthcoming in a smooth manner in turbulent environments.

5.3 Research limitations

Our study is not without limitations. First, we collected data from one country where we believe that market turbulence is generally higher than in a more mature market. Researchers may collect data from other emerging markets to allow for either model validation or cross-market comparisons. Second, this is cross-sectional data that may fail to explain how interfirm trust and formal contract indirectly explain firm performance over time. Finally, the proposed model is tested in a collectivistic society where different cultures may influence how a firm communicates or shares knowledge with key suppliers (Chang *et al.*, 2021).

5.4 Future directions

First, other necessary contingencies (e.g., explicit and tacit knowledge sharing) may also exist in the linkages of relational mechanisms. It may be valuable to examine whether the effects of knowledge sharing will similarly help us understand the drivers of interfirm knowledge sharing. Second, our study focuses on knowledge sharing in the context of the firm-supplier relationship. The contingency effect may change in another collaborative context, such as alliances with competitors. For example, firms may seek to establish knowledge-sharing connections based on their partner's strategic values (Inkpen, 2000). Future studies may replicate our findings in such a relationship. Third, although the two moderating factors (market turbulence and organizational innovativeness) are critically important, we also encourage future studies to investigate other potential moderators (e.g., organizational culture, communication systems, incentives and motivations).² For example, organizational culture may be a constraining factor because organizational culture may influence how much a firm can invest in organizational innovativeness. Similarly, motivation may affect the intensity of a firm to share

² We thank an anonymous reviewer for this suggestion.

proprietary information with its leading suppliers because this may help the suppliers to get an updated market information.

6. Conclusion

Interfirm knowledge sharing is a complex activity that requires closer attention to its role as a link between interfirm trust/formal contract and firm performance. The current study strives to show the contingency effects of market turbulence and organizational innovativeness in the firm-supplier relationship. Specifically, the study demonstrated that the effects of both informal trust and formal contracts on knowledge sharing were stronger when market turbulence was high. Similarly, the effect of knowledge sharing on firm performance was positive when organizational innovativeness was high. The three-way interaction among knowledge sharing, market turbulence, and organizational innovativeness shows that knowledge sharing leads to lower performance when both contingency factors were low. This study shows how incentivizing knowledge sharing activities needs to match with a firm's internal innovative capabilities under various external market conditions. As a result, firms need to consider external and internal constraints before they share knowledge with suppliers with the goal of creating positive firm performance. This study extends prior research on the determinant of knowledge sharing but also clarifies the past inconsistent findings on the effect of knowledge sharing on firm performance. Thus, organizational strategists (leaders) need to pay attention to when they need to share information with suppliers to benefit more from such collaborations.

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Tables and Figures

Table 1 Descriptive statistics of the studied variables (N=156)

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Firm Age	8.43	0.91	1																	
2. Firm Size	3.13	0.48	0.06	1																
3. Total Sales	3.86	1.20	0.2	0.35	1															
4. R&D Intensity	-3.79	2.45	0.05	0.05	-0.12	1														
5. Procedural Fairness	5.79	1.06	0.07	0	0.01	0.15	1													
6. Ownership: SOE	0.04	0.21	-0.06	0.08	-0.03	0.11	-0.05	1												
7. Ownership: Collective	0.04	0.19	0.05	0.05	0	0.01	0	-0.04	1											
8. Ownership: Joint Venture	0.11	0.31	0.16	0.12	-0.12	0.1	-0.01	-0.08	-0.07	1										
9. Ownership: Subsidiary	0.05	0.22	0	0.16	0.06	0.04	-0.14	-0.05	-0.05	-0.08	1									
10. Industry: Textile	0.17	0.37	0.13	0.2	0.1	-0.06	0.02	-0.1	0	-0.05	-0.1	1								
11. Industry: Automotive	0.21	0.41	-0.01	-0.14	0.15	0.01	0.15	-0.04	-0.1	-0.03	0.02	-0.23**	1							
12. Industry: Chemical	0.12	0.32	0.14	0.04	0.07	0.06	0.05	0.02	-0.07	-0.06	0.01	-0.16*	-0.19	1						
13. Industry: Electronic	0.08	0.27	-0.11	-0.05	0.01	0.04	0.02	-0.06	-0.06	-0.02	0.04	-0.13	-0.15	-0.1	1					
14. Market Turbulence	4.67	1.38	0.09	-0.01	-0.1	0.21**	0.18*	-0.04	0.02	0.06	-0.03	0.22**	-0.07	-0.16*	-0.08	1				
15. Interfirm Trust	5.55	1.03	0.05	-0.01	0.16*	0.01	0.53**	-0.01	0.08	-0.04	-0.1	-0.02	0.15	0.05	-0.13	0.14	1			
16. Formal Contract	5.55	1.27	-0.05	-0.01	0.13	0.2*	0.4**	0.1	-0.06	0.01	-0.09	-0.03	0.24**	-0.03	-0.07	0.17*	0.46**	1		
17. Org. Innovativeness	5.20	1.09	-0.07	0.05	-0.02	0.33**	0.43**	-0.03	0.01	-0.03	-0.18**	0.05	0.09	0.04	0.07	0.39**	0.33**	0.42**	1	
18. Knowledge Sharing	4.87	1.22	-0.02	-0.02	-0.21**	0.26**	0.39**	0.08	0.11	0.06	0	-0.02	0.11	-0.06	0.03	0.43**	0.3**	0.35**	0.4**	1
19. Firm Performance	5.24	1.02	-0.03	-0.02	0.09	0.23**	0.32**	0.02	-0.01	-0.04	-0.04	0	0.17	0.05	-0.01	0.14	0.43**	0.41**	0.36**	0.17*

*Correlations is significant at the 0.05 level (two-tailed).

**Correlations is significant at the 0.01 level (two-tailed).

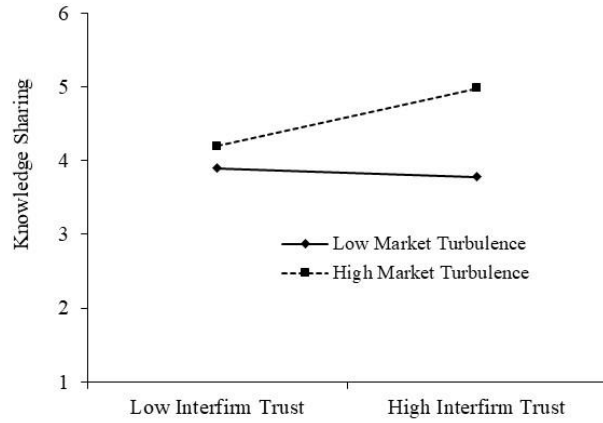
Source: Author's analysis

Table 2 Regression of contingencies for interfirm knowledge sharing and firm performance

	Interfirm Knowledge Sharing								Firm Performance					
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	B	S.E.	B	S.E.	B	S.E.	B	S.E.	B	S.E.	B	S.E.	B	S.E.
Firm Age	-.01	.10	-.06	.09	.02	.10	-.05	.10	-.11	.09	-.11	.09	-.07	.09
Firm Size	.12	.21	.13	.19	.12	.21	.17	.19	-.13	.19	-.17	.16	-.14	.18
Total Sales	-.26**	.09	-.24**	.08	-.27**	.08	-.23**	.08	.11	.08	.12	.08	.11	.08
R&D Intensity	.08*	.04	.04	.03	.06	.04	.04	.04	.08*	.03	.07*	.03	.08*	.04
Procedural Fairness	.30**	.10	.28**	.09	.32***	.09	.27**	.08	.25**	.08	.21*	.08	.20*	.09
Ownership: State-Owned Enterprise	.53	.43	.57	.39	.41	.43	.50	.39	.11	.39	.14	.38	.22	.38
Ownership: Collective	.73	.46	.84	.42	.89	.46	.73	.42	.07	.42	.08	.41	.16	.41
Ownership: Joint Venture	.17	.30	.10	.27	.14	.29	.11	.27	-.01	.27	.05	.26	-.01	.26
Ownership: Subsidiary	.42	.41	.37	.37	.45	.40	.45	.37	-.02	.37	.07	.37	.12	.37
Industry: Textile	.18	.26	-.07	.24	.14	.26	-.01	.24	.17	.24	.09	.23	.02	.23
Industry: Automotive	.35	.25	.43	.22	.25	.24	.40	.23	.30	.22	.24	.22	.22	.22
Industry: Chemical	-.11	.30	.19	.27	-.08	.29	.17	.27	.22	.27	.12	.26	-.04	.28
Industry: Electronic	.40	.35	.47	.32	.34	.34	.41	.32	-.03	.31	-.17	.31	-.18	.31
Interfirm trust (IfT)	.24*	.10	.16 ⁺	.09										
Market turbulence (MT)			.27***	.06			.27***	.07					.05	.07
IfT * MT			.16**	.06										
Formal contract (FC)					.24**	.08	.21**	.07						
FC * MT							.11*	.05						
Interfirm Knowledge sharing (IfKS)									.02	.07	-.03	.08	.03	.08
Organizational Innovativeness (OIn)											.20*	.09	.22**	.09
IfKS * OIn											.12*	.06	.07	.07
IfKS * MT													.06	.05
OIn * MT													.07	.07
IfKS * OIn * MT													-.08*	.04
<i>R</i> ²	.30		.43		.32		.44		.18		.23		.27	
<i>Adjusted R</i> ²	.23		.37		.25		.37		.09		.14		.16	
<i>F</i> statistics	4.27***		6.67***		4.64***		6.71***		2.14*		2.64**		2.51***	

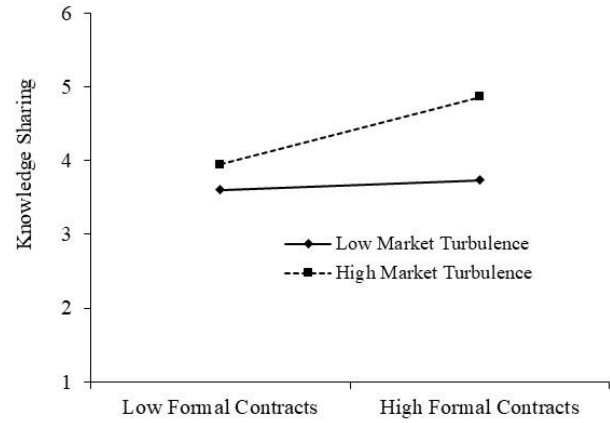
Source: Author's analysis

Figure 1a The moderating role of market turbulence on the relationship between interfirm trust and interfirm knowledge sharing



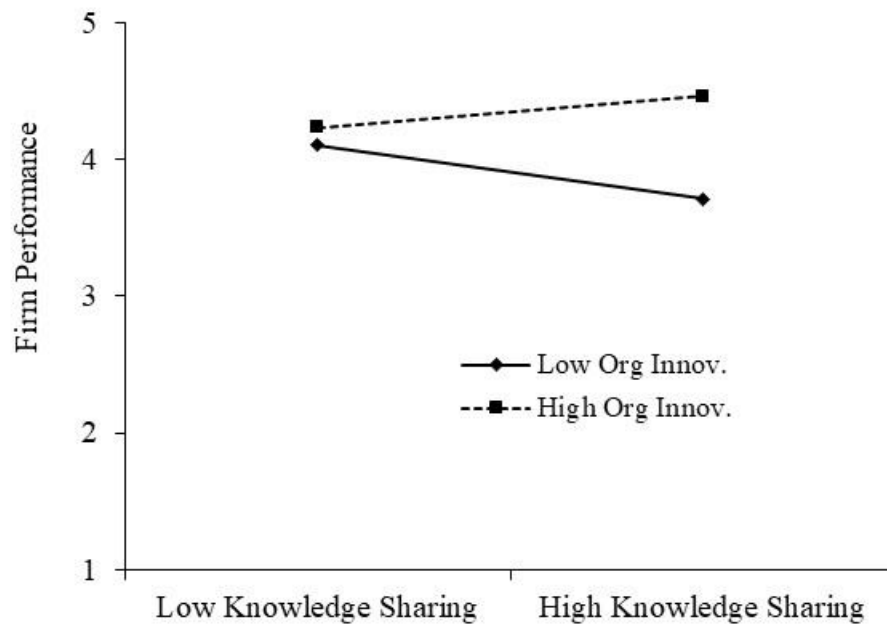
Source: Author's analysis

Figure 1b The moderating role of market turbulence on the relationship between formal contracts and interfirm knowledge sharing



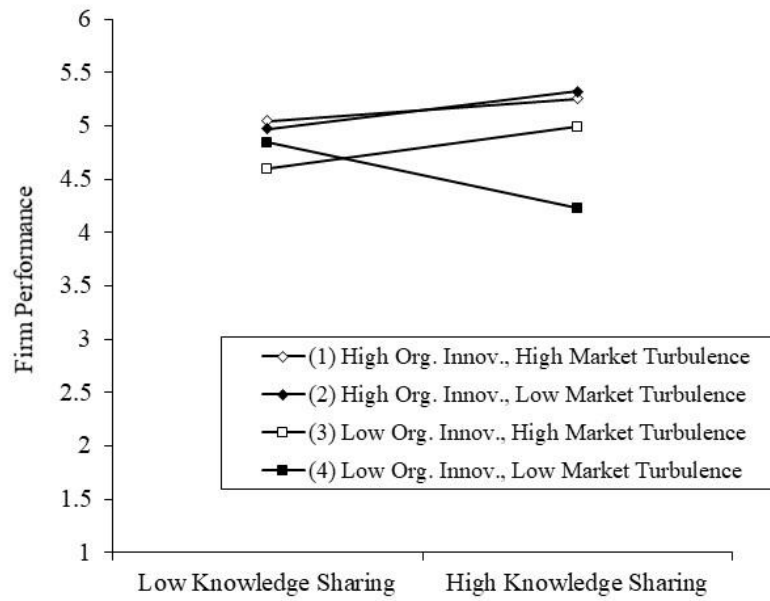
Source: Author's analysis

Figure 2 The moderating role of organizational innovativeness on the relationship between interfirm knowledge sharing and firm performance



Source: Author's analysis

Figure 3 Three-way interaction effect of interfirm knowledge sharing, organizational innovativeness and market turbulence on firm performance



Source: Author's analysis

Appendix. Scale items

Interfirm trust

Li et al. (2010)

1. This supplier is trustworthy.
2. This supplier has always been evenhanded in its negotiation with us.
3. This supplier never uses opportunities that arise to profit at our expense.

McEvily and Marcus (2005)

4. This supplier does not mislead us.
5. This supplier keeps its word.

Formal contract

Liu et al. (2009)

1. We have specific, well-detailed agreements with our main suppliers.
2. We have customized agreements that detail the obligations of both parties.
3. We have detailed contractual agreements specifically designed with our main suppliers.
4. Overtime we have developed ways of doing things with this supplier that never need to be expressed contractually or formally.

Market turbulence

Jaworski and Kohli (1993)

1. In our kind of business, customers' product preferences change quite a bit over time.
2. Our customers tend to look for new product all the time.
3. We are witnessing demand for our products and services from customers who never bought them before.
4. New customers tend to have product-related needs that are different from those of our existing customers.
5. We cater to many of the same customers that we used to in the past.

Organizational innovativeness

Bock et al. (2005)

1. Our company encourages suggesting ideas for new opportunities.
2. Our company puts much value on taking risks even if that turns out to be a failure.
3. Our company encourages finding new methods to perform a task.

Fey and Birkinshaw (2005)

4. In this company, there is a great openness to picking up ideas from outside.

Interfirm knowledge sharing

Malhotra et al. (2005)

1. We share proprietary information with our main suppliers.
2. We share confidential information with our main suppliers.
3. We share information with our main suppliers that is not available from other sources

Firm performance

Tippins and Sohi (2003)

Our firm's overall performance compared with major competitors over the past year on:
sales growth rate;
market share growth;
the growth rate of profit; and
return on investment.

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