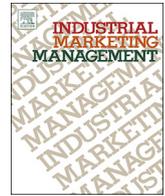




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Research paper

Product newness and product performance in new ventures: Contingent roles of market knowledge breadth and tacitness

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ABSTRACT

Although knowledge has been built around how product newness affects product performance in the context of established firms, such an effect in new ventures remains to be explored. Building on the knowledge-based view, the open innovation literature, and observations of the liability of newness, this study examines the differential effects of technological and market newness on product performance and tests how market knowledge breadth and tacitness moderate these effects in distinctive ways. Results obtained using data from new high-tech ventures in China show that market newness has a stronger positive effect on product performance than technological newness. Market knowledge breadth enhances the effect of technological newness on product performance, whereas market knowledge tacitness appears to be a double-edged sword: it weakens the effect of technological newness but enhances the effect of market newness on new product performance. These findings provide novel insights into how distinct dimensions of product newness have differential effects on product performance and a more nuanced view of how market knowledge characteristics function as boundaries in the product newness–performance link in new ventures.

1. Introduction

As product newness is a critical parameter of new product development (NPD) in industrial firms, marketing scholars have paid great attention to its impact on product performance (see [Evanschitzky, Eisend, Calantone, & Jiang, 2012](#) for a recent review). Although product newness has been widely examined in the context of established firms ([Calantone, Chan, & Cui, 2006](#)), its role in new ventures is still underexplored. Differing from most established incumbents, new ventures often confront a paradox in NPD¹: whereas they must develop and introduce radically new products to gain a market foothold and succeed in competition with incumbents ([Story, Boso, & Cadogan, 2015](#)), they often lack the resources and skills needed to develop and market such products, a characteristic of the liability of newness ([Hyytinen, Pajarinen, & Rouvinen, 2015](#); [Stinchcombe, 1965](#)). This paradox signifies the importance of considering product newness and new ventures' resource reservoirs, such as market knowledge, simultaneously in

connection with NPD. However, in spite of the importance of product newness to new ventures and the particular resource hurdles embedded in the NPD they undertake, studies on product newness in new ventures are only beginning to emerge ([Song, Song, & Di Benedetto, 2011](#)).

Although the NPD literature classifies product newness along two dimensions—technological and market newness ([Im & Workman, 2004](#); [Molina-Castillo & Munuera-Aleman, 2009](#)). *Technological newness* represents the degree to which new products embrace state-of-the-art technologies, while *market newness* reflects the degree of novelty and meaningfulness of product features and customer benefits ([Im & Workman, 2004](#); [Sorescu, Chandu, & Prabhu, 2003](#)). Whereas the positive effects of technological and market newness are well-recognized, empirical evidence is mixed, with findings of positive, non-significant, or even negative effects ([Henard & Szymanski, 2001](#); [Szymanski, Kroff, & Troy, 2007](#)). Such mixed findings call for investigation of their boundary conditions (e.g. [McNally, Cavusgil, & Calantone, 2010](#); [Rubera & Kirca, 2012](#)).

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¹ Several prior studies have used an age criterion—such as 12 years in business ([Covin, Slevin, & Covin, 1990](#)), 10 years in business ([Fernhaber & Li, 2013](#)), and 8 years in business ([Li & Atuahene-Gima, 2001](#))—to define new ventures. This study uses the intermediate cut-off line of 10 years in business. New ventures differ from small businesses as the latter could exist longer but remain small. Also, new ventures include startups that have existed for only a few months or years ([Hyytinen et al., 2015](#)), but new ventures could operate longer than startups.

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Indeed, a limited number of studies have examined contingent factors, such as team cohesiveness (Brockman & Morgan, 2006), market turbulence (Rijsdijk, Langerak, & Hultink, 2011) and product life cycle (Talke, Salomo, Wieringa, & Lutz, 2009). Although these NPD and environmental factors are important boundaries for depicting how product newness influences product performance, prior studies have overlooked the important role of new ventures' market knowledge. *Market knowledge* reflects new ventures' understandings of their competitors and customers (De Luca & Atuahene-Gima, 2007; Li & Calantone, 1998). It concerns business-to-business relationships and actions such as market reactions to competitive moves and organizational-level responses to customer needs and wants (Martín-de Castro, 2015; Ferreras-Méndez, Newell, Fernández-Mesa, & Alegre, 2015). Moreover, as NPD is a knowledge-intensive process, many firms have employed the open innovation strategy to use a wide range of external sources to help them remain innovative (Chesbrough, Vanhaverbeke, & West 2006; Laursen & Salter, 2006). In the face of resource scarcity and environmental turbulence, new ventures need external sources to broaden their knowledge base and support innovation development (Chen, Vanhaverbeke, & Du, 2016; Rubera, Chandrasekaran, & Ordanini, 2016). While the literature on open innovation highlights the critical role played by external sources of knowledge, the nature and characteristics of external market knowledge for innovation success are poorly understood (Brunswick & Vanhaverbeke, 2015). Market knowledge characteristics such as breadth and tacitness may have significant and differential impacts on the process of assimilating, integrating, and transforming firm knowledge into new products (De Luca & Atuahene-Gima, 2007; Madhavan & Grover, 1998; Zhang, Wu, & Cui, 2015). As such, new ventures' market knowledge characteristics should not be omitted from the product newness–performance link (Song, Van Der Bij, & Wegeman, 2005).

To address these research gaps, we build on the knowledge-based view (KBV) to examine how technological and market newness affect product performance in new ventures. We argue that because technological and market newness differ in their strategic emphases (technological breakthroughs versus market insights), inherent risks (high versus low), and commercialization challenges (mainstream market versus emerging or niche market), they have differential effects on the product performance of new ventures. Furthermore, we examine the moderating roles of the characteristics of market knowledge (i.e., breadth and tacitness) acquired through external ties in the link between product newness and performance because these knowledge characteristics of business-to-business markets influence knowledge management practices in the NPD process and affect how the value of new products can be realized in the market (Ferreras-Méndez et al., 2015; Zhang et al., 2015). *Market knowledge breadth* reflects the horizontal dimension and diversity of market understandings (Ferreras-Méndez et al., 2015; Xu, 2015), whereas *market knowledge tacitness* captures the vertical dimension and codifiability of market knowledge (De Luca and Atuahene-Gima, 2007; Zhou & Li, 2012). These two dimensions of market knowledge could help new ventures cope with the liability of newness in developing new products, but their moderating roles may vary due to the differences between them. Fig. 1 depicts our framework.

This study makes two major contributions to the extant literature. First, it contributes to an emerging stream of literature on NPD in new ventures by distinguishing the effects of technological and market newness on NPD performance. Given the liability of newness, new ventures have to be astute in deciding which type of newness, technological or market newness, to emphasize in developing new products. Prior empirical evidence is based largely on established companies, whereas this study is among the first to provide novel insights into such decision-making in new ventures. Second, this study addresses the NPD paradox in new ventures by examining the collective impacts of product newness and market knowledge characteristics on product performance. Our more nuanced findings show that the business-to-business

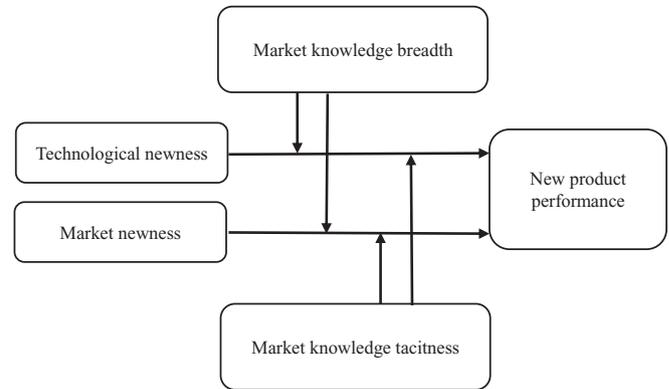


Fig. 1. Conceptual model.

market understandings outside of new ventures' organizational boundaries may be as important as product newness in addressing NPD-related challenges in new ventures.

2. Theories and hypotheses

2.1. Product newness for new ventures

Prior studies have found that highly innovative new products are more likely to generate great leaps in technology and/or market benefits (Bonner, 2010; Chandy & Tellis, 2000; Garcia & Calantone, 2002). Following prior studies (e.g. Chandy & Tellis, 2000; Molina-Castillo & Munuera-Aleman, 2009; Sethi, Iqbal, & Sethi, 2012), we classify product newness along two dimensions: technological newness and market newness, a distinction that reflects how firms develop new products (Godin & Lane, 2013). For instance, Bosch, aiming to transform itself into an Internet of Things company, has over the past several years focused on technological advancements in automation, connectivity, electrification, energy efficiency, and emerging markets, which earned the company four innovation awards at the 2017 CES in Las Vegas (Robert Bosch GmbH, 2018). Other companies innovate primarily based on market insights rather than technological breakthroughs. For instance, Stanley Black & Decker introduces > 1000 new products each year to meet potential customer demand (Stanley Black & Decker, 2018).

Whereas there is a consensus that product newness in general should enhance product and firm performance (Chandy & Tellis, 2000; Sorescu & Spanjol, 2008; Tsai & Yang, 2013), empirical findings are mixed regarding the performance impacts of technological and market newness. For instance, Talke, Salomo, and Kock (2011) find that both market and technological newness positively affect firm performance. Talke et al. (2009) find a positive impact of technological newness on product sales. In contrast, McNally et al. (2010) document evidence that market newness affects product performance negatively. Moreover, Molina-Castillo and Munuera-Aleman (2009) find that market and technological newness have a negative influence on new product performance. Such mixed findings motivate researchers to identify contingent conditions that enable product newness to affect performance (McNally et al., 2010; Rubera & Kirca, 2012).

The KBV regards knowledge as the most strategically important resource, and the essence of a firm lies in its ability to acquire, combine, create, and apply internal and external knowledge to perform important activities (Aarikka-Stenroos, Jaakkola, Harrison, & Mäkitalo-Keinonen, 2017; Grant, 1996; Kogut & Zander, 1992). Firms have increasingly embraced the open innovation model, in which they adopt external pathways to acquire knowledge from various sources (Chesbrough et al., 2006; Van de Vrande, De Jong, Vanhaverbeke, & Rochemont, 2009). They rely on their interactions with external customers, suppliers, competitors, and other institutions to glean innovative ideas (Du,

Leten, & Vanhaverbeke, 2014). Accordingly, they can successfully innovate by drawing on expertise and knowledge acquired from external sources (Du et al., 2014). New ventures should consider searching for external knowledge as a key managerial task (Lopez-Vega, Tell, & Vanhaverbeke, 2016).

Firm knowledge also varies by *type* and has important *characteristics* (De Luca & Autuahene-Gima, 2007; Kogut & Zander, 1992). For example, firms can acquire technological knowledge, market knowledge, and/or knowledge in other fields. Such knowledge can also be described in terms of its breadth and tacitness (De Luca & Autuahene-Gima, 2007; Ferreras-Méndez et al., 2015). From the perspective of the KBV, NPD is a process that involves transforming firms' embedded knowledge into new products, services, or a combination of these (Madhavan & Grover, 1998). As such, the characteristics of firm knowledge significantly affect the value of technological and market newness in new ventures.

Specifically, various characteristics of firm knowledge not only influence whether new ventures can *utilize such knowledge to meet the resource requirements* of product newness but also impact whether new ventures can *effectively integrate the relevant knowledge* to achieve product-newness goals (Cui & Wu, 2016). In this study, we follow Cui and Wu (2016), De Luca and Autuahene-Gima (2007), and Ferreras-Méndez et al. (2015) to study two important characteristics of business-to-business market knowledge—breadth and tacitness. Market knowledge breadth reflects the horizontal dimension of a new venture's knowledge base and the diversity of its knowledge inputs (Xu, 2015; Zhou & Li, 2012). A high level of market knowledge breadth indicates that a new venture has a wide scope of understanding of its current and potential customers (e.g. characteristics, demand, preferences) and competitors (e.g. strategies and products) in business-to-business markets (Ferreras-Méndez et al., 2015; Xu, 2015). Market knowledge tacitness captures the vertical dimension of a new venture's knowledge, reflecting the understandability and codifiability of its knowledge contents (Kogut & Zander, 1992; Zhou & Li, 2012). Since tacit knowledge is hard to imitate and is embedded in organizational processes, it is an important source of sustainable advantage (Grant, 1996). Broad and tacit understandings of the market help new ventures accumulate market insights, establish initial connections with customers and competitors, and facilitate subsequent knowledge acquisition. As Estevez-Pérez and Mañez-Castillejo (2008) find, when new ventures develop more market knowledge, they are more likely to overcome the liability of newness and to survive.

2.2. Direct effects of technological and market newness

New ventures that emphasize technological newness aim to incorporate state-of-the-art technologies into new products (Madhavan & Grover, 1998), so technological newness involves fundamental changes in a new venture's technological trajectory (Chandy & Tellis, 2000). In contrast, new products with the freshest market newness highlight new attributes and features that may not involve technological advancement (Sorescu et al., 2003). As such, technological newness requires heavy investment in R&D activities to advance technological frontiers, whereas market newness depends to a greater extent on market research activities to generate new market insights and improve customer benefits (Sorescu & Spanjol, 2008). Because value realization for both technological newness and market newness involves degrees of risk and uncertainty and a range of commercialization challenges, we argue that market newness likely has a stronger impact on product performance than technological newness, for two reasons.

First, new ventures may face varying degrees of risk and uncertainty in the product development process when they focus on technological newness rather than market newness. When focusing on technological newness, new ventures have to rely on two inseparable stages in developing their new products: advancing technologies and integrating new technologies with market demand (Godin & Lane, 2013; Li &

Calantone, 1998). In contrast, new ventures usually start with market research to identify new attributes and features and improve customer benefits when their NPD projects focus on market newness (Cooper, 1990). The risks associated with market newness hinge on market acceptance and competitive responses to new features and such risks can be managed largely by more thorough market research at the front end (Kjellberg, Azimont, & Reid, 2015; Zhou, Yim, & Tse, 2005). As compared with generating market insights, developing and incorporating technological advancements into product offerings entails a resource- and time-consuming process along with high uncertainties in technological and business feasibilities (Kock, Gemünden, Salomo, & Schultz, 2011).

Second, new products featuring technological or market newness face varying levels and types of market challenges in the new product commercialization stage. Technological newness often addresses current demand in mainstream markets, i.e., solving existing customer problems with alternative solutions (Garcia & Calantone, 2002). It is very difficult, however, for new ventures to persuade existing customers to switch to their offerings because they lack perceived legitimacy (Su, Xie, & Li, 2011). In contrast, market newness often highlights new attributes and features that meet unfulfilled and sometimes unarticulated customer demand in emerging or niche markets (Chandy & Tellis, 2000; Kock et al., 2011), which makes it relatively easier for customers to accept new products. Once the new products are introduced to a target market, those featuring market newness as compared with others featuring technologies newness are accepted more readily by customers. In addition, new products developed for an emerging market (market newness) would face less intense competition as opposed to new products that were introduced to the mainstream market (technological newness). Thus, we predict:

H1. : Compared with technological newness, market newness relates more positively to new ventures' product performance.

2.3. Moderating roles of market knowledge characteristics

According to the KBV, the firm is the mechanism through which distinct types of knowledge are acquired, assimilated, created, integrated, and exploited for better firm performance, including NPD (Grant, 1996). The same applies to new ventures. However, unlike established companies, new ventures may suffer from the liability of newness (Stinchcombe, 1965), which means that they may lack strategic resources, legitimacy, or social connections, or internal role formalization (Hyytinen et al., 2015; Su et al., 2011). Such resource and legitimacy deficits and role ambiguity would make external market knowledge critically important in the NPD process for new ventures and also cause the NPD process to be significantly influenced by the characteristics of business-to-business market knowledge (De Luca & Autuahene-Gima, 2007). Given the differences between technological newness and market newness we have reviewed as well as those between knowledge breadth and tacitness, we begin by predicting that market knowledge breadth enhances the effect of technological newness on product performance.

First, because technological newness emphasizes the “means” of developing new products—new ventures likely start with technological advancements and then exploit such advancements by integrating them with customer needs (Sorescu & Spanjol, 2008)—broad market knowledge assists new ventures in identifying opportunities for technological exploitation with a wider scope. Market knowledge breadth provides a broad spectrum of insights into customer demand and preferences as well as information on competitive products and competitive moves in business-to-business markets (Zhou & Li, 2012). Such broad knowledge helps new ventures conduct market segmentation, targeting, and differentiation. As a result, new ventures that harness technological newness can more efficiently develop differentiated new products from existing alternatives and match the corresponding

market demand (Kim & Atuahene-Gima, 2010).

Second, a broad spectrum of market insights can mitigate the liability of newness and help new ventures spread risk in the process of exploiting technological knowledge. New ventures often have novel ideas but fail to commercialize them because they have limited experience in solving unusual problems (Kock et al., 2011). Broad market knowledge enhances new ventures' purview of the market and provides sufficient knowledge to overcome the liability of newness (Ferrerás-Méndez et al., 2015). In this regard, new ventures can better achieve innovative tasks and resolve complex tasks. As such, market knowledge breadth helps new ventures transform novel ideas into new products, thereby intensifying their effects on product performance (Bao, Sheng, & Zhou, 2012). Furthermore, a broad base of market knowledge increases flexibility and adaptability, making new ventures less likely to find themselves locked into blind spots of existing technical domains (Xu, 2015). Thus, we predict:

H2a. : The relationship between technological newness and new ventures' product performance is stronger when market knowledge breadth is high than when it is low.

We suggest, however, that market knowledge tacitness may weaken the effect of technological newness. First, differing from broad understandings of market insights, market knowledge tacitness provides new ventures with in-depth understandings of potential customer demand, so that new ventures engaging in technological newness may not have access to a wide spectrum of customers for which to utilize their new technologies but may instead be stuck in narrow market segments. In addition, technological newness compels new ventures to pursue technological superiority, which is gained mainly through in-house R&D activities (Kock et al., 2011). Technological newness therefore drives NPD activities to be more internally focused and requires new ventures to concentrate on internal technological knowledge creation. However, market knowledge tacitness requires new ventures to focus on gleaning in-depth understandings of customers and competitors in business-to-business markets (De Luca & Atuahene-Gima, 2007), demanding more extensive interaction with external environments (Zhang et al., 2015). In this sense, new ventures may be driven by forces pushing simultaneously in opposite directions. With limited resources, their NPD projects would suffer and their new products would be mediocre.

Second, because market knowledge tacitness increases the cost and time involved in knowledge assimilation, transformation, integration, and exploitation (Nonaka, 1994), the inherent risks and uncertainties of developing new products from technological advancements will be heightened. Since tacit market knowledge is difficult to codify and deliver, new ventures must exert considerable effort to convert tacit knowledge into explicit information and correctly comprehend and address latent customer needs and competitive actions (Bierly, Damanpour, & Santoro, 2009). High market knowledge tacitness thus requires investing additional cost and time in subsequent knowledge assimilation and integration processes. Since technological newness requires heavy investments, new ventures may lack sufficient resources to fully exploit tacit market knowledge to facilitate the success of technological newness (Kock et al., 2011). In contrast, when market knowledge is explicit, it can be easily codified and new ventures may have a transparent understanding of the target market, making technological newness an asset that helps them satisfy target customers (Zhou et al., 2005). Therefore, we predict:

H2b. : The relationship between technological newness and new ventures' product performance is weaker when market knowledge tacitness is high than when it is low.

Regarding the effect of market newness on product performance, we start by positing that market knowledge breadth may weaken performance. First, high levels of market knowledge breadth imply the possession by a firm of a wide range of information about customer demand and competitors' strategies in business-to-business relationships

(Bao et al., 2012), which may additionally burden new ventures seeking to transform market knowledge into new products. Although diverse and heterogeneous market knowledge is helpful in generating new product ideas (Fang, 2008; Kogut & Zander, 1992), the value of market newness can be realized only when new ventures actively engage in integrating such discrete knowledge and transforming it into new market offerings (Ferrerás-Méndez et al., 2015; Xu, 2015). However, identifying and selecting appropriate customer segments is not a simple process (Kock et al., 2011). As Grant (1996) points out, the breadth of market knowledge contributes to the complexity of knowledge linkages and hampers knowledge recombination (Aarikka-Stenroos et al., 2017; Galunic & Rodan, 1998). Limited recognition and resources might constrain new ventures seeking to integrate complex knowledge and incorporate market insights into new products (Su et al., 2011; Tsai, Chou, & Kuo, 2008). Thus, the process of achieving market newness could become problematic. In contrast, when the breadth of market knowledge is low, market knowledge from multiple sources can be easily integrated and transformed to facilitate the realization of market newness (De Luca & Atuahene-Gima, 2007).

In addition, within firms, market knowledge breadth decreases the level of shared common knowledge among new venture employees, potentially causing role ambiguity in new ventures and making personal-level knowledge-sharing and communication difficult (De Luca & Atuahene-Gima, 2007; Zhou & Li, 2012). Broad market knowledge involves numerous variations and might lead to information overload (Eppler & Mengis, 2004). Due to the liability of newness, cognitive attention and capability in new ventures are limited, which can only amplify the difficulties of knowledge-sharing and communication (Su et al., 2011). In this case, without fully understanding or utilizing broad market knowledge, it can be difficult for new ventures to manage the process of achieving market newness and capture value from doing so. As a result, the contribution of market newness to new product performance is undermined. Therefore, we predict:

H3a. The relationship between market newness and new ventures' product performance is weaker when market knowledge breadth is high than when it is low.

In contrast, tacit market knowledge may enhance the efficacy of market newness. First, because tacit knowledge provides in-depth market insights into customers and competitors in business-to-business relationships, it helps new ventures fulfill the focal tasks of market newness, i.e., understanding and satisfying potential customer needs and outperforming rivals (Boso, Story, & Cadogan, 2013; Chandy & Tellis, 2000). Market knowledge tacitness helps new ventures comprehend competition and customer needs, demand, and preferences beyond the status quo more accurately and in a timelier fashion. Moreover, since the major concern of market newness is future market acceptance and competitor reactions (De Luca & Atuahene-Gima, 2007; Zhou et al., 2005), market knowledge tacitness provides new ventures with accurate and in-depth understandings of their customers and competitors, enabling them to cope more effectively with these future risks and challenges.

Second, products with high market newness will be unique in a given target market and less imitable because market knowledge tacitness enhances knowledge protection (Zander & Kogut, 1995). Moreover, the acquisition of tacit market knowledge relies on the reciprocal exchange of benefits between new ventures and their partners, so unintended knowledge spillovers to competitors become much less likely. As tacit knowledge is more difficult for competitors to acquire and imitate, they are less likely to develop effective alternatives to achieve a similar degree of advancement in product functions and features (McEvily & Chakravarthy, 2002). As such, when acquired knowledge is integrated into the process of achieving market newness, market knowledge tacitness can preserve economic value by inhibiting knowledge diffusion and spillovers (De Luca & Atuahene-Gima, 2007). Conversely, when market knowledge is explicit, market newness will be

less effective, as such knowledge can be easily comprehended and imitated by competitors.

H3b. The relationship between market newness and new ventures' product performance is stronger when market knowledge tacitness is high than when it is low.

3. Methodology

3.1. Sampling and data collection

We empirically test our conceptual framework using data from high-tech new ventures located in China in 2009. China's transitional economy and intensified competition make it a rich context in which to study product newness in new ventures. First, new ventures have become a major component of China's economy with significant contributions to economic growth and employment. Second, to deal with intensive competition, high-tech new ventures actively engage in NPD (Kollmann & Stöckmann, 2014). The rapidly changing market environment forces these new ventures to absorb external market knowledge concerning business-to-business relationships to develop innovative new products (Atuahene-Gima, Li, & De Luca, 2006; Tsai & Wang, 2008).

The initial sampling frame comprised 500 new ventures that had been operating no longer than 10 years at the time of the survey, randomly selected from a directory of high-tech enterprises provided by a business research firm. The new ventures are located in Beijing, Shanghai, and Guangdong as well as their surrounding provinces. Based on previous research and field interviews, the questionnaire was originally prepared in English and then translated into Chinese using back-translation procedures to confirm conceptual equivalence. To ensure the content and face validity of the survey instrument, we performed pre-tests with 20 senior managers and modified the survey instrument accordingly. The questionnaire was addressed to the sample firms' senior managers (CEOs, vice presidents, general managers, or marketing managers) through onsite interviews, which helps ensure the quality of the information (Zhou, 2006). During the interviews, the trained interviewers asked the new ventures' managers to answer questions in the survey based on NPD projects they had undertaken within the three years preceding the survey.

After excluding new ventures that had not developed any new products within the three years preceding the survey and excluding responses with excessive missing data, the final sample comprised 147 new ventures, resulting in a response rate of 29.4%. Although our sample is not very large, the sample size and various ratios (the ratio of the size of the sample to the number of items; the ratio of the size of the sample to the number of variables) in our research compare favorably with those reported in previous studies (Augusto & Coelho, 2009; Boso et al., 2013; O'Cass, Heirati, & Ngo, 2014).

Comparison tests were conducted to check whether responding firms differed systematically from non-responding firms. No significant differences were found in terms of venture age, number of employees, or annual sales, suggesting that non-response bias was unlikely a major concern. Among the sampled new ventures, 57.8% of the informants were CEOs or general managers, and the rest were senior-level R&D/marketing managers or directors. The sampled new ventures covered a variety of high-tech industries, including electronics (21.8%), software development (19.7%), electric equipment (17%), information technology (9.5%), pharmaceuticals (15.6%), and others (16.3%). Data from high-tech new ventures across multiple industries enabled us to generalize the research findings. In the 147 new ventures, the average number of employees was 209 and the majority of the firms were domestic (77.0%). The profiles of the sampled new ventures are presented in Table 1.

Table 1
Profiles of the sampled new ventures ($N = 147$).

Sample characteristics	Frequency	%
Venture age		
1–3	12	8.2
4–6	61	41.5
7–8	46	31.3
9–10	28	19.0
Industry		
Information technology	14	9.5
Electronics	32	21.8
Electric equipment	25	17.0
Software development	29	19.7
Pharmaceuticals	23	15.6
Others	24	16.3
Ownership		
State-owned	7	4.8
Private	85	57.8
International joint venture	17	11.6
Wholly foreign owned	17	11.6
Others	21	14.3
Number of employees		
0–50	15	10.2
50–100	59	40.1
100–300	46	31.3
300–500	16	10.9
500–1000	11	7.5
Annual sales (in Millions of RMB)		
0–10	36	24.5
10–30	32	21.8
30–50	21	14.3
50–100	36	24.5
> 100	22	15.0

3.2. Measures and validation

All measures were adapted from previous studies. All perceptual scales were rated using a seven-point Likert format (1 = strongly disagree, 7 = strongly agree). Details pertaining to the measurement items and validity assessment are reported in Table 2.

The measure of *new product performance* was adapted from Ernst, Hoyer, and Rübbsaamen (2010), with three items assessing the overall performance of a focal new venture's NPD compared with that of its main competitors (Bonner, 2010). We adapted *technological newness* and *market newness* measures from previous research (Im & Workman, 2004; Kock et al., 2011; Talke et al., 2011). Respondents were asked to indicate the degree of newness in terms of the technology used in comparison with competitors' products as well as the degree of newness inherent to product features and benefits.

We adapted the measure of *market knowledge breadth* from Bao et al. (2012) and De Luca and Atuahene-Gima (2007) to ask respondents to assess the extent to which a new venture has acquired diverse and broad knowledge about its customers and competitors from external ties. We measured *market knowledge tacitness* with three items that assessed the extent to which a new venture's knowledge of its customers and competitors acquired from external ties could be formally articulated, documented, or codified (Bierly et al., 2009; De Luca & Atuahene-Gima, 2007). As such, our measures of knowledge characteristics reflect how new ventures accumulate market knowledge through business-to-business relationships.

Control variables. We used several variables to control for firm- and industry-level effects. We controlled for *venture age*, measured as the number of years since a new venture's inception. We also controlled for *venture size*, indicated by the natural logarithm of annual sales. For *venture ownership*, we included two dummy variables—foreign-owned firms (FOEs) and state-owned firms (SOEs)—using domestic private new ventures as the baseline (Zhou & Li, 2012). We measured *R&D strength* with an item which evaluates the relative strength of new

Table 2
Construct measurement and validity assessment.

Item	SFL
New product performance (CR = 0.76, AVE = 0.51)	
Compared to major competitors, our overall new product program is far more successful.	0.79
Compared to major competitors, our overall new product development cycle time has been relatively shorter.	0.73
The overall quality of our new products is higher than that of our competitors.	0.62
Technological newness (CR = 0.89, AVE = 0.68)	
Our products always incorporate the state-of-the-art technology.	0.74
The technology our firm's product incorporates is really 'out of the ordinary'.	0.89
The technology of our products is quite new to our industry.	0.84
The technology incorporated in our new products always offers dramatic improvements than that in existing product features.	0.81
Market newness (CR = 0.71, AVE = 0.45)	
Customers perceive our product features as novel/unique.	0.68
Our new products introduced many completely new features to the market.	0.65
The product shows an unconventional way of solving problem	0.69
Market knowledge breadth (CR = 0.80, AVE = 0.57)	
The customer knowledge acquired from external ties is in quite broad domains.	0.59
The competitor knowledge acquired from external ties is in quite broad domains.	0.79
The knowledge of customers and competitors acquired from external ties ranges in wide domains.	0.86
Market knowledge tacitness (CR = 0.82, AVE = 0.60)	
Overall, the market knowledge that we acquired from external ties mainly includes unwritten information, informal practical know-how, and personal experience.	0.77
It is very difficult to completely document the market knowledge acquired from external ties.	0.71
Our employees have difficulties in completely articulate the market knowledge acquired from external ties.	0.84
Model fit: $\chi^2(94) = 194.48, p < .01, CFI = 0.90, IFI = 0.91, RMSEA = 0.08.$	

Notes: SFL = standardized factor loading; CR = composite reliability; AVE = average variance extracted, HSV = highest shared variance with other constructs.

ventures' R&D relative to the R&D activity of their competitors. With regard to industry-level factors, we included five dummy variables for five main industries (information technology, electronics, electric equipment, pharmaceuticals, and software development), with other industries as the baseline.

Consistent with established tradition (Boso et al., 2013), we used tenure in a new venture and industry to measure respondents' experience and a self-report scale to measure their level of familiarity with their firms. On average, informants had 7.82 years of industry experience, 4.53 years of firm experience, and a mean familiarity with the new venture of 5.93 (on a 7-point scale). These statistics indicated that the respondents were knowledgeable and capable of providing valid and accurate assessments of the survey questions.

3.3. Construct reliability and validity

Before testing the hypotheses, we applied several methods to assess construct reliability and validity. We used the two-step approach recommended by Anderson and Gerbing (1988) to assess convergent validity and reliability. First, we ran a confirmatory factor analysis using AMOS on an overall, five-factor measurement model to assess the psychometric properties of the constructs. As presented in Table 2, the fit indices show that the measurement model fits the data reasonably well ($\chi^2(94) = 194.48, p < .01$, comparative fit index [CFI] = 0.90, incremental fit index [IFI] = 0.91, and root mean square error of approximation [RMSEA] = 0.08). Furthermore, all items loaded significantly on their theoretical constructs ($p < .001$) and the standardized factor loadings ranged from 0.59 to 0.89, suggesting satisfactory convergent validity. In addition, no composite reliability was lower than the minimum threshold of 0.70, indicating that these measures demonstrated adequate convergent validity and reliability.

We assessed discriminant validity using the procedure suggested by Fornell and Larcker (1981). First, we calculated the 95% confidence intervals (CIs) of the correlation coefficients between any two constructs. All of the correlation coefficients were significantly different from 1. In addition, we ran a series of pairwise chi-square difference tests to examine the discriminant validity of all latent constructs (Fornell & Larcker, 1981). Every unrestricted model (a two-factor solution) exhibited a significantly better fit than the restricted model

(with a single-factor solution and factor correlation fixed at 1), indicating the distinctness of every construct. Second, we found that the square root of the average variance extracted for each construct was much higher than the correlations with other latent constructs in the model (please see Table 3). This means each construct shares greater variance with its indicators than with other constructs (shown in Table 2), providing further confidence of discriminant validity.

3.4. Common method variance

Using key informants as a data source potentially exposes our data to common method bias (CMB). A variety of methods recommended by Podsakoff, MacKenzie, Lee, and Podsakoff (2003) were adopted to assess the influence of CMB. First, the latent methods factor technique was used to capture the effect of CMB. All self-reported items were allowed to load both on their theoretical constructs and on a latent common methods variance factor. As compared with the original five-factor measurement model, the new model with the latent methods factor did not show improved model fit ($\chi^2/df = 2.04, RMSEA = 0.08, CFI = 0.91, IFI = 0.90$). Furthermore, the partial correlation adjustment procedure was applied (Lindell & Whitney, 2001). We considered *government intervention*, which is theoretically unrelated to at least one construct in our study, as the marker variable. The four-item *government intervention scale* (Cronbach's alpha = 0.82) was adapted from Child, Chung, and Davies (2003). The lowest positive correlation between *government intervention* and other variables ($r = 0.01$, *government intervention* and *market newness*) was selected to adjust the construct correlations and statistical significance. A comparison of the correlations before (the correlation coefficients below the diagonal in Table 3) and after (the correlation coefficients above the diagonal in Table 3) the adjustment showed that none of the significant correlations became insignificant for the focal variables (or multi-item constructs). Collectively, these diagnostics suggested that CMB was unlikely to be a major concern in this study.

4. Analysis and results

We used two-stage regression analyses to test our hypotheses. Since new ventures' market knowledge breadth and market knowledge

Table 3
Descriptive statistics of the constructs.

Variables	1	2	3	4	5	6	7	8	9	10
1. New product performance	(0.71)	0.31**	0.59**	0.21**	0.04	−0.16*	0.13	0.19*	−0.08	0.12
2. Technological newness	0.32**	(0.82)	0.49**	0.24**	−0.09	−0.02	0.02	0.15†	−0.07	0.20*
3. Market newness	0.60**	0.50**	(0.67)	0.15†	0.07	−0.13	0.07	0.17*	−0.07	0.11
4. Market knowledge breadth	0.22**	0.25**	0.16*	(0.75)	0.37**	−0.15†	0.00	−0.04	−0.08	0.00
5. Market knowledge tacitness	0.05	−0.08	0.08	0.38**	(0.77)	−0.03	−0.06	−0.30**	−0.11	0.09
6. Venture age	−0.15†	−0.01	−0.12	−0.14†	−0.02	−0.02	0.21**	−0.09	0.02	−0.22**
7. Venture size	0.14†	0.03	0.08	0.01	−0.05	0.22**	0.01	0.13	0.15†	0.03
8. FOE	0.20*	0.16*	0.18*	−0.03	−0.29**	−0.08	0.14†	−0.11	−0.12	0.02
9. SOE	−0.07	−0.06	−0.06	−0.07	−0.10	0.03	0.16*	−0.11	0.03	0.02
10. R&D strength	0.13	0.21**	0.12	0.01	0.10	−0.21**	0.04	0.03	0.03	0.06
Marker Variable	−0.09	0.01	−0.18*	0.33**	0.37**	−0.11	−0.08	−0.16*	−0.11	0.06
Mean	5.09	4.52	5.25	3.95	4.50	6.46	8.15	0.24	0.03	3.32
S.D.	0.77	0.98	0.76	0.97	1.04	2.17	1.35	0.43	0.18	1.54

$N = 147$.

Notes: Zero-order correlations are below the diagonal; adjusted correlations are above the diagonal; the diagonal elements in bold are the square roots of the average variance extracted for the multi-item constructs.

FOE = Foreign owned enterprise; SOE = State owned enterprise.

** $p < .01$.

* $p < .05$.

† $p < .10$ (2-tailed).

Table 4
Standardized estimates: Multiple moderated regressions.

Variables	DV: New product performance									
	Model 1		Model 2		Model 3		Model 4		Model 5	
	b	t	b	t	b	T	b	t	b	t
Venture age	−0.17*	−1.91†	−0.08	−1.06	−0.07	−0.95	−0.09	−1.23	−0.08	−1.11
Venture size	0.15	1.69	0.09	1.29	0.08	1.16	0.09	1.29	0.09	1.30
FOE	0.13	1.51	0.07	0.94	0.07	0.90	0.08	1.13	0.07	0.97
SOE	−0.07	−0.89	−0.04	−0.50	−0.02	−0.30	−0.01	−0.19	−0.01	−0.18
R&D strength	0.09	1.09	0.06	0.87	0.06	0.84	0.05	0.76	0.05	0.73
Information technology	−0.20*	−2.05	−0.06	−0.69	−0.07	−0.86	−0.06	−0.68	−0.08	−0.94
Electronics	−0.08	−0.75	0.04	0.41	0.03	0.31	0.07	0.72	0.03	0.36
Electric equipment	0.00	0.03	0.04	0.40	0.01	0.05	0.08	0.88	0.03	0.34
Software development	−0.09	−0.84	−0.05	−0.58	−0.06	−0.66	−0.03	−0.36	−0.05	−0.55
Pharmaceuticals	−0.09	−0.90	0.02	0.25	−0.00	−0.02	0.05	0.54	0.00	0.02
Direct effects										
Technological newness (TN)			−0.01	−0.09	0.03	0.34	0.03	0.33	0.06	0.78
Market newness (MN)			0.54**	6.83	0.55**	7.04	0.54**	6.86	0.53**	6.99
Market knowledge breadth			0.22**	2.97	0.12	1.55	0.27**	3.47	0.18*	2.27
Market knowledge tacitness			−0.02	−0.29	−0.10	−1.18	−0.04	−0.56	−0.11	−1.45
Interaction effects										
TN * Market knowledge breadth					0.31**	2.79			0.37**	3.35
TN * Market knowledge tacitness							−0.26*	−2.59	−0.32**	−3.21
MN * Market knowledge breadth					−0.10	−1.03			−0.17	−1.46
MN * Market knowledge tacitness							0.27**	2.67	0.25*	2.22
R ²	0.13		0.42		0.46		0.46		0.50	
Δ R ²			0.29**		0.04*		0.04*		0.08**	
F	2.00*		6.84**		6.79**		6.88**		7.10**	

$N = 147$.

** $p < .01$.

* $p < .05$.

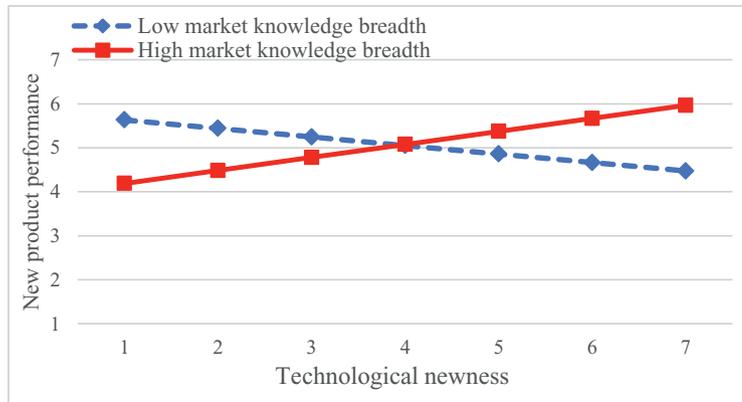
† $p < .10$ (2-tailed)

tacitness could influence the likelihood that new ventures engage in NPD, technological newness and market newness are likely endogenous. Following previous studies (Luo, Rindfleisch, & Tse, 2007; Slotegraaf, Moorman, & Inman, 2003), in the first stage we regressed technological/market newness on these factors to gain the residual to parse out the influence of these factors. Then in the second stage, we calculated the relevant interaction terms using the residuals in the regression equations. To facilitate the interpretation of the moderating effects, we mean-centered all the moderators (Aiken & West, 1991). The largest variance inflation factor value was 3.32—substantially below

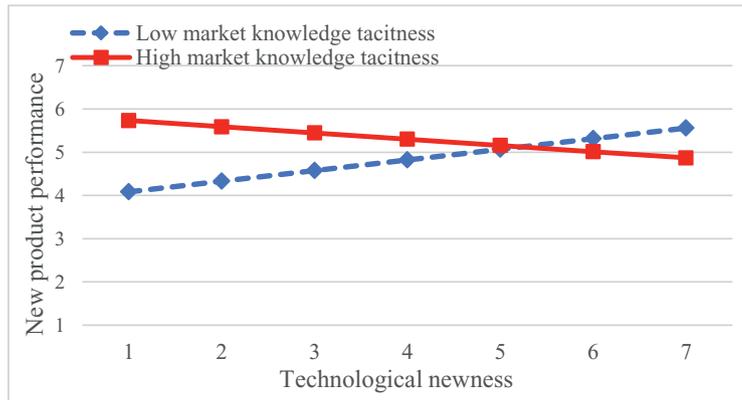
the threshold of 10. Therefore, our analysis was unlikely to be biased by multicollinearity. In addition, case-wise diagnostics found no cases with a standardized residual higher than the commonly accepted threshold of 3, suggesting that outliers were not a severe problem in our analysis. We report the results in Table 4.

In the regression models, the baseline model (Model 1) contained only the control variables. Model 2 included the independent and moderating variables. With Models 3 and 4 we examined the moderation effects of market knowledge breadth and market knowledge tacitness, respectively. We incorporated all the interactions with the

Panel A H2a



Panel B H2b



Panel C H3b

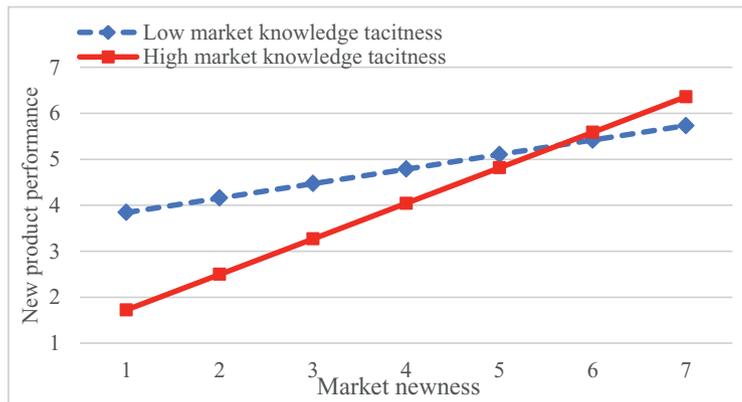


Fig. 2. Decomposing the interaction effects.

moderators in Model 5. To facilitate further interpretations, we decomposed the interaction terms and plotted the relationships for the low (mean – SD) and high (mean + SD) conditions for each significant moderation effect, as seen in Fig. 2 (Aiken & West, 1991).

H1 predicts that market newness has a greater influence on new product performance than technological newness. As the results obtained from Model 5 and shown in Table 4 indicate, we find that technological newness had a positive but insignificant effect on new product performance ($b = 0.06$, n.s.), whereas market newness was positively and significantly related to new product performance ($b = 0.53$, $p < .01$). The t -test ($t = 4.17$, $p < .01$) of these two coefficients reveals that the coefficient of market newness was significantly greater than that of technological newness, in support of H1.

H2a predicted that market knowledge breadth strengthens the effect of technological newness. As the results obtained from Model 5 and shown in Table 4 show, the interaction term for technological newness and market knowledge breadth was positively and significantly related

to new product performance ($b = 0.37$, $p < .01$), in support of H2a. The results of our simple slope analysis (Panel A of Fig. 2) provided additional insight into this moderating effect. When market knowledge breadth was high, technological newness had a positive effect on new product performance ($b = 0.30$, $p < .01$), whereas when market knowledge breadth was low, this effect was negative ($b = -0.19$, $p < .05$).

As the results obtained from Model 5 and presented in Table 4 show, the interaction term for market knowledge tacitness and technological newness had a negative effect on new product performance ($b = -0.32$, $p < .01$), supporting H2b. The simple slope analysis reported in Panel B of Fig. 2 suggests that when the level of market knowledge tacitness was high, the effect of technological newness on new product performance was negative ($b = -0.14$, $p < .05$). However, technological newness had a positive effect on new product performance ($b = 0.25$, $p < .01$) when market knowledge tacitness was low.

H3a also predicted that market knowledge breadth negatively moderates the effect of market newness on new product performance, but the regression coefficient was not significant ($b = -0.17$, n.s.), failing to support H3a. In contrast, the interaction term for market knowledge tacitness and market newness was positively associated with new product performance ($b = 0.25$, $p < .05$), supporting H3b. The results, shown in Panel C of Fig. 2, reveal that the positive link between market newness and new product performance was greater at a high level of market knowledge tacitness ($b = 0.77$, $p < .01$) than at a low level ($b = 0.31$, $p < .05$).

5. Discussion

5.1. Theoretical contributions

This study examines the role of product newness in new ventures. Based on the KBV, we investigate how market knowledge characteristics moderate the impacts of technological and market newness on new product performance. The results show that market newness has a stronger effect on product performance than technological newness. Furthermore, the impact of technological newness is stronger when market knowledge breadth is high but is weaker at high levels of market knowledge tacitness. On the other hand, the effect of market newness is stronger at high levels of market knowledge tacitness. Our study makes several important theoretical contributions to the NPD literature.

First, our study uncovers how product newness impacts product performance in the context of new ventures. Whereas the product newness–performance link has been examined in the context of established firms and contradictory findings abound, only some preliminary evidence has been reported in the context of new ventures (Song et al., 2011; Tsai & Yang, 2013). This study moves one step further to examine how different types of product newness—technological and market newness—impact product performance distinctly. We find that market newness has a stronger positive effect on new product performance than technological newness. Indeed, technological newness has no significant main effect on product performance in new ventures, possibly due to their limited resources and the unique context of emerging markets.

The underdeveloped legal and business supporting systems in emerging markets make it difficult for new ventures to acquire relevant resources and effectively protect their intellectual property rights associated with advanced technological development (Yang & Su, 2014). Thus, the unique context poses challenges for new ventures and inhibits them from achieving the potential of technological newness. At the same time, unique market conditions in China and massive and multi-layered market segments make it relatively easy for new ventures to benefit from market newness there. Thus, compared with technological newness, market newness has a greater effect on product performance for new ventures. However, the relative effect might not hold in developed countries, where the institutional and market environments are more mature and developed, making the benefits of technological newness easier to obtain and protect. Therefore, these findings highlight the importance of differentiating the effects of technological and market newness on new product performance in the context of new ventures in emerging markets.

Second, this study specifies knowledge characteristics as boundary conditions for product newness in new ventures. Marketing scholars have recognized the important role of knowledge, including knowledge acquisition, creation, and application, in NPD (De Luca & Atuahene-Gima, 2007; Madhavan & Grover, 1998; Shu, Page, Gao, & Jiang, 2012), yet they have paid limited attention to how specific knowledge factors moderate the efficacy of NPD activities. Given the liability of newness, new ventures face a NPD paradox which requires considering product newness and market knowledge characteristics collectively. Although previous studies have considered NPD and environmental factors as boundaries of the product newness–performance link

(Brockman & Morgan, 2006; Rijdsdijk et al., 2011; Talke et al., 2009), they have downplayed the particular context of new ventures in the NPD process. By identifying this knowledge gap, we were able to examine in particular how new ventures' market knowledge breadth and tacitness facilitate or hinder the achievement of technological newness and market newness (Bao et al., 2012; De Luca & Atuahene-Gima, 2007). Moreover, new ventures should use external knowledge proactively to facilitate the internal innovation process (Chesbrough et al., 2006). Whereas previous research finds that openness to external environments can help firms acquire expertise and knowledge and improve their ability to innovate (Laursen & Salter, 2006), this study extends such research to demonstrate the critical roles of the nature and characteristics of market knowledge acquired from external ties in the linkage between product newness and product performance.

As our findings show, technological newness significantly enhances product performance only when a venture's market knowledge breadth is high. However, market knowledge tacitness appears to be a double-edged sword: whereas it weakens the role of technological newness and turns its effect on new product performance from positive to negative, it also strengthens the market newness–performance link. In addition, we find no significant influence of knowledge breadth on the market newness–product performance link. One explanation for this unsupported effect may be that while the integration of diverse market knowledge is systematic, complicated, and difficult, a high level of market knowledge breadth also increases new ventures' learning skills and enables them to identify novel ideas and develop creative solutions to successfully achieve market newness (Bao et al., 2012; Xu, 2015). In summary, these findings provide a deeper understanding of the roles of knowledge concerning business-to-business relationships in NPD in new ventures and address divergent findings regarding the function of market knowledge (Zhang et al., 2015).

5.2. Managerial implications

Our findings offer suggestions to help new venture managers better manage their NPD. First, managers should understand that product newness is not a unidimensional concept, and technological and market newness have differential implications for product performance. Whereas market newness can bring significant gains to new ventures, technological newness is not significantly related to product performance. Therefore, managers should be cautious when they pursue technological advancement. In the transitional context of the Chinese economy, it may be preferable for new ventures to focus on market newness rather than technological newness due to China's underdeveloped formal institutions and inadequate enforcement of intellectual property rights. Because market newness directs new ventures to emphasize emerging or niche markets, their proprietary understandings of a given target market, rather than technological breakthroughs, could help them better defend against potential imitations.

Our examples show that firms can develop new products with an emphasis on technological newness (e.g., Bosch) and/or market newness (e.g., Stanley Black & Decker). In China, new products that were developed based on market newness are flourishing, whereas new products related to technological advancement or breakthroughs claim only minor market shares (McKinsey & Company, 2015). For example, Xiaomi regularly launches new features and updates their products to meet potential demand and thereby has rapidly emerged as one of the most successful new ventures in the market. In contrast, Beigene engages in the development of new products based on breakthrough technologies and it has proved difficult for this type of new venture to achieve market success in China (McKinsey & Company, 2015).

Second, managers should match types of product newness with their specific market knowledge. If new ventures possess diverse market knowledge, they can embrace technological newness to achieve better product performance. If their market knowledge is largely tacit, then pursuing market newness can generate superior product performance.

Managers should devote extra attention to understanding the benefits and downsides of the dimensions of market knowledge to benefit from distinct types of product newness. Therefore, there is no “one-for-all” solution for new ventures in China. The paradox between product newness and resource deficits in new ventures could be resolved by combining product newness and market knowledge characteristics appropriately.

5.3. Limitations and further research

This study suffers from several limitations, some of which create avenues for future research. First, caution should be taken in generalizing our findings to other contexts. Also, our research design is cross-sectional, which limits our ability to identify causal relationships. A longitudinal design would help uncover the differential effects of distinct types of product newness on product performance in new ventures over time. Further, since we collect our data from single informants, our research is subject to the potential threat of CMB. Although we adopted a statistical procedure to examine the presence of CMB and found that it is not a major issue, we cannot fully avoid the potential threat of CMB arising from questioning a single informant from each firm. Additional research should collect data from multiple sources or employ objective measures to corroborate our findings. Further, our sample is not very large. We focus on high-tech new ventures and use onsite interviews to obtain high-quality data, but it is difficult to collect more information due to time and cost constraints. Future research could collect more information to construct a larger sample and investigate the framework to generate more consistent and efficient estimations.

Second, this study demonstrates that the characteristics of market knowledge play important roles in the success of product newness. Although breadth and tacitness are the key critical characteristics of market knowledge, future research could extend the conceptual framework by investigating other characteristics, such as depth and specificity (De Luca & Atuahene-Gima, 2007; Zhou & Li, 2012). This could help draw a more complete picture of how market knowledge characteristics influence the effectiveness of technological and market newness. Moreover, using a contingent model, our study does not examine the processes or mechanisms underlying the effects of product newness on new product performance. Future research could explore mechanisms that might facilitate the achievements of technological and market newness for new ventures.

Third, the characteristics of market knowledge acquired from external ties influence the efficacy of product newness. Some firms may be in a better position to assimilate and utilize market knowledge (Zhou & Li, 2012). What factors could enable new ventures to benefit more from market knowledge acquisition, their capability or ownership? Therefore, future research could investigate how and why some new ventures could better leverage the acquired knowledge and facilitate the success of product newness.

Fourth, given the important influence of technological knowledge on the innovation process, this study is limited insofar as it focuses only on market knowledge. A more explicit incorporation of the role of the characteristics of technological knowledge may offer a better understanding of the value of product newness. Further research could examine the dynamic interplay or the combined effects of market knowledge and technological knowledge characteristics in the link between product newness and product performance of new ventures.

Lastly, our sample consists of high-tech new ventures in China, a country that features unique institutional and market environments. Institutional environments create opportunities for but also pose threats to organizations and influence the cost of information search and incentives to commit resources (Auh & Menguc, 2009; Yang & Su, 2014), consequently affecting the effectiveness of technological and market newness. Research examining the interplay between product newness and institutional and market forces, such as legal inadequacy, cultural norms, and environmental turbulence, could lead to fruitful findings.

Moreover, although China shares many characteristics with other emerging markets, it also displays certain unique features that differentiate it (Zhou, 2006). It would be interesting to conduct additional research to collect data from both China and other emerging markets and examine the implications of product newness.

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