How to Improve Firm Performance by Balancing Innovation Orientations of Exploration and Exploitation? Moderating Effects of Cluster Relationships

Zhendong Li  
Hangzhou Dianzi University  
School of Management  
lizhendong@hdu.edu.cn

Marina Yue Zhang  
Swinburne University of Technology  
Swinburne Business School  
myzhang@swin.edu.au

Huiying Zhang  
Tianjin University  
College of Management and Economics  
hyzhang@tju.edu.cn

Abstract

We argue that an inverted U-shaped correlation exists between a firm’s balance of exploration versus exploitation innovation orientations and its growth performance. Further, we posit that for a firm in an industry cluster in geographic proximity, this U-shaped correlation can be moderated by its cluster relationships. We test these hypotheses in a survey of 638 innovation-intensive SMEs in four industry clusters in China. Our empirical study confirms an inverted U-shaped correlation. We also find that the number and strength of a firm’s cluster relationships positively influence this correlation: the former by enhancing its exploratory innovation capability, and the latter its exploitative innovation capability. Our research contributes to the discourse on firms’ balanced innovation orientations and performance by considering the influence of cluster relationships. Our study suggests to innovation-oriented SMEs appropriate innovation balancing strategies to enhance firm performance by working on the number or strength of their cluster relationships.
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ABSTRACT

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Keywords: balance of innovation orientations; exploration; exploitation; firm performance; cluster relationships; number of cluster relationships; strengthen of cluster relationships
INTRODUCTION

There are two innovation orientations: exploration and exploitation, and they each contribute to firm performance in different ways. Exploitative orientation, incremental in nature, can contribute to firms’ current growth, by refining, improving and extending their existing technological assets and innovation competence, whereas exploratory orientation, largely uncertain and risky, may contribute to firms’ future growth by experimenting with novel technology, knowledge and competence for radical breakthroughs (Benner & Tushman, 2002; Benner & Tushman, 2003; Rowley, Behrens, & Krackhardt, 2000). To sustain viable growth, firms need to have both innovation orientations in their innovation strategy.: exploratory and exploitative innovations are complementary in each other’s effect on firm performance (Bauer & Leker, 2013; Gupta, Smith, & Shalley, 2006). However, they are vastly different in their strategic focus and inevitably compete for limited organizational resources, and thus, have competing effects on firm performance (Benner & Tushman, 2002; Benner & Tushman, 2003; He & Wong, 2004). To maximize growth, firms need to find an optimal balance to strengthen the complementary effects but mitigate the competing effects between the two. However, ow to balance these two orientations remains a managerial challenge for firms, especially those facing scarce resource conditions.

Research has confirmed that the relationship between firms’ innovation balance and their growth performance is not linear (e.g., Gupta et al., 2006). There are many internal and external factors that can influence this relationship (Huang, Ding, & Chen, 2014). For example, firm-specific factors, such as market orientation (Atuahene-Gima, 2005; Kyriakopoulos & Moorman, 2004), resource endowment (Jansen, van Den Bosch,
Volberda, 2006; Lubatkin, Simsek, Ling, & Veiga, 2006), firm scope (Gibson & Birkinshaw, 2004; Lubatkin et al., 2006; McNamara & Baden-Fuller, 2007), firm’s technology diversity (Quintana-García & Benavides-Velasco, 2008), and firm age (Coad, Segarra, & Teruel, 2016), have been identified as having moderating effects on a firm’s innovation balance and performance. Contextual factors, such as the speed of change (Levinthal & March, 1993), and the intensity of competition (Lewin, Long, & Carroll, 1999) have also been identified as moderators for this relationship. Recent literature has recognized the role played by inter-firm factors, such as structural features of collaborative networks (Gilsing, Nootbooom, Vanhaverbeke, Duysters, & van den Oord, 2008), and firms’ positions in networks, in this relationship. However, little effort has been dedicated to understanding the role of firms’ cluster relationships on their innovation balance and performance.

Firms, especially those in technology-intensive industries, hardly operate in isolation; they are often in industry clusters forming complementary industry value chains. An industry cluster is a collection of firms that operate in related industries (Arikan, 2009), and sometimes in geographic proximity (Bell & Zaheer, 2007). It is not clear how cluster firms benefit from their cluster relationships to improve their innovation balancing strategy and performance. In this research we aim to investigate whether there exists an optimal balance point between exploratory and exploitative innovations at which a cluster firm may maximize its performance, and, if so, how the firm’s cluster relationships influence this relationship.

A firm’s innovation capability is largely determined by the structure of its knowledge base (Grant, 1996; Leonard & Sensiper, 1998). In recent decades, a rapidly changing external environment (e.g., modularization of production and globalization of value chains) has forced
firms to expand their knowledge bases, across firm boundaries, as it has become increasingly challenging for any firm to rely on its own resources for innovation (McCann & Folta, 2011). Firms located in industry clusters have unique opportunities in relation to acquiring external knowledge. In fact, cluster firms actively source external knowledge from their cluster networks and alliances to stay innovative (Hernández-Espallardo, Sánchez-Pérez, & Segovia-López, 2011; Stadler, Rajwani, & Karaba, 2014; Tripsas, 1997). Knowledge acquisition in clusters is especially important for small and medium-sized enterprises (SMEs), which heavily rely on their inter-organizational links, especially in geographic proximity, for innovation (Edwards, Delbridge, & Munday, 2005). Indeed, a cluster ‘membership’ helps cluster firms have access to new information, ideas, and opportunities (McEvily & Zaheer, 1999), acquire new knowledge and build innovation capability (Britton, 2003; Stadler et al., 2014). However, not only firm’s cluster membership, but also the location and embeddedness of a firm in clusters can have profound impact on its knowledge acquisition and innovation capability (Boschma, 2005; Giuliani, 2007; Gnyawali & Srivastava, 2013). Growing evidence has suggested that a firm can benefit from its relationships in a cluster of related firms for innovation (Fang, Lee, & Schilling, 2010; McCann & Mudambi, 2005; Schilling & Phelps, 2007). However, opinions differ on how firms’ cluster relationships influence their knowledge acquisition and innovation capability building.

Our study is motivated by the need to address these unresolved issues in relation to firms’ performance under a balanced innovation strategy, and the roles played by their cluster relationships. We investigate these issues using survey data of 638 innovation-intensive SMEs located in four industry clusters in Tianjin, China. The results of our study support our
hypotheses. That is, there exists an inverted U-shaped correlation between a firm’s innovation balance and its performance, and this relationship is moderated by the firm’s cluster relationships: the number of a firm’s cluster relationships positively influences this relationship by increasing the firm’s exploratory innovation capability, while the strength of its cluster relationships positively influences this relationship by enhancing the firm’s exploitative innovation capability.

This paper contributes to the ongoing discussion about firms’ balance of exploration and exploitation innovation orientations and performance in two ways. First, by unpacking the impact of different attributes of cluster relationships (number vs. strengthen of relational ties) on firms’ innovation balance and performance, this paper adds to the exploratory/exploitative innovation literature by examining the effects of cluster network ties on the balancing strategy that drive firms’ innovation orientation and performance. As suggested by Stadler et al. (2014), this point deserves more academic attention. Second, our research provides empirical evidence on how SMEs in clusters manage their cluster relationships with other cluster firms to improve their innovation balancing strategy and performance.

The rest of the paper is organized as follows. In the next section, we review relevant literature and develop hypotheses. In the Methods section, we outline the procedures of sampling and data collection, and define the variables used in this study. Our data analysis is presented in the Results section. In the Discussion section, we elaborate the theoretical and practical implications of the results. We conclude the paper by summarizing its key findings, limitations and suggestions for future research.
LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The balance between exploratory and exploitative innovation and firm performance

Since the concepts of exploration versus exploitation were introduced in organizational learning (March, 1991), many scholars have examined their applications in other management fields, such as knowledge sourcing, strategic alliances, capability building, organizational adaptation, new market development and technological innovation (e.g., Atuahene-Gima, 2005; He & Wong, 2004; Katila & Ahuja, 2002; Lavie & Rosenkopf, 2006; Tushman & O'Reilly, 1996). According to March (1991), exploration includes activities captured by terms such as ‘search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation’, and exploitation encompasses activities defined as ‘refinement, choice, production, efficiency, selection, implementation, and execution’. From these differences, we can see that exploration and exploitation represent two orientations in innovation activities: the former is used in experimenting with novel technologies and knowledge for developing new products, markets or sales channels, in order to create opportunities for future growth, and the latter is often used in refining, improving and extending existing technologies, products and markets, in order to sustain existing performance (Jansen et al., 2006; He & Wong, 2004). Nevertheless, both innovation orientations, though they require different organizational resources and capabilities, contribute to firm growth in different ways (Jansen et al., 2006). In other words, if a firm relies on exploitative innovation without investment in exploration of the unknown, it may fail to survive when faced with technological discontinuity. Vice versa, if a firm relies on exploratory innovation without paying attention to exploitation of what is already known, it may sacrifice profits from its existing technological assets (Benner & Tushman, 2002; Floyd & Lane, 2000; Gupta et al., 2006).
An increasing number of innovation studies have recognized that firms need to achieve a balance between exploration and exploitation to not only sustain current, but also create opportunities for future, growth (e.g., Cao, Gedajlovic, & Zhang, 2009; He & Wong, 2004; Uotila, Maula, Keil, & Zahra, 2009). However, scholars are divided on how to achieve this goal (e.g., Boumgarden, Nickerson, & Zenger, 2012). For example, one stream of research argues that there exist complementary effects between exploratory and exploitative innovations (Cao et al., 2009; He & Wong, 2004), and that co-investment in the two may mutually reinforce each other’s performance (Benner & Tushman, 2003; He & Wong, 2004). The logic behind this argument is that firms need exploration to increase the chances of technological breakthroughs, which provides directions for firms in their exploitation; and improvement on efficiency and productivity through exploitation helps firms accumulate sufficient and necessary knowledge for exploratory innovation. Organizational scholars propose that structural or behavioural separation – an ambidextrous organization – may enable firms to manage these two types of innovation simultaneously to benefit from their complementary effects (Gibson & Birkinshaw, 2004; Jansen, Volberda, & van Den Bosch, 2005; Lavie & Rosenkopf, 2006). However, this perspective fails to recognize the competing effects between the two, given that most firms operate with limited resources and within constrained technological and organizational boundaries (Rothaermel & Alexandre, 2009). Due to conflicting demands for limited organizational resources, trade-offs between exploratory and exploitative innovations can lead to reduced effectiveness of any ambidextrous mechanisms and, hence, weakened firm performance (Jansen et al., 2006; Lavie & Rosenkopf, 2006; Raisch, Birkinshaw, Probst, & Tushman, 2009). This problem is even
more severe for SMEs as they often encounter resource constraints (Herrera & Sánchez-González, 2013). Furthermore, SMEs may not have the necessary hierarchical administrative systems to afford, let alone manage, the structural or behavioural separation of ambidexterity (Lubatkin et al., 2006; Sinha, 2015).

To overcome the challenge posed by the aforementioned competing effects, another stream of research posits a temporal or systemic separation (a punctuated equilibrium model) to manage the tension between exploratory and exploitative innovations. This type of mechanism helps firms, particularly those operating under conditions of severe resource scarcity but with high-level organizational flexibility, manage exploration and exploitation sequentially by employing one innovation orientation at a time in response to the firms’ internal and external conditions (Burgelman, 2002; Gupta et al., 2006; Mudambi & Swift, 2011). In other words, when a firm concentrates its limited resources on one orientation at a time and shifts to the other with ease and relatively low switching costs when conditions change, it is more likely to improve firm performance. This mechanism is particularly effective for SMEs (Lubatkin et al., 2006; Sinha, 2015). However, this view does not give enough consideration to the benefits of complementary effects of the two; nor do they discuss the implications of applying the model in resource abundant but less flexible organizations.

It seems that there is consensus in the literature that sustainable high performance requires firms to balance the two innovative orientations, but more and more evidence suggests that the relationship between innovation balance and performance is complex and dynamic (Rothaermel & Alexandre, 2009; Uotila et al., 2009). In fact, scholars have recognized that the dynamic interplays of exploratory and exploitative innovations have
profound impacts on firm performance, depending on the specificities of firms’ internal resources and external competitions (Gupta et al., 2006). Ultimately, to enhance a firm’s performance by balancing the two innovation orientations it is necessary to maximize the effects of their interplays (enhancing the complementary but mitigating the competing effects). If a firm leans too much towards one innovation orientation, neglecting the other, it will lose the benefits of the complementary effects. On the flip side, if a firm adopts both innovation orientations equally, the two orientations will compete severely against each other, offsetting the complementary effects. Both of these scenarios will reduce firm performance. Hence, there could exist an optimal balancing point between the firm’s exploratory innovation (ER) and exploitative innovation (EI) at which its performance can be maximized. This suggests that the relationship between a firm’s balance of innovation orientations and performance could be an-inverted U-shaped curve. We use \((ER-EI)/(EI+ER)\) to represent the balance between the two innovation orientations and put forward the following hypothesis:

**H1.** An inverted U-shaped correlation exists between a firm’s balance of ER vs EI and its performance. That is, when the innovation balance \([(ER-EI)/(EI+ER)]\) changes between -1 and 1, the firm performance first goes up and then goes down.

**Moderating effects of cluster relationships**

There are many factors that can influence firms’ innovation balance and performance. For firms in technology related industries, to stay competitive in technological development and innovation capability, they often actively seek information and knowledge from external networks (Collins & Smith, 2006; Phelps, 2010; Srivastava & Gnyawali, 2011). Innovation, be it exploration or exploitation, is a process by which firms develop new knowledge and other intangible assets. A firm’s knowledge acquisition through cluster relationships can be
defined as the firm’s ability to make sense of and integrate acquired information or ideas through formal and informal interactions with other cluster firms, and then translate them into a firm-specific knowledge base. Thus, firms may increase their innovation capability by building relationships with other firms in external networks. In fact, the networks from which a firm can source its external knowledge become an important asset for technology firms to stay innovative (Bell, 2005; Tripsas, 1997).

Firms acquire knowledge for innovation from external networks through direct links such as partnerships, tightly-coupled sources such as new product development alliances, or loosely-coupled sources such as by joining industry associations or consortia (Dai, Goodale, Byun, & Ding, 2018). Industry clusters are one critical network from which firms can acquire relevant knowledge and, thus, develop innovation capability. The network relationships among cluster firms in industry clusters are similar to those described by Dai et al. (2018). In fact, due to geographic proximity and/or industry relatedness of clusters, network relationships in industry clusters can be more beneficial for cluster firms, as such firms are more likely to build direct or indirect links with others within the clusters, and acquire relevant information, ideas, and knowledge for innovation (Pouder & Caron, 1996). In fact, empirical evidence has suggested that cluster relationships can increase cluster firms’ awareness of new technological trends and motivation to innovate (Gnyawali & Srivastava, 2013), and hence, improve firm performance (McCann & Folta, 2011).

The reason that firms can benefit from their networks/clusters is that network relationships may increase the scope of a firm’s search for new knowledge, and increase the depth by which it uses or reuses its existing knowledge (Katila & Ahuja, 2002). As Ozer and
Zhang (2015) argue, a firm’s cluster membership and relationships with other firms may determine its knowledge sources and, thus, innovation capability. In recent decades, aspects of cluster relationships, such as inter-firm learning, knowledge flows, technological collaboration and sharing, and network structures, have been identified as factors influencing cluster firms’ innovation performance (Inkpen & Wang, 2006; Sammarra & Biggiero, 2008; Zhou & Li, 2012). Different innovation activities demand different knowledge bases and innovation capabilities (Tödtling, Lehner, & Kaufmann, 2009). On the flipside, different network relationships may help firms develop different knowledge bases and innovation capabilities. However, how such network relationships contribute to a firm’s innovation capability building and, thus, performance, remains understudied, with a few exceptions. For example, Schilling and Phelps (2007) argue that firms embedded in alliance networks with high clustering (scope) and high reach (quality) in clusters have greater potential to increase their exploratory innovation than those without such alliances. In contrast, Ozer and Zhang (2015) suggest that cluster memberships enhance firms’ exploitative product innovation but may hinder their exploratory innovation.

Though there are inconsistencies in the conclusions about the effect of network relationships on innovation orientation and performance, two attributes of network relationships are commonly used to study this phenomenon: relational breadth and relational depth (Wasserman & Faust, 1994). In this study, we examined the roles of cluster networks by their relational breadth and relational depth on the relationship between firms’ innovation balance and performance. As Lin et al. (2016) point out, inter-organizational partnerships increase the scope but not the depth that a firm might acquire knowledge from its network.
Indeed, a firm with more network ties may expand the scope of its access to new information, knowledge and technology, which, as a consequence, may encourage exploratory innovation. Hence, the number of a cluster firm’s dyadic network ties with other cluster firms measures its relational breadth, which has a direct impact on the scope of the firm’s heterogenous knowledge resources (e.g., Arikan, 2009; Stuart, 2000).

From the perspective of cluster location, the more central it is in the cluster, the more network relationships a cluster firm has within a cluster; the centrality of its location, hence, may enable the firm to acquire more knowledge, and enhance its innovation performance (Bell, 2005; Tripsas, 1997). McCann and Folta (2011) explain that when a firm is located in a structural hole (centre) of a network, enabling the firm the potential to develop more alliance partners (increasing the number of network ties), it has a higher chance to improve its performance on exploratory innovation. These studies all suggest that there exists a positive correlation between a firm’s relational breadth (number of network ties) in a cluster and its propensity to acquire heterogeneous knowledge. In other words, the more network relationships a firm has, the more it can acquire heterogeneous resources, which may be conducive to its innovation performance in exploring unknowns and improve firm performance (Fiol, 1995; Phelps, 2010; Rodan, 2002; Rodan & Galunic, 2004; Srivastava & Gnyawali, 2011). Hence, we posit the following hypothesis.

**H 2a.** The larger the number of network ties a cluster firm has with other cluster members, the more its optimal innovation balance skews toward exploratory innovation orientation, and the higher the firm’s performance. In other words, the number of network ties a cluster firm has within a cluster positively moderates the inverted-U curve between the innovation balance and firm performance by moving the curve in an upper right direction.
Rowley et al. (2000), on the other hand, suggest that not just the breadth, but the depth of network ties, within a cluster, can also impact a firm’s innovation capability and performance. The depth of a cluster firm’s network ties with other cluster members measures its relational strength, and the stronger a relationship, the more likely the firm will develop deep level closeness, reciprocity and indebtedness with its relationship partners (Granovetter, 1973), which may lead to information sharing, especially exchange of tacit knowledge (Leonard & Sensiper, 1998). The reason for this is that strong relationships enable cluster firms to develop deep and concentrated networks, isolated from the influence of industry norms, status quo of industry knowledge and dominant technology (even just temporarily) (Ahuja, 2000; Burt, 2004; Burt, 2009; Schilling & Phelps, 2007). For example, von Hippel’s (1987) research suggests that frequent informal information exchange between a firm and its partners, and even its rivals, can facilitate further development and improvement of its existing products. Madhavan et al. (2004) confirm that strengthened cluster relationships can contribute to a firm’s endogenous creativity which contributes to its exploitation of existing technology, and improved firm performance.

While deep relationships between cluster firms enable them to acquire informal information and tacit knowledge from one another, the closeness in cluster relationships may lead to high levels of homogeneity in their knowledge structures and innovation activities (e.g., product design and production process) (Bell & Zaheer, 2007). In an industry cluster, most firms are in related product families or on related value chains, and their knowledge bases are related and, to a large extent, similar. When a firm’s cluster relationships with other cluster members are strengthened, it is likely that the firm increases homogeneous resources.
for knowledge (Sen & Egelhoff, 2000). This situation is especially true when a small number of firms in cluster relationships create narrow but robust circulations of existing knowledge among themselves, which may fence away external (heterogeneous) influences (Ozer & Zhang, 2015; Sen & Egelhoff, 2000). Indeed, deep cluster relationships often result in knowledge overlapping among cluster firms (Pouder & Caron, 1996). Therefore, cluster firms with deep cluster relationships are more likely than those without such relationships to actively seek common grounds for cooperation through strong network ties, which may lead to further convergence of their product designs and other innovation activities (Jansen et al., 2006). Homogenous knowledge and innovation activity may lead such cluster firms to avoid risk and engage in exploitative, rather than exploratory, innovation. This is to say that the stronger a firm’s cluster relationships, the more likely it will have more exploitative innovation activity, through the accumulation of homogenous knowledge. Thus, we posit the following hypothesis.

\[ H \ 2b. \ The \ stronger \ a \ firm’s \ cluster \ relationships, \ the \ more \ likely \ its \ innovation \ balance \ skews \ toward \ exploitative \ orientation, \ and \ the \ higher \ the \ firm’s \ performance. \ In \ other \ words, \ the \ strength \ of \ a \ firm’s \ network \ ties \ positively \ moderates \ the \ inverted-U \ curve \ between \ its \ innovation \ balance \ and \ performance \ by \ moving \ the \ curve \ in \ an \ upper \ left \ direction. \]

Figure 1 illustrates the links of the theoretical constructs in this study.
METHODS

Sample and data collection

To test our hypotheses, we conducted a survey with innovation-intensive small and medium-sized enterprises (SMEs) in four industry clusters in Tianjin. As a transportation junction connecting inland Northern China with the global market via air and sea, Tianjin is one of four autonomous municipalities in China. In recent years, the city has become one of
the country’s innovation centres. At the end of 2015, with an increasing number of technology-oriented SMEs, Tianjin was home to ten high-tech industry clusters, including electronic information, biopharmaceutics, marine technologies, new materials, sustainable energy and environmental protection, aerospace, new concept vehicles and equipment manufacturing, which, collectively, contributed to about 75% of the city’s GDP. For these two reasons, Tianjin provided an ideal context in which to examine SMEs’ innovation strategy and their performance in clusters.

Endorsed by the Tianjin Municipal Government, we sent questionnaires to 1,256 innovation-intensive SMEs chosen from a total of 3,453 such firms registered in Tianjin that are on the government radar by showing high potential as industry innovators. We received 638 valid and complete questionnaires (an effective return rate of 50.8%). The 638 firms that completed the survey are distributed in four industry clusters: 46.6% in the electronic information industry (Cluster 1), 33.7% in the biopharmaceutical industry (Cluster 2), 12.5% in the new materials industry (Cluster 3), and 7.2% in the sustainable energy and environmental protection industry (Cluster 4). To test variances of firms across four different clusters, we conducted Duncan’s multiple range test (Duncan, 1955). The results are: $p=0.533$ on the means of firm size, $p=0.154$ on the means of firm age, $p=0.303$ on the means of firm ownership (see Table 1). These results suggest that the sample firms do not have significant variances across industry clusters in terms of firm size, firm age and firm ownership.
Table 1. Duncan’s multiple range test of the four clusters

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<th>Firm size</th>
<th>Firm age</th>
<th>Firm ownership</th>
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<tr>
<td></td>
<td>(N)</td>
<td>Mean</td>
<td>Mean</td>
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<tr>
<td></td>
<td></td>
<td>Subset for alpha=0.05 (1)</td>
<td>Subset for alpha=0.05(1)</td>
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<tr>
<td>Cluster 1</td>
<td>297</td>
<td>3.660</td>
<td>3.424</td>
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<tr>
<td>Cluster 2</td>
<td>215</td>
<td>3.628</td>
<td>3.326</td>
</tr>
<tr>
<td>Cluster 3</td>
<td>80</td>
<td>3.674</td>
<td>3.413</td>
</tr>
<tr>
<td>Cluster 4</td>
<td>46</td>
<td>3.638</td>
<td>3.500</td>
</tr>
<tr>
<td>(F)</td>
<td></td>
<td>0.361</td>
<td>1.245</td>
</tr>
<tr>
<td>Sig.</td>
<td></td>
<td>0.533</td>
<td>0.154</td>
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The questionnaire we used for this study comprises two parts: the first part consists of questions related to control, moderating and independent variables, and was answered by general managers or equivalent of the surveyed firms; the second part relates to dependent variables, and was answered by financial managers or equivalent of the firms. This method of separating the questionnaire to be completed by personnel in different functions is to mitigate self-reporting and self-evaluation effects that can result in common method variance (CMV) (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Siemsen, Roth, & Oliveira, 2010). To control for the impact of CMV, we also conducted Harman’s one-factor test. According to Podsakoff et al. (2003), if a single factor emerges that accounts for a large percentage of the total variance, the data may have a CMV issue. In our test, the highest factor accounts for 30.9% of the total variance explained, which indicates that CMV is unlikely to significantly affect the results.

**Definitions and Measurements of the Variables**

The **independent variable** in this study is the balance between innovation orientations of exploration and exploitation. There are two common methods to measure exploratory and
exploitative innovations: first, by counting the frequency with which the two types of innovation orientations are mentioned in subject firms’ publicly available materials (e.g., annual reports and letters to shareholders) (Uotila et al., 2009); second, by surveying a sample of subject firms using questionnaires (He & Wong, 2004; Jansen et al., 2005; Jansen et al., 2006). The first method is suitable for studying large, public firms, for which public information is easily and reliably available to researchers. The subject firms in this study are unlisted SMEs. In fact, most of these firms do not use open channels to communicate their firm-related information to the public. The limited public information is not entirely reliable. For these reasons, we chose to use the survey method to measure the independent variable.

The questionnaire used to measure exploratory and exploitative innovations was adopted from Benner and Tushman (2002; 2003), He and Wong (2006), and Jansen et al. (2006).

For the balance of the two innovation orientations, the ratio of the two (Jansen et al., 2005), or the absolute difference of the two (Cao et al., 2009; He & Wong, 2004; Uotila et al., 2009) are commonly used measures. However, both measures, being positive in value, are unable to provide directional indication of the domineering orientation between exploratory innovation (ER) and exploitative innovation (EI) (i.e., whether a subject firm is inclined to invest more in one or the other). To obtain the direction of a firm’s innovation orientation, we introduced a new measure: \((\text{ER}-\text{EI})/(\text{ER}+\text{EI})\). The value of this measure is between -1 and +1, indicating whether the direction of the balance between the two is leaning toward EI (-) or ER (+). This relative measure can also effectively mitigate the impact of firm size on total investments in innovation.

The dependent variable used in this study is firm growth performance. We use relative
growth in financial and market performance to measure a firm’s growth performance (FGP). This relative measurement mitigates the influence of firm size on firm performance. A firm’s growth can be measured by improvements in its financial performance and market competitiveness, compared to three years before (Cao et al., 2009; He & Wong, 2004). We, hence, measure FGP by 1) growth of sales revenue, 2) increase in market share, 3) growth in after-tax profit, and 4) improvement in market competitiveness, over three years. We assign a nominal value to this variable using a seven-point scale: if a firm’s growth rate of FGP over three years is smaller than -30%, the firm scores 1 point; if the growth rate is between -30% and 0, the firm scores 2 points; if the growth rate is between 0 and 20%, the firm scores 3 points; if the growth rate is between 20% and 40%, the firm scores 4 points; if the growth rate is between 40% and 60%, the firm scores 5 points; if the growth rate is between 60% and 80%, the firm scores 6 points; and if it is larger than 80%, the firms scores 7 points.

There are two **moderating variables** in this study: the breadth and the depth of a firm’s network ties in the cluster. We use the number of network ties, including partnerships (e.g., joint venture partners), formal alliances (e.g., R&D alliances) and informal alliances (e.g., participating in various industry associations or consortia) a firm has in the cluster to measure the breadth of its cluster relationships (NCR), and the strength of these network ties to measure the depth of its cluster relationships (SCR) (Bell, 2005; Gilsing et al., 2008; Giuliani, 2007; Liu, 2011). We measured each item by a seven-point Likert scale, with 1 denoting ‘strongly disagree’ and 7 denoting ‘strongly agree’ with our questions (such as ‘the firm has a large number of ties with ... in a cluster’, and ‘the firm has strong ties with...in a cluster’).

We used four **control variables**, firm size, firm age, firm ownership and market
competition in this study. We measured firm size by a firm’s total assets, sales revenues and total number of employees (Baum, Locke, & Smith, 2001; Cao et al., 2009; Lavie, Kang, & Rosenkopf, 2011). We measured firm age by the number of years since the firm’s registration (1= less than 4 years; 2= 4-6 years; 3= 7-10 years, 4= 11-15 years; 5= 16-20 years; 6= 21-30 years; and 7= more than 30 years). In China, firm ownership (i.e., state-owned or privately-owned) has a strong impact on its innovation strategy and growth performance. We set the dummy variable for firm ownership (0= non state-owned enterprises; and 1= state-owned enterprises). We measured the market competition a firm faces by the frequency of ‘price wars’ involving subject firms, the number of new entries, and whether competitors followed any successful product launch with similar offerings in the market place (Auh & Menguc, 2005; Baker & Sinkula, 2007; Jansen et al., 2005; Jansen et al., 2006).

Table 2 summarizes dependent and independent variables in this study with their definitions and measurements.
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<th>Construct</th>
<th>Definition and Measure</th>
<th>References</th>
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<tr>
<td><strong>Exploratory Innovation (ER)</strong></td>
<td>ER is about pursuing new things and it can lead to radical discoveries. It contributes to firm’s future growth, though uncertainty and risky. ER require new knowledge or knowledge that deviates from existing framework. Four items are used to measure a firm’s investment in ER: developing new technologies or applying technology in new areas, searching for and developing new customers, attempting to explore new markets, and exploring new sales channels.</td>
<td>Levinthal and March, 1993; March, 1991; Rowley et al., 2000; Benner and Thushman, 2002; McGrath, 2001</td>
</tr>
<tr>
<td><strong>Exploitative Innovation (EI)</strong></td>
<td>EI is about efficient utilization of existing technological assets. It is incremental in nature and designed to meet the needs of existing customers/markets. EI contributes to firm’s current growth, by benefiting from existing knowledge and skills. Four items are used to measure a firm’s investment in exploitative innovation: upgrading the quality of existing products/services, striving to improve the versatility of existing products/services, attempting to enhance productivity, and making great efforts to improve the efficiency of existing distribution channels.</td>
<td>O’Reilly &amp; Tushman, 2008; Raisch and Birkinshaw, 2008; Raisch et al., 2009; Levinthal and March, 1993; Benner and Thushman, 2002; 2003;</td>
</tr>
<tr>
<td><strong>Balance of Innovations (BIs)</strong></td>
<td>The absolute or relative difference between investments in ER and EI. The interplay of complementary and competing effects between ER and EI determines the relationship of firms’ innovation balance and growth performance.</td>
<td>Cao et al., 2009; He and Wong, 2004; Uotila et al., 2009; Boumgarden et al., 2012</td>
</tr>
<tr>
<td><strong>Relational Breadth (measured by the number of network ties) (NCR)</strong></td>
<td>NCR measures the breadth of relationships a cluster firm has with other cluster members. We measure NCR by three items: a firm’s number of formal partners (NCR1), its number of formal alliances (e.g. R&amp;D alliances) (NCR2) and the number of informal alliances (e.g. various industry associations a firm participates) (NCR3). The higher a firm’s NCR, the more important its position is in a cluster.</td>
<td>Knoke &amp; Kuklinski, 1982; Burt, 2004; 2009; Gilising et al., 2008</td>
</tr>
<tr>
<td><strong>Relational Depth (measured the strength of network ties) (SCR)</strong></td>
<td>SCR measures the depth of a firm’s cluster ties with other cluster members. We measure SCR by three items: closeness (frequency of all kinds of contacts; the degree of knowledge and information exchange; and the degree of reciprocal services) with partners (SCR1), with other members in formal alliances (SCR 2) and informal alliances (SCR 3).</td>
<td>Granovetter, 1973; Rindfleisch &amp; Moorman, 2001; Marsden and Campbell 1984; Mathews et al. 1998</td>
</tr>
<tr>
<td><strong>Firm Growth Performance (FGP)</strong></td>
<td>Firm’s growth performance is a relative value, measured by a firm’s financial results and market competitiveness over previous three years. FGP is measured by four items: growth of sales revenue, increase in market share, growth in after-tax profit and improvement in market competitiveness.</td>
<td>Hart, 1992; Cao et al., 2009; He &amp; Wong, 2004</td>
</tr>
</tbody>
</table>
RESULTS

Table 3 depicts the statistics (means, standard deviations, and correlations) of the variables of this study. From the means, we can see that, on average, the majority of the subject firms are SMEs, the market competition the firms face is mild, 34.2% of the firms are state-owned enterprises, and the average age of the firms is 12.4 years. The test of multicollinearity indicates that the values of variance inflation factor (VIF) for all the independent and control variables are below the threshold of 10, and their tolerance values are above the threshold of 0.1, verifying that the likelihood of problems caused by multicollinearity is small (Fox, 1991).

<table>
<thead>
<tr>
<th>Table 3. The statistics (means, standard deviations, and correlations) of the variables</th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Firm size (FS)</td>
<td>3.647</td>
<td>0.590</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Market competition (MC)</td>
<td>3.544</td>
<td>0.569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Firm age (age)</td>
<td>4.632</td>
<td>0.715</td>
<td>.136**</td>
<td>.003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Firm ownership (ownership)</td>
<td>0.342</td>
<td>0.577</td>
<td>.205**</td>
<td>.022</td>
<td>-.031</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Exploratory innovation (EI)</td>
<td>3.884</td>
<td>1.552</td>
<td>.052</td>
<td>-.044</td>
<td>.089</td>
<td>-.023</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Exploitative innovation (ER)</td>
<td>3.652</td>
<td>1.100</td>
<td>.164**</td>
<td>-.058</td>
<td>.052</td>
<td>.017</td>
<td>.064</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Number of cluster ties (NCR)</td>
<td>3.205</td>
<td>0.768</td>
<td>.191**</td>
<td>-.043</td>
<td>.225**</td>
<td>-.042</td>
<td>.164**</td>
<td>.194**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Strength of cluster ties (SCR)</td>
<td>3.865</td>
<td>1.007</td>
<td>-.010</td>
<td>-.142*</td>
<td>-.095*</td>
<td>-.063</td>
<td>-.029</td>
<td>.138**</td>
<td>.031</td>
<td></td>
</tr>
<tr>
<td>9. Firm growth performance (FGP)</td>
<td>3.296</td>
<td>1.106</td>
<td>.105*</td>
<td>-.348*</td>
<td>.034</td>
<td>.043</td>
<td>.125**</td>
<td>.206**</td>
<td>.108*</td>
<td>.294**</td>
</tr>
</tbody>
</table>

We used a hierarchical regression method to test the hypotheses. Four models of the four control variables (firm size, market competition, firm age, and ownership) with the independent or moderating variables, and interactive items of them were tested. In Table 4, we show the results of the correlations between firms’ balance of innovation orientations (BIs),
number of cluster relationships (NCR), strength of cluster relationships (SCR) and firm growth performance (FGP).

Table 4. The correlations between firms’ balance of innovation orientations and performance, moderated by SCR and NCR

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>S.E</th>
<th>M2</th>
<th>S.E</th>
<th>M3</th>
<th>S.E</th>
<th>M4</th>
<th>S.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.011</td>
<td>0.053</td>
<td>0.103</td>
<td>0.055</td>
<td>0.039</td>
<td>0.057</td>
<td>0.130</td>
<td>0.049</td>
</tr>
<tr>
<td>Ownership</td>
<td>0.029</td>
<td>0.085</td>
<td>0.041</td>
<td>0.082</td>
<td>0.045</td>
<td>0.077</td>
<td>0.046</td>
<td>0.074</td>
</tr>
<tr>
<td>FS</td>
<td>0.041</td>
<td>0.035</td>
<td>0.092</td>
<td>0.035</td>
<td>0.129</td>
<td>0.033</td>
<td>0.117</td>
<td>0.031</td>
</tr>
<tr>
<td>MC</td>
<td>-0.230**</td>
<td>0.034</td>
<td>-0.231**</td>
<td>0.033</td>
<td>-0.196**</td>
<td>0.031</td>
<td>-0.128**</td>
<td>0.031</td>
</tr>
<tr>
<td>EI</td>
<td>0.173**</td>
<td></td>
<td>0.043</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER</td>
<td>0.096*</td>
<td></td>
<td>0.055</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIs</td>
<td></td>
<td></td>
<td>0.204**</td>
<td>0.023</td>
<td>0.164**</td>
<td>0.021</td>
<td>0.097*</td>
<td>0.022</td>
</tr>
<tr>
<td>BIs²</td>
<td></td>
<td></td>
<td>-0.251**</td>
<td>0.085</td>
<td>-0.259**</td>
<td>0.086</td>
<td>-0.237**</td>
<td>0.077</td>
</tr>
<tr>
<td>NCR</td>
<td></td>
<td></td>
<td></td>
<td>0.106*</td>
<td></td>
<td>0.082</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIs×NCR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.239**</td>
<td>0.031</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIs²×NCR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.127**</td>
<td>0.037</td>
<td></td>
</tr>
<tr>
<td>SCR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.203**</td>
</tr>
<tr>
<td>BIs×SCR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.284**</td>
</tr>
<tr>
<td>BIs²×SCR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.116**</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.168</td>
<td>0.216</td>
<td>0.321</td>
<td>0.367</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.160</td>
<td>0.209</td>
<td>0.311</td>
<td>0.358</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$-Value</td>
<td>21.212</td>
<td>28.991</td>
<td>32.378</td>
<td>40.397</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerance</td>
<td>≥0.944</td>
<td>≥0.845</td>
<td>≥0.601</td>
<td>≥0.741</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIF</td>
<td>≤1.060</td>
<td>≤1.183</td>
<td>≤1.663</td>
<td>≤1.349</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M1 is the baseline model, which includes four control variables, as well as EI and ER. M2 is built by adding the balance of innovation orientations (BIs) and its quadratic term (BIs²) on M1. The results of M1 and M2 indicate that the balance items of BIs and BIs² have more effect than the individual ER or EI on independent variable FGP (adj. $R^2=0.209$, $P<0.001$). The correlation between the quadratic term of BIs and FGP is negative and significant ($\beta=-0.251$, $P<0.001$). Thus, these results support H1, that there exists an inverted U-shaped correlation.
between a firm’s balance of innovation orientations and its growth performance.

We build M3 by adding to M2 the number of a firm’s cluster relationships (NCR), the interaction of NCR and the balance of innovations (BIs), the interaction of NCR and the quadratic term of BIs. The results of M3 suggest that the interaction of firm’s number of cluster relationships (NCR) and the linear term of BIs is positive and significant ($\beta=0.239$, $P<0.001$), and the interaction of NCR and the quadratic term of BIs is also positive and significant ($\beta=0.127$, $P<0.001$). In addition, the direct effect of NCR on FGP is positive and significant ($\beta=0.106$, $P<0.01$). Following the procedures in Aiken et al.’s (1991) study, we established an equation about the moderating effect of NCR on the correlation between BIs and FGP, as:

Equation 1: $Y = -(0.259-0.127 \times NCR) \times X^2 + (0.164 +0.239 \times NCR) \times X + 0.106 \times NCR$,

where $X$ is the balance of innovation orientations (BIs) and $Y$ is firm growth performance (FGP).

The relationship between BIs and FGP are plotted in Figure 2 as an inverted U-shaped curve. We can see that when NCR moves from -1 to 1 (data standardization), the highest point of the inverted-U curve moves in an upper right direction (meaning the innovation balance is skewing to exploratory innovation), and FGP increases. Thus, H2a is supported (adj. $R^2=0.311$, $P<0.001$).
We build M4 by adding to M2 the strength of a firm’s cluster relationships (SCR), the interaction of SCR and the balance of innovations (BIs), the interaction of SCR and the quadratic term of BIs. This model was used to test the moderating effect of SCR on the correlation between a firm’s BIs and FGP. As shown in M4, the interaction of SCR and BIs is negative ($\beta=-0.284$, $P<0.001$), and the interaction of SCR and the quadratic term of BIs is also negative ($\beta=-0.116$, $P<0.001$). The direct effect of SCR on FGP is positive ($\beta=0.203$, $P<0.001$). Based on these results, we built an equation of the moderating effect of SCR on the correlation between the balance of innovations and firm growth performance, as:

Equation 2: \[ Y = - \left( 0.237 + 0.116 \text{ SCR} \right) \times X^2 + \left( 0.097 - 0.284 \text{ SCR} \right) \times X + 0.203 \text{ SCR}, \]

where $X$ is the balance of innovation orientations (BIs) and $Y$ is firm growth performance (FGP).

When the value of SCR changes from -1 to 1, FGP underlined by BIs ($X$) is plotted in an inverted U-shaped curve (see Figure 3). We can see that the highest point of the inverted-U curve moves to the upper left (skewing toward exploitative innovation), and FGP increases.
Thus, H2b is supported \((adj. R^2=0.358, \ P<0.001)\).

![Figure 3. Moderating effect of SCR](image)

**DISCUSSION**

Our research confirms that an inverted U-shaped correlation exists between a firm’s balance of two innovation orientations and its growth performance for cluster firms (H1 is supported).

We also verify that this correlation is moderated by the firm’s cluster relationships: the broader a firm’s cluster relationships, the more it will lean toward exploration in its innovation balance, and the higher will be its growth performance (H2a is supported); on the other hand, the stronger a firm’s cluster relationships, the more it will lean toward exploitation in its innovation balance, and the higher will be its growth performance (H2b is supported).

**Theoretical implications**

This paper contributes to the ongoing discourse on firms’ balance between exploration and exploitation innovation and their performance by adding the moderating effects of cluster relationships.

First, in contrast to previous studies that compare cluster firms with non-cluster ones in
examining the effects of cluster relationships on firms’ innovation strategy (e.g., Ozer & Zhang, 2015), we tested the effects of cluster relationships, by relational breadth (number) and depth (strength), on cluster firms’ innovation balance and performance. On the breadth of cluster relationships, we find that the number of relational ties is beneficial to a firm’s exploratory innovation, which is in alignment with the proposition of Fiol (1995) and Zang (2018), that the number of a firm’s network ties may nurture creative breakthroughs. The reason for such a moderating effect is because broad cluster networks may help a firm acquire heterogeneous knowledge (McCann & Folta, 2011; Wang & von Tunzelmann, 2000), which can enhance the firm’s exploratory innovation capability. Our findings also support Rowley et al.’s (2018) argument that a firm’s broad cluster relationships may benefit its exploratory innovation capability, but not exploitative innovation capability. As shown in Figure 2, the number of a firm’s relational ties has little impact on its performance if it leans toward exploitative innovation. This result is different from Ozer & Zhang’s (2015) work, which found that a focal cluster firm’s network ties are positively related to its exploitative innovation in product.

On the depth of relational ties, our findings suggest that the strength of a firm’s relational ties may benefit the firm in exploitative innovation by increasing the efficiency of using existing technology. The reason for this is perhaps because a firm with deep cluster relationships may increase the chance of acquiring homogenous knowledge through information exchange and knowledge sharing facilitated by trusted and reciprocal links with relational firms (Jansen et al., 2006), the use of which may be conducive to incremental innovations (Fleming, 2001; Kogut & Zander, 1992), and enhanced firm performance. One
thing worth emphasizing is that our results suggest that when a cluster firm possesses stronger network ties with other cluster firms, its performance can be negatively influenced if it adopts an exploratory innovation orientation, as illustrated in Figure 4 (on the right of the intersection of the two curves). Therefore, we can argue that firms with strong network ties that adopt an exploratory innovation orientation may suffer short-term, lower performance than those who concentrate on exploitation orientation. This conclusion is in alignment with Dai et al. (2018) who claim that close R&D alliances among technology-intensive firms can be detrimental to their strategic flexibility and innovation performance. The reason for this is perhaps that firms embedded in this type of deep network relationship may need to give up their own innovation projects in order to have their strategic focus aligned with the interests and perspectives of multiple parties. One consequence of this type of compromising behaviour may be a phenomenon of some partners getting ‘free rides’ by sharing innovation outcomes within closely-knit networks – some firms benefitting from others without investing in their own. This phenomenon could lead to the detriment of the long-term viability of the clusters, especially in high-risk, high-return industries where exploratory innovation is key. For example, most cluster firms in our sample are in close geographic proximity, and often operate in the same industry or in related industries on the same value chain. These firms are collaborators and competitors at the same time. When the relationship between two firms in this situation deepens (the network ties are strengthened), they tend to develop interdependence with each other and benefit from a free ride on the partner’s innovation outputs, which can be detrimental to the viability of the relationship and firm performance.

Last but not least, we used a new method to measure exploratory and exploitative
innovations (ER and EI) and their balance in this study. Different from Uotila et al.’s method (2009) which indirectly measures a firm’s innovation balance by counting the frequency of key phrases related to the two innovation orientations in public reports, or Bauer & Leker’s method (2013) which measures the investment on R&D under each of the innovation orientations (logistically it is difficult to differentiate the investments related to the two types of innovation activities), we used a large-scale survey of innovation-intensive SMEs, similar to Jansen et al.’s method (2005). We also introduced the concept of relative difference between ER and EI, (ER-EI)/(ER+EI), to measure the balance of firms’ innovation orientations. This method can not only indicate the orientation direction of a firm’s innovation balance, but also mitigate the impact of the size of the firm’s total innovation investments. This improvement in methods is an addition to the existing literature by providing directional indication of innovation orientation balance (e.g., Cao et al., 2009; He & Wong, 2004; Jansen et al., 2005; Uotila et al., 2009).

In summary, this research enriches our understanding of cluster firms’ innovation balancing strategy and performance, and the moderating roles of their cluster relational breadth and depth. Theoretically, we extend understanding in this field beyond the level of the firm by assessing inter-organizational firm links. Through empirical evidence from SMEs, we also highlight the importance for SMEs of managing cluster relationships in their innovation balancing strategy (Edwards et al., 2005; van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009).

**Practical implications**

Our research has significant managerial implications for SMEs, especially those in emerging
markets. From the perspective of innovation strategy, a firm should consider its innovation balancing strategy in the context of its cluster relationships. Ultimately, an optimal balance between exploratory and exploitative innovations is not a fixed target; it is contingent upon internal and external conditions, such as the firm’s cluster relational ties. A firm’s increased number of relational ties will help it acquire heterogenous resources from other cluster firms, which can enhance the firm’s exploratory innovation capability. The implication for managers in this situation is that the focal firm should adopt a balancing strategy leaning toward exploratory innovation to benefit from the scope of its network ties. On the other hand, a firm’s cluster relational strength helps the firm acquire homogenous resources, which enhances the firm’s exploitative innovation capability. The implication is that firms in this situation should adopt a balancing strategy leaning toward exploitative innovation to capitalize on the strength of their network ties.

The results of this study also offer practical guidance for firms aiming to enhance their cluster relationships. If a firm needs to enhance its exploratory innovation capability, it should consider increasing the scope of its relational ties with other cluster firms, such as building collaborative relationships with other firms, or participating in formal or informal collaborative alliances or industry associations. On the other hand, if a firm needs to enhance its exploitative innovation capability, it should focus on strengthening relationships with its strategic partners, such as intensifying information exchange and knowledge sharing.

**Limitations and future research agenda**

There are several limitations in this research. First, we had a relatively large proportion of state-owned enterprises in the sample (34.2%). Given that state-owned enterprises often have
less control over their innovation strategy (e.g., they may pursue an innovation strategy, either focusing on one type of innovation but ignoring the other, simply to fulfil a national innovation mission or to get subsidies from the government); even though we controlled for firm ownership, their innovation balance and growth performance may not reflect the effects of their own innovation capabilities and the influence of their cluster relationships. Second, our sample is limited to one city – Tianjin (with a small number of firms registered in Tianjin but located in nearby Beijing). Given significant geographic differences in the economy, labour force, industry policy, market, and so on, across China, our findings cannot be claimed to represent the entire country.

For future research, we intend to expand our study to other geographic locations in China. Further effort should also be put into identifying the relational conditions under which cluster firms may manage the optimal balance point of this inverted U-shaped correlation between innovation orientations and growth performance. Future research might also examine other possible moderators that could affect this inverted U-shaped correlation.

**Conclusions**

This study advances our understanding of the relationship between balancing exploratory and exploitative innovations and firm performance. We hypothesized and tested the moderating roles of cluster firms’ relationships with other cluster firms (number and strength) on this relationship. Our research highlights the importance of cluster relationships in knowledge acquisition and innovation capability development, and, thus, firm performance, for cluster firms.
REFERENCES


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