Journal of Small Business Management

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/ujbm20

Antecedents of strategic ambidexterity in firms' product innovation: External knowledge and internal information sharing

Liang Mei, Francesco Rentocchini & Jin Chen

To cite this article: Liang Mei, Francesco Rentocchini & Jin Chen (2021): Antecedents of strategic ambidexterity in firms' product innovation: External knowledge and internal information sharing, Journal of Small Business Management, DOI: 10.1080/00472778.2021.1944635

To link to this article: https://doi.org/10.1080/00472778.2021.1944635

JOURNAL OF SMALL BUSINESS MANAGEMENT
https://doi.org/10.1080/00472778.2021.1944635

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

Antecedents of strategic ambidexterity in firms' product innovation: External knowledge and internal information sharing

Liang Mei [a,b], Francesco Rentocchini [c,d], and Jin Chen [b,e]

[a]National School of Development, Peking University, China; [b]Research Center for Technological Innovation, Tsinghua University, China; [c]European Commission, Joint Research Centre (JRC), Directorate B. Growth & Innovation, Unit B.7—Knowledge for Finance, Innovation & Growth; [d]Department of Economics, Management and Quantitative Methods, University of Milan, Italy; [e]School of Economics and Management, Tsinghua University, China

ABSTRACT

The conflict between "faster, better and cheaper" and high environment uncertainty forces firms to choose between different product innovation strategies. This study shows that firms can develop strategic ambidexterity in product innovation (SAPI) through diverse product innovation strategies, by effectively exploiting internal and external resources as well as their combination. The work explores the relationship between the interplay of external knowledge sources and internal information sharing for SAPI in 600 small- and medium-sized Chinese manufacturing enterprises. The results show knowledge breadth and depth and information sharing are positively related to SAPI, which tends to increase when knowledge depth is associated with information sharing. The study contributes to new product development (NPD) literature by introducing the concept of strategic ambidexterity in product innovation, and exploring the roles of external knowledge sources and internal information sharing, and their complementarity, on the ability to develop firm-level SAPI. It further provides implications for open innovation studies.

KEYWORDS

Product innovation; ambidexterity; open innovation; knowledge; China

Introduction

Product innovation plays a central role in a firms' competitiveness. However, the high failure rates for firms' internal new product development (NPD) (Kuester et al., 2012) and the high external uncertainty of the business environment (Bingham et al., 2014) pose challenges for firms in translating product innovation into performance. Appropriate strategies for product innovation thus become vital for firms pursuing competitive advantage (e.g., Cankurtaran et al., 2013; Shinkle & McCann, 2014), such as time-based

CONTACT Dr. Francesco Rentocchini francesco.rentocchini@ec.europa.eu European Commission, Joint Research Centre (JRC), Directorate B. Growth & Innovation, Unit B.7 – Knowledge for Finance, Innovation & Growth, Edificio Expo, Calle Inca Garcilaso, 3, 41092 Sevilla, Spain

Supplemental data for this article is available online at https://doi.org/10.1080/00472778.2021.1944635

strategies[1] (Cankurtaran et al., 2013; Stanko et al., 2012), market launch and related entry strategies (Kuester et al., 2012), and product quality strategies (Tellis & Johnson, 2007).

However, potential trade-offs may arise, particularly when a firm promotes these strategies simultaneously. Internally, one such trade-off ensues from the conflicts between different product innovation strategies (PIS). For example, a shorter NPD time does not always imply higher product quality or lower development costs (Tellis & Johnson, 2007). Therefore, managers need to decide among product information strategies by exploring an optimal balance of "faster, better and cheaper" (Stanko et al., 2012; Swink et al., 2006). Externally, another trade-off may arise due to the environment uncertainty surrounding the firm regarding opportunity capture, which calls for managers to make appropriate strategic choices in products to exploit opportunities in the environment (Bingham et al., 2014; Nadkarni & Narayanan, 2007).

Prior literature has adopted a paradoxical lens to address these trade-offs, originally tracing back to the metaphor story *The Hedgehog and The Fox*[2] (Berlin, 2013). For the internal trade-off, two alternative scope strategies have been highlighted for firms (Carroll, 1985; Carroll & Swaminathan, 2000): "generalist" firms can rely on a variety of new product segments by broadening resource bases, while "specialist" firms tend to capitalize on accumulated resources with a reduced number of NPDs (Barroso & Giarratana, 2013; Jourdan & Kivleniece, 2017). For the external trade-off, two types of strategic choices fit the fast-changing environment to capture the opportunity: "opportunist" firms tend to retain strategic variety for flexibility while "strategist" firms are more disciplined in following a strategic focus (Bingham et al., 2014; Nadkarni & Narayanan, 2007).

The paradoxical lens of firms addressing trade-offs has one basic implicit assumption regarding resource restriction, leading to a firm's inability to coordinate a wide range of different product information strategies in a trade-off (Voss & Voss, 2013). This issue is particularly important in small and medium size enterprises (SMEs), as they face resource scarcity, unsystematic innovation activities, and inferior capabilities, which result in higher failure rates of innovations (e.g., Van de Vrande et al., 2009; Vanhaverbeke, 2017; Wynarczyk et al., 2013). However, the literature underemphasizes that a firm's resource restrictions could be alleviated, leading to the need to revisit the binary strategic choice of managers. Externally, many firms have sourced knowledge and resources by opening their traditional organizational

[1]Cankurtaran et al. (2013) summarize similar concepts related to time-based strategies on new product development such as time-to-market, innovation speed, lead time, innovation time, product development time, project completion time, and total time.

[2]According to Berlin, the fox knows many things while the hedgehog has only a trick. Berlin indicated that there are two fundamental ways of understanding the world and acting in the world; the hedgehog has a unified view of the world and pursues a focused and clear goal in action; in contrast, the fox appreciates experiencing the diversity and diversification of the world and pursues different or even conflicting goals in action.

boundaries (Chesbrough, 2003; Laursen & Salter, 2006), particularly when firms are embedded in an environmental resource-munificence condition such as Industry 4.0 (Amezcua et al., 2013). Internally, firms with strong organizational capabilities can structure, bundle and leverage resources effectively to achieve their strategic purpose of NPD (Sirmon et al., 2007, 2011). Further, the potential interactive and integrating effects between external knowledge and internal capabilities for product innovation have also been considered (e.g., West & Bogers, 2014).

We accordingly contribute to the paradoxical lens conversation by contending that an additional way to tackle the trade-offs is to adopt both strategic variety and intensity among different product information strategies at the same time. Firms that do so develop what we term "strategic ambidexterity" in product innovation. We further surmise that firms can develop strategic ambidexterity in product innovation (SAPI) as long as they are able to build on their internal and external resources. For SMEs, operating with multiple NPD strategies it is conducive to increasing their success rate. Correspondingly, external and internal resources used for one single purpose could be adapted for new strategic applications extending the potential array of outputs that attenuate resource constraints (Voss & Voss, 2013). Therefore, vigorous firms are not only likely to choose a generalized strategy to improve efficiency, but also emphasize the development of specialization.

Therefore, we generate our main research question: *What are the antecedents of a firm developing SAPI and how do these antecedents matter to the firm's SAPI*? We contribute to the NPD literature by developing SAPI and further exploring both internal and external antecedents of SAPI, particularly in the context of SMEs, which revisits the resource restriction assumption on firms dealing with strategic trade-offs (e.g., Stanko et al., 2012; Voss & Voss, 2013). Moreover, the construction and antecedents' exploration of SAPI brings new knowledge to the NPD literature by extending the focus from product innovation performance (e.g., Cankurtaran et al., 2013; Kuester et al., 2012) to SAPI through the pursuit of diverse product information strategies. The literature reports only limited evidence on guiding choices in firms' different product information strategies (Acur et al., 2010), and particularly regarding the underexplored interaction effects between internal and external antecedents on product innovation strategic choice (Vega-Jurado et al., 2008). To address this gap, we combine literature on NPD, open innovation and the resource orchestration view, and make contributions by exploring the roles of external knowledge sources, internal organizational capabilities on information sharing, and their complementarity, on the firm-level SAPI. Moreover, we contribute to open innovation literature by extending the *openness* measure (involving the *breadth* and *depth* from Laursen & Salter, 2006) to the NPD context of product information strategies, which represents a novel strand of the existing product innovation studies (e.g., Acur et al., 2010; Cankurtaran et al., 2013), and highlights the role of organizational capabilities (information sharing) beyond the R&D capabilities that were skewed for product innovation in prior studies (e.g., Vanhaverbeke et al., 2014).

Theory and hypotheses

Strategic ambidexterity in product innovation

The term "ambidexterity" has been used to indicate a firm's ability to pursue two different initiatives simultaneously: exploitation and exploration in its original definition of manufacturing efficiency and flexibility, and induced and autonomous strategy processes (for a review, see, Gibson & Birkinshaw, 2004). We accordingly adopt a similar terminology – strategic ambidexterity in product innovation (SAPI).

Previous literature has highlighted how firms rely on different strategies for successful product innovations, involving time-based strategies (for example, Cankurtaran et al., 2013), intensive market launch and related penetration strategies (Kuester et al., 2012), superior product quality strategy (Tellis & Johnson, 2007), and customer orientation strategy (Lynn & Akgün, 1998). However, considering the potential incompatibility of the "faster, better and cheaper" features of NPD goals (Swink et al., 2006), uncertain and fast-changing environments (Bingham et al., 2014), and firms' scarce product innovation resources (Barroso & Giarratana, 2013), managers largely need to make a choice from the different product information strategies (Stanko et al., 2012).

The existing literature illustrates the above trade-offs in adopting different product information strategies. For example, some studies consider the trade-off between variety and intensity of horizontal product strategies under resource scarcity (Barroso & Giarratana, 2013; Combs et al., 2011), while others highlight the trade-off between strategic flexibility and strategic focus due to market uncertainty (Bingham et al., 2014; Nadkarni & Narayanan, 2007). Overall, there seems to be an inherent difficulty in combining a high number of product information strategies, due to an apparent incompatibility between exploration and exploitation (for example, Gibson & Birkinshaw, 2004), and the strategic concerns between variety and intensity in product segments (Barroso & Giarratana, 2013; Jourdan & Kivleniece, 2017). As suggested by Combe et al. (2012), variety should be balanced with stability in strategic focus, and the friction between strategic variety and strategic intensity is a key strategic challenge given the resource scarcity (Brozovic, 2018; Combe et al., 2012). In contrast, recent contributions highlight the possibility for complementarity between different strategies, pointing to building ambidexterity for firms (for example, Z. Wei et al., 2014). Extending the ambidexterity view to the strategic concerns in NPD contexts, we define SAPI as *the ability of firms to carry out strategic variety and intensity among a wide number of product innovation strategies at the same time*. Notably, we expect firms to develop SAPI the more they expand efforts for external resources via open innovation (Chesbrough, 2003) or when firms build internal organizational capabilities to orchestrate resources properly (Sirmon et al., 2007, 2011).

Knowledge sources and strategic ambidexterity in product innovation: Open innovation

Open innovation is defined as "a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology" (Chesbrough, 2003, p. xxiv), and where knowledge flows purposively across firms' boundaries via outside–in, inside–out, or coupled modes (Enkel et al., 2009). Given resource scarcity, firms, particularly SMEs, must search for, identify and use diverse external knowledge to follow through strategy and innovation (Laursen & Salter, 2006). By accessing knowledge sources, firms expand their resource base and create an open resource repertoire to extend horizontal product strategies (Barroso & Giarratana, 2013), balance diverse product information strategies and alleviate uncertainty (Jourdan & Kivleniece, 2017).

Previous studies have identified heterogeneous external knowledge sources including suppliers (Li & Vanhaverbeke, 2009), competitors (Lim et al., 2010), customers, and users (Von Hippel, 2001), government agencies (Hewitt-Dundas, 2006), universities (Rajalo & Vadi, 2017), and intermediaries (Y. Zhang & Li, 2010), among others. These studies used two concepts – *knowledge breadth* and *knowledge depth* – to represent how and the extent to which a firm purposively uses external knowledge in innovations (Laursen & Salter, 2006; Love et al., 2014). Knowledge breadth is the *quantitative* characterization of external knowledge sources, indicating the number of the focal firm's diverse partners, and knowledge depth is the *qualitative* characterization of a firm's external knowledge links with specific partners.

Recognizing the inherent complexity of NPD and environment uncertainty, we contend that external knowledge sources are needed for firms to promote SAPI. With the increase in number of diverse knowledge sources, a firm has more opportunities to access useful and valuable external knowledge on different product innovation strategic activities (Love et al., 2014). In addition, a firm with diverse external knowledge sources can promote resource deployment in multiple market settings without losing its internal basis (Combs et al., 2011), bring flexibility to the mix of product information strategies (Lant et al., 1992), and reduce the likelihood of routine dependence or organizational inertia (Nadkarni & Narayanan, 2007). When facing environmental change, a firm with broad knowledge can bundle diverse knowledge sources flexibly to improve adaptation and fit between the knowledge breadth and the combined product information strategies for competitive advantage (Bingham et al., 2014; Sirmon et al., 2007). Therefore, we propose:

Hypothesis 1: The breadth of external knowledge sources used in firm innovation strategies is positively related to strategic ambidexterity in firm product innovation.

Knowledge depth is also important for a firm implementing SAPI when searching for external knowledge. First, knowledge depth builds the rigid resources for firms' specific product information strategies that are valuable in a narrow set of strategic markets (Combs et al., 2011). Unlike the diverse knowledge sources drawn from to fit the combined product information strategies, managers are inclined to transform unique knowledge sources into a specific product development process to increase the relevant success rate (Laursen & Salter, 2006). Second, a firm learns and absorbs knowledge from partners by promoting knowledge depth. Specific knowledge is situation-dependent and related to specific partners, with which the firm establishes long-term interactions and a basis of shared learning and trust (Laursen & Salter, 2006). Within intensive interactions, a firm identifies valuable knowledge sources by long-term learning and screening, and acquires suitable knowledge as crucial assets for product innovation (Nadkarni & Narayanan, 2007). Third, prior studies have demonstrated the preference of innovative firms to focus on knowledge depth derived from a small number of sources (Laursen & Salter, 2006), such as steering valuable resources and concentrating external attention. This reduces the possibility of misunderstanding, erroneous interpretation and misapplication of external knowledge sources impacting product innovation (Luca & Atuahene-Gima, 2007), accelerates flow and transformation of external knowledge sources necessary for product information strategies and their portfolios, and maintains robustness and stability by strategic consistency (Combe et al., 2012). All these encourage firms to promote product information strategies via the "stick to their knitting" approach (Combs et al., 2011). Therefore, we propose:

Hypothesis 2: The depth of external knowledge sources used in firm innovation strategies is positively related to strategic ambidexterity in firm product innovation.

Information sharing and strategic ambidexterity in product innovation: Resource orchestration

Internal firms' organizational capabilities matter for SAPI, particularly when firms do well in resource orchestration. The resource orchestration view states that possessing valuable, rare, inimitable and nonsubstitutable resources (Barney, 1991) cannot guarantee competitive advantage, and firms further need to orchestrate these resources effectively (Sirmon et al., 2011). This involves structuring the portfolio of resources, bundling resources to build capabilities, and leveraging and enriching resources to develop firms' managerial capabilities to facilitate innovations (Sirmon et al., 2007).

Prior literature has highlighted the importance of the synergy of different product information strategies (Sirmon et al., 2011), involving speed, quality, and cost (Jiménez-Jiménez & Sanz-Valle, 2011). To effectively manage diverse product information strategies, appropriate organizational capabilities are necessary (Alegre & Chiva, 2013), referring to a firm's internal organizational management functions like "administrative styles, the formalization of internal communication systems, and the interdependence of work teams" (Vega-Jurado et al., 2008, p. 617). Further, the development of organizational capabilities for resource orchestration become even more critical in the presence of environment uncertainty and resource limitations (Sirmon et al., 2007).

Basically, a firm can be depicted as an information-process network combining different practices for information interactions (Luca & Atuahene-Gima, 2007). *Information sharing*, referring to the open culture for a firm facilitating cross-functional interactions (Song & Montoya-Weiss, 2001), is an important organizational capability for a firm's SAPI. First, information sharing creates an intraorganizational common understanding conducive to product innovations (Wu, 2008). Firms with better internal information sharing have transfunctional strategic beliefs, behaviors, and operational processes, helping their employees to better perceive and understand the innovative experiments on product innovation collectively (Y. Wei et al., 2013). This in turn enhances the joint problem-solving activities, encourages the development of common commitment to execute diverse product information strategies in one firm interactively (Acur et al., 2010; McEvily & Marcus, 2005), and reduces task conflicts among diverse groups in NPD contexts (Moye & Langfred, 2004). Second, information sharing facilitates the spread of intraorganizational knowledge for product innovation (Lin et al., 2013). Prior literature has demonstrated the positive effects of knowledge dissemination among a firm's employees and business units on both new product introductions (Darroch & McNaughton, 2002) and new idea generation for product development (Sáenz et al., 2012). By orchestrating vertical and horizontal information flows, a firm creates an unimpeded network for effective knowledge synthesis for product innovation among departments and between hierarchical managerial levels (Sirmon et al., 2011; Wooldridge et al., 2008). Finally, information sharing shapes an innovative climate for firm members' collective risk-taking activities (Acur et al., 2010). Highly innovative product strategies are accompanied by high technological and market uncertainty, potentially challenging the existing experience of firm members (Lau et al., 2010). Enhancing innovative climate and risk-taking commitment encourages the high involvement of a firm's product innovation process (Acur et al., 2010; Y. Wei et al., 2013). Therefore, we propose:

Hypothesis 3: The extent of information sharing within a firm is positively related to strategic ambidexterity in firm product innovation.

External knowledge sources and internal information sharing

We expect the combination of external knowledge sources and internal information sharing to encourage SAPI, and find support for the complementary effect. According to the open innovation literature, sourcing both diverse and specific knowledge assets is central to focus the firm's overall strategic purpose and improve the strategic portfolio in product innovation (Laursen & Salter, 2006). However, this is not enough to guarantee the value capture from the outside-in processes, as complementary internal factors are needed to effectively facilitate the use of knowledge sources (West & Bogers, 2014). The resource orchestration view supports that firms willing to develop SAPI should be able to effectively orchestrate resources (Sirmon et al., 2011), and the practice of information sharing accordingly is one of the most important complementary mechanisms facilitating not only the direct knowledge assimilation and transformation in outside-in processes, but also the integration and reconfiguration of external and internal knowledge resources (Lin et al., 2013). The open culture that information sharing contributes to a firm helps overcome the "not invented here" syndrome by adopting external knowledge appropriately for product information strategies (Chesbrough, 2003), thus reinforcing the positive association between knowledge breadth and depth and SAPI.

Regarding the external knowledge breadth, it first creates an abundant knowledge asset base for firms' internal resource orchestration for SAPI through the pursuit of diverse product information strategies. By leveraging the intraorganizational common understanding (Wu, 2008), facilitating knowledge dissemination (Lin et al., 2013) and constructing an innovative climate (Acur et al., 2010) for product innovation, information sharing encourages the collective participation and common involvement in these inbound innovation-resourcing processes (Y. Wei et al., 2013; Wooldridge et al., 2008). Accordingly, it leverages the potential alignment of external diverse knowledge resources to the different product information strategies (Sirmon et al., 2011), which enables strategic flexibility and consistency of product innovation simultaneously (Brozovic, 2018), as resources emphasizing change may influence strategic variety whereas resources valuing discipline may affect strategic intensity (Combs et al., 2011). Moreover, the internal information sharing further enables firms to combine both diverse external knowledge and internal resources (e.g., ideas, processes, and knowledge) in novel configurations in different NPD contexts (Markovic & Bagherzadeh, 2018). Firms that foster intraorganizational information sharing ensure that the retrieved and absorbed diverse external knowledge sources can be assigned, structured and bundled to different business units (Foss et al., 2011), which improves the orchestration of external resources and internal capabilities for appropriate product innovation strategy portfolios (Zobel, 2017). Therefore, we propose:

Hypothesis 4: The interaction between the extent of information sharing within a firm and the breadth of external knowledge sources used in firm innovation strategies is positively related to strategic ambidexterity in firm product innovation.

The combination of external knowledge depth and internal information sharing also improves SAPI. First, the embeddedness of interfirm interactions with a small number of knowledge sources can be seen as a firm's strategic resources (Crook et al., 2008), and information sharing enables the characteristics of these identified resources to be more understandable and assimilable by the firm's employees (Y. Wei et al., 2013). A firm, therefore, can deliberately reduce the intraorganizational knowledge asymmetry toward the specific external resources and encourage interdepartmental collaborations to help avoid the confusion of product flows (Lau et al., 2010) in order to improve the synergy among different product information strategies (Sirmon et al., 2011). In addition, the information sharing facilitates the effective bundling of internal resources with the identified external knowledge. As information sharing allows the absorbed identified external knowledge to spread across the firm (Foss et al., 2011), the firm could allocate the appropriate internal innovation activities to fit the specific external knowledge resources (Zobel, 2017) to take advantage of bundling and leveraging of combined external and internal assets for product innovations (Lau et al., 2010). This kind of combined benefit can be further accumulated regarding the deepening interactions with specific external knowledge sources (Nadkarni & Narayanan, 2007) and the thickening of the firm's orchestrating capabilities (Sirmon et al., 2011). Therefore, we propose:

Hypothesis 5: The interaction between the extent of information sharing within a firm and the depth of external knowledge sources used in firm innovation strategies is positively related to strategic ambidexterity in firm product innovation.

Figure 1 shows the conceptual framework.

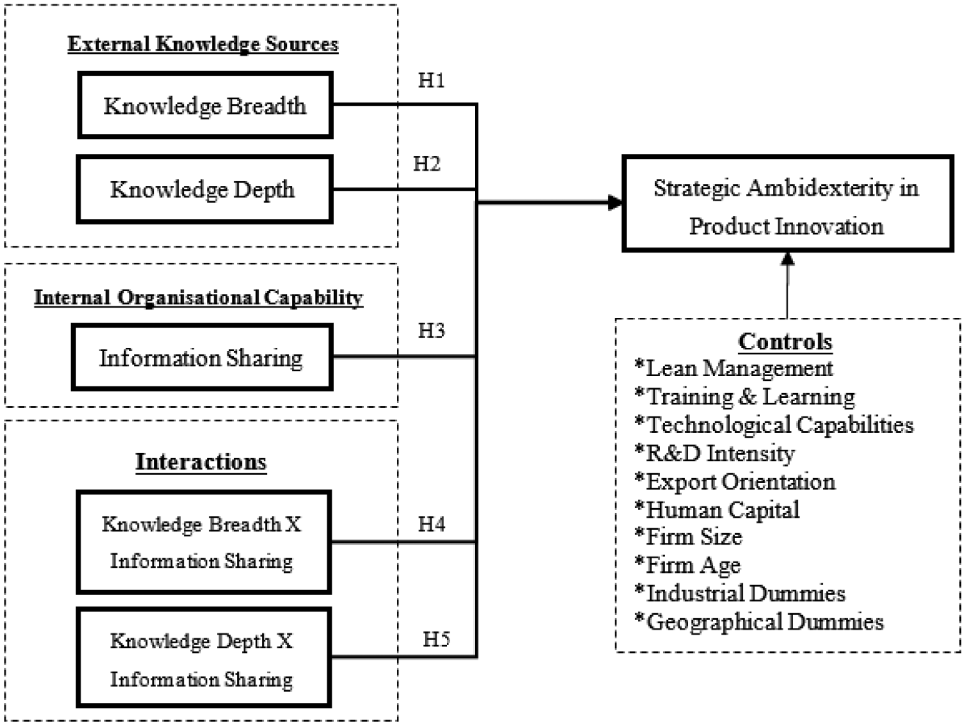

Figure 1. The conceptual framework.

Data and methods

Data

We tested our hypotheses in the empirical context of SMEs in China's Zhejiang Province. China provides an appropriate setting due to its complex economies in dynamic transition (Zhou & Wu, 2010), with SMEs accounting for more than 99% of all firms contributing to China's economic growth and employment (Zeng et al., 2010). Zhejiang Province is one of the fastest-growing regions in China, experiencing rapid growth and ranked first in income per capita in China for 21 consecutive years.[3] Zhejiang Province's industrial structure is a combination of traditional manufacturing industries (such as textiles and machinery) and high-tech industries (such as internet, and bio instruments and equipment).

The sample was initially drawn from a survey administered to the Directory of Zhejiang Manufacturing Enterprises via post by the Zhejiang Economic and Information Commission between September and December 2013. One thousand manufacturing enterprises with total annual revenue less than 400 million RMB[4] were randomly selected from the directory of SMEs

[3]Source: Zhejiang Statistical Yearbook (2014).

[4]The Ministry of Industry and Information Technology of China issued a standard classification of manufacturing SMEs in 2011, indicating that enterprises with annual total revenue less than 400 million RMB are SMEs.

compiled by the provincial government. We mainly used perceptual measurements in the survey because firms are usually reluctant to share objective data due to confidentiality issues (Ward et al., 1996), and subjective survey data was used to compare firms from different industries (Ledwith, 2000).

The questionnaire was originally developed in English and then translated into Chinese. To avoid cognitive misunderstanding for conceptual equivalence (Hoskisson et al., 2000), we asked two researchers to carry out the translations independently and then made comparisons until consensus was reached. For content and face validity, we conducted face-to-face interviews with five senior managers for their corrections on the questionnaire, enhancing the relevance and completeness of the items (Zhou & Wu, 2010). The questionnaire had two main parts. The first part was on the firm's innovation activities (for example, different innovation strategies) and general demographic information (such as size and foundation year), and the second part had questions on organizational capabilities and external knowledge sources. To minimize problems arising from common method bias (Podsakoff et al., 2003), we assigned each part to two different respondents (one senior manager and one operational manager) in each firm, increasing response accuracy due to a shorter questionnaire (Y. Zhang & Li, 2010). The two respondents from each firm were selected based on criteria such as long tenure in the firm, and engaging in or being responsible for core businesses involving the firm's product innovation, organizational management, and external collaboration.

We obtained 711 preliminary responses from the sample of 1,000 manufacturing firms. After removing 111 questionnaires containing several missing data items, our final sample had full information for 600 firms. This size greatly exceeds the common recommendation of a large sample for advanced statistical analyses (MacCallum et al., 1999). Of the firms, 34.7% were in the light industry, 26.7% in the machinery industry, 13.7% in the textile industry, 13.3% in the electronics equipment industry, 6.7% in the bio instruments and equipment industry, and 5.0% in the hardware and software equipment industry.

A high response rate (in our case 60%) is commonly acknowledged as a good sign against nonresponse bias (Armstrong & Overton, 1977, p. 396). We further investigated possible nonresponse bias by comparing the size and age of participating (600) and nonparticipating firms. A one-way ANOVA analysis of variance showed no significant difference for firm size (F-statistic = 0.944; Sig. = 0.332) and age (F-statistic = 2.011; Sig. = 0.156). We also compared the same characteristics for the early 10% (60 firms) and the late 10% of respondents (Armstrong & Overton, 1977) and found no significant difference in firm age (F-statistic = 1.081; Sig. = 0.301) or size (F-statistic = 0.025; Sig. = 0.875).

Since the survey was completed by two respondents per firm, potential common method bias (CMB) problems were largely controlled for

(Podsakoff & Organ, 1986). We applied Harman's single-factor test as a further check of CMB. Results show the first and most important factor explains 39% of the total variance, lower than the 50% threshold (Podsakoff et al., 2003), indicating the absence of CMB. In addition, as one of our interaction hypotheses was supported, we further argue the absence of CMB, as it is improbable for respondents to hold an "interaction-based theory" mindset that systematically biases their responses to produce these interaction effects (Aiken et al., 1991).

To check respondents' self-assessment of knowledgeability (Kumar et al., 1993), we adopted a seven-point Likert-type scale, anchored at "1 – a little involved" to "7 – heavily involved." The mean responses were 5.88 for senior managers and 5.84 for operational managers (with no significant difference: $t = 1.901$, $p < .05$). Both respondents for each firm were asked one common question on whether the firm exported products from China. The correlation test between their answers was checked for consistency (Nunnally & Bernstein, 1994; Y. Zhang & Li, 2010). The resulting correlation value of 0.913 (significant at $p < .01$) indicated good consistency.

Dependent variables and estimation method

We examined the relationship between leverage of external knowledge sources, internal organizational capability, and their interplay on the ability of the firm to combine different product information strategies simultaneously, namely SAPI. The respondents were asked to rate the importance of the different product information strategies they adopted during the period 2010 to 2013 on a seven-point Likert-type scale anchored at "1 – Not at all important" to "7 – Extremely important." Items relating to a broad number of different product information strategies were constructed (Acur et al., 2010; Carson et al., 2012): (1) frequent introduction of new products (Intensive launching PIS); (2) being first to introduce new products (First-mover PIS); (3) timely introduction of new products into the market (Time-to-market PIS); (4) develop and introduce products of the highest quality (Differentiation PIS); (5) using new products to penetrate markets (Market penetration PIS), and (6) introduce new products that meet customers' needs well (Target PIS). The main dependent variable was then created following Bozeman & Gaughan (2007) and Tartari et al. (2014), by computing an index combining both variety and intensity of product innovation strategies (*PIS index*) as follows:

$$PIS\ index_i = \sum_{s=1}^{S} r_s(1 - p_s)$$

where i is the firm, s is the type of product innovation strategy (with s taking an integer value between 0 and 6), and r_s is the rating received by the type of product innovation strategy s in the Likert-type scale; p_s is the frequency of firms' use of each type of product innovation strategy in the sample and is defined as:

$$p_s = \frac{\sum_{n=1}^{N} f_{n,s}}{N}$$

where f_s is a dummy variable taking the value of 1 if the firm considers the product innovation strategy s as relevant (by assigning it a value of 5 or higher) and 0 otherwise; n is the firm and N is the total number of firms in our sample (N =600). As highlighted in Tartari et al. (2014), this measure has the attractive feature of considering the "difficulty" of certain activities by incorporating the frequency of product innovation strategy nonoccurrence (1-p_s).

A high *PIS index* reflects reliance on a wide range of strategies, thus proxying well for our theoretical construct of SAPI. The scores for this measure range from 2 to 10.5, following a close to normal distribution. The type of information provided by this measure is illustrated in the following two contrasting cases from our sample: a firm with a score of 2.03; and a firm with a score of 10.48. The low-score firm just relies on two product information strategies as it deems the others not relevant. Moreover, the two adopted strategies are seen as low importance to the firm as it rated both of them 2 out of 7. The second example refers to a firm with a portfolio of product information strategies distributed across all six possible PIS types. In this case the adopted strategies were all rated as extremely important with a score of 7 out of 7.

Our dependent variable is restricted both by lower (zero is the minimum number of product information strategies available) and upper bounds (six is the maximum number of strategies available). Following Papke and Wooldridge (1996) and Laursen and Salter (2014), we normalize the *PIS index* to vary between 0 and 1 and apply a fractional logit regression estimation as follows:

$$E(PIS\ Index|x) = \Theta(\mathbf{x}\beta + \mathbf{z}\gamma)$$

where the *PIS index* is the variable constructed following the procedure above,[5] Θ(.) is the logistic function, x is the vector of key explanatory variables for firm i (see the following section), and $\mathbf{z}$ is the vector of controls for firm i (see section on control variables below).

[5]We also adopted a more standard PIS measure as the sum (average) of scores for each type of strategy and obtained results with no qualitative difference.

Explanatory variables

For our key explanatory variables, we capture the breadth and depth of external knowledge sources in the firm's innovation strategy based on prior literature (Laursen & Salter, 2006). We use the following 14 external knowledge sources: suppliers of equipment, materials, or components; clients or customers; competitors; consultants; universities or other higher education institutes; private research institutes; professional conferences, meetings; trade associations; technical and trade press; fairs and exhibitions; joint ventures; government agencies; intellectual property organizations; and lead users. *Knowledge breadth* takes a value from 0 to 14 based on the number of knowledge sources for firm innovations. *Knowledge depth* ranges from 0 to 14 based on the number of knowledge sources the firm rates as highly important. Both measures show a good degree of internal consistency with Cronbach's alpha of 0.87 for *Knowledge breadth* and 0.91 for *Knowledge depth*. The extent of correlation between the two measures is in line with prior studies such as Laursen and Salter (2006), supporting the expectation that they measure two different empirical constructs.

Our second set of explanatory variables refers to the importance of a firm's information sharing, which is regarded as a typical organizational capability. Previous studies do not provide a unified scale to define organizational capability involving information sharing, but rather use different constructs to emphasize specific parts of the concept (Alegre & Chiva, 2013; Vega-Jurado et al., 2008; Xu et al., 2012; Yam et al., 2011). For this reason, instead of relying on an existing set of measures, we adopt Churchill's (1979) framework and develop our measures following the procedure below. First, we decided on a pool of items relating to organizational practices that subtend organizational capability based on prior literature. Next, we asked industry experts to review and modify the selected items. The revised set of items was included in the questionnaire to rank their importance level.

We ran factor analysis on the 18 different items to synthesize the common factor information underlying organizational capability, and obtained three predicted factors: Information sharing, Lean management, and Training and Learning.[6,7] Previous literature facilitates the interpretation of these three constructs (Souitaris, 2002; Templeton et al., 2002; Xu et al., 2012). The first factor is labeled *Information sharing* and proxies for the ability of the firm to share knowledge within the organization (Y. Wei et al., 2013). The second group, *Lean management*, contains a range of items relating to attempts to streamline the organization's processes to reduce or eliminate non-value-

[6]The factors were obtained on the basis of three diverse factor extraction methods including the Iterated Principal Factors Method, the Maximum Likelihood Method, and the Principal Components Method. Details and results of factor extraction are available in the online supplemental material.

[7]For a robustness check, we also used the average value of the items entering each factor instead of the predicted factor and obtained robust results.

added activities via an assessment of processes and projects within the organization (Narasimhan et al., 2006). The third group is named *Training and learning*, such as upskilling through specialized training or practices to favor learning among peers (Song et al., 2003). We used the factor *Information sharing* as the main regressor and retained the other two factors *Lean management* and *Training and learning* as controls, not only regarding our theoretical consideration, but also because *Information sharing* is the first and most important explanatory factor.[8]

These three measures show good degrees of internal consistency with Cronbach's alpha greater than the threshold value of 0.7 (Kline, 2015): 0.92 for *Information sharing*, 0.92 for *Lean management*, and 0.89 for *Training and learning*. We implemented a set of analyses to assess the construct validity of organizational capability. First, we ran a confirmatory factor analysis on items, showing that all factor loadings are statistically significant ($p < .001$) with values for the standardized loadings greater than 0.5 indicating the unidimensionality of our measures (Anderson & Gerbing, 1988). Next, we checked convergent validity by computing the composite reliabilities (CR) and average variance extracted (AVE) for the three constructs of organizational capability (Fornell & Larcker, 1981): for information sharing CR=0.87 and AVE=0.43; for Lean management CR=0.88 and AVE=0.58; and for Training and learning CR=0.85 and AVE=0.59. In all of the cases the CR was greater than 0.8 and the AVE was close to the threshold value of 0.5, showing adequate reliability and convergent validity. Finally, to evaluate the constructs' discriminant validity, we compared the unrestricted model to the restricted model[9] by fixing a correlation value of one between each pair of constructs. Our constructs showed good discriminant validity as the unrestricted model had better fit and the chi-squared test was not rejected at standard confidence levels. As the absolute values related to the three constructs of organizational capability were all smaller than the square roots of their AVE, we further demonstrated good discriminant validity (Fornell & Larcker, 1981).

Control variables

We minimized omitted variable bias by including a large set of controls. We first controlled for the above predicted two factors of organizational capability, *Lean management* and *Training and learning*. Lean management was regarded as an organizational resources bundle for product value-chain improvement that contributes to diverse product information strategies (Narasimhan et al., 2006), such as time-to-market acceleration, manufacturing cycle time

[8]*Information sharing* explained 56.16% in principal component factor analysis, 54.03% in maximum-likelihood factor analysis, and 68.5% in iterated principal factor analysis.

[9]The model is composed of the three constructs of organizational capability and the one construct of technological capability measured by a Likert-type scale.

reduction, productivity leveraging, quality security, and manufacturing costs control (White et al., 1999). Training and learning was seen not only as a valuable resource for motivated employees to implement a firm's strategies (Chadwick et al., 2015), but also contributed to teamwork cooperation that positively influences product innovation (Collins & Smith, 2006).

We controlled for the firm's technological capabilities to further capture the complex nature of the firm's product innovation profile as in prior literature (Vega-Jurado et al., 2008; Zhou & Wu, 2010). Following Zhou and Wu (2010), we evaluated the ability of the firm to rely on various technologies via factor analysis on five different items of technological capabilities, involving (1) Acquiring relevant technological information; (2) Identifying new technological opportunities; (3) Responding to technological change; (4) Mastering state-of-art technologies; and (5) Developing a series of innovations constantly. The resulting predicted factor was then included as a control variable.[10,11]

The extent of Research and Development (R&D) investment has been shown to be relevant to product innovation not only as a provider of knowledge inputs for a firm's exploration activities (Love et al., 2014), but also as a key proxy for its absorptive capacity central to external knowledge adoption (Cohen & Levinthal, 1990). We thus included *R&D intensity as* a control variable to avoid potential confounding effects. As it is difficult to obtain exact R&D investment data from China's manufacturing firms (Von Zedtwitz, 2005), we used the proportion of employees employed in R&D activities within the firm.

We considered a set of characteristics that might influence innovation resources, incentives and engagement in different product information strategies: export orientation (*Export oriented*), measured as a dummy variable equaling 1 if the firm exported products abroad and 0 otherwise (Y. Zhang & Li, 2010), and firm size (*Log Size*) measured as the natural logarithm of the number of employees in the reference period (+1). Human capital also plays an important role in product innovation (for example, Kato et al., 2015), and we included a dummy, *Human capital*, taking the value of 1 when the CEO respondent of the firm has a bachelor's degree or above and 0 otherwise (Kato et al., 2015). We also included among the controls (natural log transformed and +1) firm's age (*Log Age*), relating to experience in developing product innovations (for example, Schneider & Veugelers, 2010).

We also included five dummies for the effect of industry characteristics on the abovementioned six industries. Finally, we considered confounding effects stemming from the geographical specificities of the area where the firm

[10]Results are available in the online supplemental material.
[11]The measure shows a good degree of internal consistency (Cronbach's alpha = 0.87; CR = 0.91) and convergent validity (AVE = 0.68).

operates. We controlled for this by including a set of 10 geographical dummies at the city level of aggregation.

Table 1 reports descriptive statistics and a correlation matrix for variables. In general, correlation among the independent variables was low, and the variance inflation factor ranged between 1.04 and 2.23 (well below the threshold value of 5), suggesting the absence of multicollinearity problems.

Results

In Table 2, we examine the relevance of the ability to combine different product information strategies (namely SAPI) across sectors. We also examine the level of knowledge breadth and depth, internal organizational capabilities, and technological capability in each industry. The average value of our *PIS index* is 0.699 (with a maximum possible value of 1), mainly driven by an above average value of 0.738 for the machinery industry, and values below the average for the light, textile, electronics, bio equipment and hardware and software industries. For external knowledge sources, although firms in our sample tend to use more than nine external knowledge sources for innovation (the average value of *Knowledge breadth* is 9.428), they draw from only about two sources in an intensive way (the average value of *Knowledge depth* is 2.263). For industry differences, the machinery industry by far has the highest level of external search breadth and depth as well of the product information strategies index, while the hardware and software industry shows a good level of adopting knowledge breadth (the value is above the average). Moreover, different industries rely on different combinations of organizational capabilities. For example, the electronics and machinery industries have higher levels of in-house information sharing, and the electronics, bio equipment, hardware and software, and machinery industries ascribe more importance to lean management. Conversely, the bio equipment, machinery and electronics industries rely more on training and learning activities. Finally, the bio equipment, machinery and light industries exhibit higher levels of technological capability.

Table 3 reports the main results, presenting the fractional logit regression estimate for our proxy of SAPI. Model 1 is the baseline model including the set of all control variables only. Model 2 further adds our main explanatory variables. For the controls, Model 1 shows that the two types of organizational capabilities – Lean management and Training and learning – are positively associated with firms' ability to combine different product information strategies, in line with prior literature regarding them as valuable organizational resources for product innovation (Chadwick et al., 2015; Narasimhan et al., 2006). Model 1 further indicates that technological capability is significantly positively correlated with the ability to combine different product information strategies. This resonates well with the strategic

Table 1. Correlation table (n = 600).

		Mean	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11
1	PIS index	0.70	0.17	0	1	1										
2	Knowledge breadth	9.43	3.95	0	14	0.41	1									
3	Knowledge depth	2.26	3.49	0	14	0.38	0.45	1								
4	Information sharing	5.64	0.87	3	7	0.38	0.21	0.24	1							
5	Lean management	5.43	1.10	1.4	7	0.45	0.28	0.27	0.00	1						
6	Training and learning	5.82	0.93	2.25	7	0.34	0.21	0.20	0.00	0.00	1					
7	Tech capability	5.71	0.89	1	7	0.71	0.35	0.33	0.44	0.36	0.43	1				
8	R&D	0.21	0.16	0	1	0.11	0.11	0.27	0.03	0.19	0.00	0.10	1			
9	Export-oriented	0.72	0.45	0	1	0.20	0.06	0.06	0.18	0.10	0.00	0.19	−0.06	1		
10	Human capital	0.47	0.50	0	1	0.03	0.02	−0.02	−0.03	0.01	0.03	0.00	0.06	−0.02	1	
11	Log size	2.47	0.52	0.60	3.30	0.13	0.01	−0.14	0.11	0.14	0.03	0.18	−0.22	0.29	−0.01	1
12	Log age	1.23	0.21	0.70	1.81	0.08	0.03	−0.07	0.08	0.03	0.01	0.10	−0.10	0.18	0.02	0.37

All values (absolute value) above 0.1 are significant at standard confidence levels ($p < .5$); Descriptive statistics for Information sharing, Lean management, Training and learning and Tech capability refer to the average value of the seven-point Likert-type scale.

Table 2. Product innovation strategies, external knowledge leveraging, organizational capabilities and technological capability by industry (n = 600).

Industry	N	PIS index	Knowledge breadth	Knowledge depth	Information sharing	Lean management	Training and learning	Tech capability
Machinery	160	0.738	10.169	3.013	5.658	5.503	5.872	5.760
Bio Instruments and Equipment	40	0.676	9.250	1.800	5.619	5.555	6.138	5.940
Electronics Equipment	80	0.679	8.963	1.700	5.710	5.565	5.822	5.690
Textile	82	0.680	9.402	1.951	5.629	5.132	5.671	5.588
Hardware and software	30	0.626	9.533	1.900	5.556	5.540	5.592	5.307
Light industry	208	0.698	9.067	2.168	5.615	5.410	5.805	5.735
Average	600	0.699	9.428	2.263	5.638	5.433	5.818	5.708

Table 3. Determinants of the balanced index of product innovation strategy (n = 600).

	PIS Index			
	Model 1	Model 2	Model 3	Model 4
Knowledge breadth		0.015**	0.018**	0.016**
		(0.008)	(0.008)	(0.008)
Knowledge depth		0.021**	0.018**	0.013
		(0.009)	(0.009)	(0.009)
Information sharing		0.127***	0.054	0.087**
		(0.030)	(0.067)	(0.034)
Know breadth × information sharing			0.009	
			(0.007)	
Know depth × information sharing				0.025***
				(0.010)
Training and learning	0.205***	0.214***	0.210***	0.212***
	(0.027)	(0.028)	(0.029)	(0.028)
Lean management	0.083***	0.099***	0.100***	0.099***
	(0.030)	(0.029)	(0.029)	(0.029)
Tech capability	0.486***	0.379***	0.381***	0.387***
	(0.033)	(0.035)	(0.036)	(0.036)
R&D	0.047	−0.057	−0.065	−0.102
	(0.171)	(0.177)	(0.176)	(0.176)
Export oriented	0.131**	0.093	0.105*	0.104*
	(0.059)	(0.057)	(0.057)	(0.057)
Human capital	0.048	0.052	0.055	0.060
	(0.048)	(0.046)	(0.047)	(0.047)
Log size	−0.028	−0.012	−0.010	−0.013
	(0.061)	(0.059)	(0.059)	(0.059)
Log age	−0.003	0.000	−0.010	−0.009
	(0.135)	(0.133)	(0.133)	(0.132)
Industry effects	Yes	Yes	Yes	Yes
Geographical effects	Yes	Yes	Yes	Yes
Wald chi-squared	733.485	850.460	845.777	854.121
df	23.000	26.000	27.000	27.000
p-value	0.000	0.000	0.000	0.000
Pseudo-R-squared	0.069	0.073	0.073	0.074
Observations	600.000	600.000	600.000	600.000

Fractional logit regressions with robust standard errors in parentheses. The dependent variable in all columns is a measure combining variety and intensity in product innovation strategies and developed following the methodology of Bozeman & Gaughan (2007) and Tartari et al. (2014). Significance levels: $*p < .05$, $**p < .01$, $***p < .001$.

management literature showing a complementarity between strategic flexibility and technological capability (Zhou & Wu, 2010). Similarly, an export-oriented firm is more likely to rely extensively on a higher number of product information strategies. Interestingly, firm size, human capital and R&D intensity are not relevant.

Model 2 in Table 3 shows the main focused results: the effect of external search breadth and depth and organizational capabilities on the product information strategies index. *Knowledge breadth and Knowledge depth* both exhibit significantly positive relationships with the *PIS index* ($\beta = 0.015$, $p < .01$ and $\beta = 0.021$, $p < .01$, respectively) with no significant difference between the two effects ($\chi^2[1] = 0.17$, $p > .1$), supporting Hypotheses 1 and 2. The information sharing presents a significantly positive correlation with the *PIS index* ($\beta = 0.127$, $p < .001$) supporting Hypothesis 3.

Hypotheses 4 and 5 refer to the interactions between external knowledge breadth and internal information sharing, and external knowledge depth and internal information sharing. Model 3 and Model 4 in Table 3 report our second specification, which adds a full set of two-way interactions between *Knowledge breadth and depth* and *Information sharing* of organizational capability to the former model accordingly. A positive sign would mean that the two constructs reciprocally reinforce; a negative sign would point to a substitution effect. We did not find any significant effect pointing to the interplay between *Knowledge breadth* and *Information sharing* in Model 3, which did not support Hypothesis 4. In contrast, Model 4 has a significantly positive coefficient for *Knowledge depth X Information sharing*, pointing to a reciprocally reinforcing effect ($\beta = 0.025$, $p < .001$) that supports Hypothesis 5.

We provide a graphical representation of the result and plot the average marginal effects of knowledge depth for various information sharing values with 95% confidence intervals in Figure 2, providing additional evidence on the complementarity effect of Hypothesis 5. When all the other variables are at their mean values, the average marginal effects of knowledge depth are negative (but not statistically significant) at values of information sharing below the mean; however, they turn positive and are increasing for higher values of information sharing. The confidence intervals show that the average marginal effects of knowledge depth are significant only for values of information sharing above the mean.

Conclusions and discussion

Our study examined the effect of firms' external knowledge breadth and depth, and internal information sharing, on the ability of firms to promote SAPI. In addition, we tested how the interactions of external knowledge breadth and depth and internal information sharing affect SAPI. The results show that

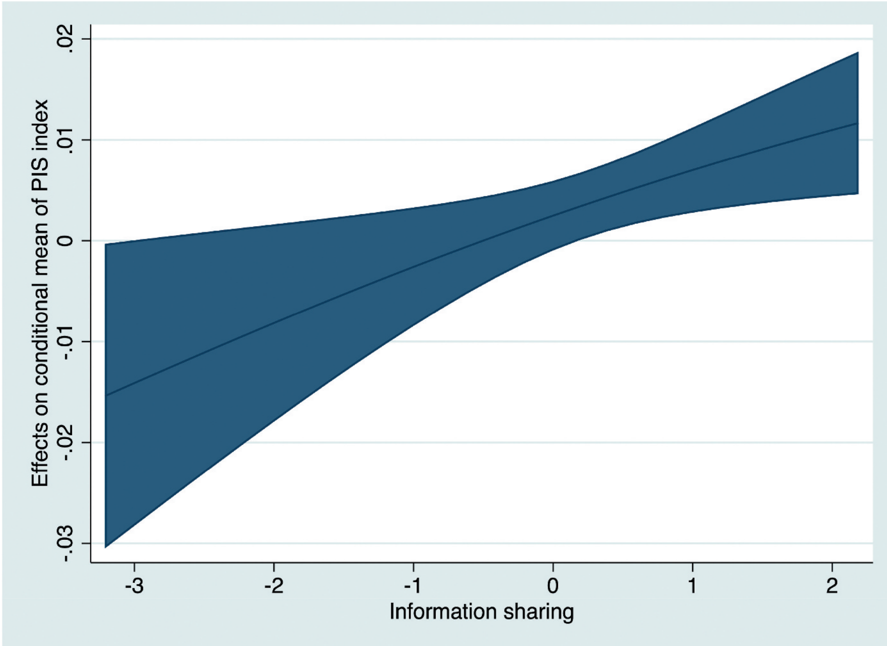

Figure 2. Average marginal effects of knowledge depth with 95% confidence interval.

firms' external knowledge breadth and depth, and internal information sharing, have positive effects on the ability to combine different product information strategies. Moreover, firms' internal information sharing and external knowledge depth, rather than knowledge breadth, reciprocally reinforce each other to positively correlate with SAPI. We make the following contributions.

Theoretically, we first contribute to the NPD literature on antecedents on the ability to combine different product information strategies. We add to the extant literature by conceptualizing *strategic ambidexterity in product innovation*. Regarding NPD, prior literature mainly holds the assumption of firms' resource scarcity, particularly for SMEs, and accordingly highlights the existence of trade-offs in product innovation decisions (for example, Barroso & Giarratana, 2013). The trade-offs involve potential internal conflicts of diverse product information strategies to achieve "faster, better and cheaper" (Stanko et al., 2012; Swink et al., 2006), and difficulty in making appropriate product innovation strategies fit the external uncertainty of firms' business environment (Bingham et al., 2014). Firms thus tend to choose between product diversification based on a broad resource base and a strategic focus with narrow resource accumulation (Barroso & Giarratana, 2013; Bingham et al., 2014; Jourdan & Kivleniece, 2017). Our work revisits this paradoxical lens addressing the above trade-offs and argues that firms can develop SAPI, combining both variety and intensity of different product information strategies, as long as they are capable of orchestrating external and internal resources (Sirmon et al., 2007), which points to a third viable option to product innovation. We take a step further and investigate the external and internal antecedents of SAPI, which have attracted little attention in prior NPD literature (Acur et al., 2010; Vega-Jurado et al., 2008), and add depth to the NPD literature by exploring the relationship between external knowledge sources and internal capabilities and SAPI. Notably, we show that the following factors have a positive effect on firm SAPI: the capacity of the firm to (i) expand knowledge sources beyond organizational boundaries (Alexy et al., 2018; Laursen & Salter, 2006); (ii) leverage information sharing for internal resource orchestration (Sirmon et al., 2007, 2011), and (iii) ensure complementarity between firms' external knowledge depth and internal information sharing. In addition, we extend the NPD research in the context of Chinese manufacturing SMEs, with firms facing limited natural resources and experiencing immense and rapid changes in their business environment. As prior studies mainly consider the role of antecedents on Chinese manufacturing firms' product innovation performance (for example, Jeong et al., 2006; J. Zhang & Wu, 2017), we advance attention on SMEs in particular by focusing on the antecedents which matter to firms' ability to deal with diverse product information strategies, and further explore the role of external knowledge sources, internal information sharing, and their complementarity on firms' SAPI in a combined framework.

Second, we add to the open innovation literature. Studies on how *knowledge breadth* and *knowledge depth* affect firms' performance are regarded as a key issue in the field (for example, Laursen & Salter, 2006). We extend this research stream to the NPD context by targeting the role of knowledge breadth and depth on firms' product innovation strategic choices. We further show the complementary role of organizational capabilities (internal information sharing) for external knowledge sourcing (external knowledge depth), tentatively supporting the frontier opportunities proposed by Vanhaverbeke et al. (2014), targeting firms' functions beyond R&D capabilities in open innovation (we highlight organizational capabilities). As is the case with administrative styles, internal communication systems, and teams' interdependence (Vega-Jurado et al., 2008), organizational capabilities can be treated as internal hidden resources relating to bundles of non-R&D activities in open innovation contexts (West & Bogers, 2014). In this sense, information sharing plays an important integrating mechanism – also complementing West & Bogers's (2014) innovation integration review – helping firms profit from external sources. We further differentiate this integrating mechanism, and argue that it matters only to firms focusing on small numbers of external knowledge sources but cannot affect firms engaging in knowledge breadth. We surmise that this may be because the specific and focused knowledge is more likely to be translated, assimilated and transformed to consensus by firms in the information-sharing process (Wu, 2008), while the information sharing ineffectively reinforces the variety of knowledge sources' benefits. Based on this combined consideration of external knowledge sources and internal organizational capability on information sharing, we not only directly respond to Alexy et al.'s (2018) claim that future open innovation research should emphasize how firms jointly deploy external resources and internal capabilities for value creation and capture, but also steer the open innovation literature by connecting it with existing management theories (Vanhaverbeke et al., 2014). Here we embrace open innovation with the resource orchestration view, and indicate that their combination reflects how firms benefit from orchestrating both external and internal organizational resources. Finally, we further extend the open innovation literature's geographical context. Using data from Chinese manufacturing SMEs, we extend the open innovation frontier proposed by Vanhaverbeke et al. (2014) toward non-Western and SME contexts.

We provide relevant practical implications for managers as our primary stakeholder (Fisher, 2020). First, managers should consider an ambidextrous vision in the strategies they adopt for product innovation, coping with the potential trade-offs across different product information strategies and the changing environmental uncertainty. We argue that in addition to relying on an "either/or" dichotomy logic by acting as generalist or specialist firms coordinating different product information strategies, or by behaving as opportunists or strategists to adapt to the fast-changing environment to capture opportunity, managers could deliberately and strategically cultivate their strategic vision according to an ambidextrous logic, playing as a hybrid actor carrying out strategic variety and intensity simultaneously through the pursuit of diverse product information strategies. To do so, managers – particularly the ones who are in charge of SMEs – need to be aware of the challenge of resource constraints to developing SAPI. Accordingly, they need to primarily overcome resource constraints by leveraging external resources and/or enhancing organizational capabilities like information sharing by effectively orchestrating internal resources. Further, the combination of specific internal and external factors seems to reinforce each other. The mutually reinforcing effect between knowledge depth and information sharing we observed supports focusing on a reduced number of external sources – while facilitating internal information sharing – to help further develop SAPI.

Our study has some limitations that suggest avenues for future research. First, the cross-sectional design of the study may have a reverse causality problem. However, we suggest this is not a significant concern for three reasons. First, the existing literature in general argues that the external knowledge and internal capabilities, particularly information sharing, matter to firms' product innovations (for example, Laursen & Salter, 2006; Lin et al., 2013; Vega-Jurado et al., 2008). Second, it is difficult to explain the reverse causality of the significant interaction effects of our study, which offer stronger support to our hypotheses (Simons & Peterson, 2000, p. 109). Third, the face-to-face interviews with five senior managers in our study indicate that firms have engaged in exploring knowledge sources and practicing information sharing independently and prior to developing product information strategies, as these activities are more convenient, playing a fundamental role for firms accumulating strategic and operational resources. Nonetheless, we need to construct a longitudinal design to assess the hypotheses and uncover relevant dynamic mechanisms in our empirical research framework.

The second limitation is that our work focuses on a single country, China, which weakens the external validity of our results. Future work should aim to extend our analysis to a number of countries to obtain greater generalizability. Our third limitation is only including six types of product innovation strategy in our empirical setting as more product innovation strategies might be available to firms.

Acknowledgments

Special thanks go to two anonymous reviewers and the editor for their helpful suggestions. We are grateful for the comments from Prof. Henry Chesbrough, Marcus Holgersson, Frederic Ley Roy, Chiara R. De Marco, and Annika Lorenz on Berkeley Innovation Seminar 2017, Haas School of Business, UC Berkeley. Francesco Rentocchini is currently an employee of the European Commission. The views expressed are purely his personal views and may not in any circumstances be regarded as stating an official position of the European Commission. The usual caveats apply.

Funding

Liang Mei acknowledges the support received from the General Project of National Natural Science Foundation of China titled "The Governance Mechanism of Emerging Technology Based on Responsible Innovation Paradigm: An Ambidexterity Perspective" under Grant number 72174005, and the Humanities and Social Science Fund of Ministry of Education of China under Grant number 20YJC630102.

ORCID

Liang Mei http://orcid.org/0000-0003-3845-7754
Francesco Rentocchini http://orcid.org/0000-0002-6414-0577
Jin Chen http://orcid.org/0000-0002-0156-9237

References

Acur, N., Kandemir, D., De Weerd-Nederhof, P. C., & Song, M. (2010). Exploring the impact of technological competence development on speed and NPD program performance. *Journal of Product Innovation Management*, *27*(6), 915–929. https://doi.org/10.1111/j.1540-5885.2010.00760.x

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

Alegre, J., & Chiva, R. (2013). Linking entrepreneurial orientation and firm performance: The role of organizational learning capability and innovation performance. *Journal of Small Business Management*, *51*(4), 491–507. https://doi.org/10.1111/jsbm.12005

Alexy, O., West, J., Klapper, H., & Reitzig, M. (2018). Surrendering control to gain advantage: Reconciling openness and the resource-based view of the firm. *Strategic Management Journal*, *39*(6), 1704–1727. https://doi.org/10.1002/smj.2706

Amezcua, A. S., Grimes, M. G., Bradley, S. W., & Wiklund, J. (2013). Organizational sponsorship and founding environments: A contingency view on the survival of business-incubated firms, 1994–2007. *Academy of Management Journal*, *56*(6), 1628–1654. https://doi.org/10.5465/amj.2011.0652

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411–423. https://doi.org/10.1037/0033-2909.103.3.411

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, *14*(3), 396–402. https://doi.org/10.1177/002224377701400320

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Barroso, A., & Giarratana, M. S. (2013). Product proliferation strategies and firm performance: The moderating role of product space complexity. *Strategic Management Journal*, *34*(12), 1435–1452. https://doi.org/10.1002/smj.2079

Berlin, I. (2013). *The Hedgehog and The Fox: An essay on Tolstoy's view of history*. Princeton University Press.

Bingham, C. B., Furr, N. R., & Eisenhardt, K. M. (2014). The opportunity paradox. *MIT Sloan Management Review*, *56*(1), 29–35. https://sloanreview.mit.edu/article/the-opportunity-paradox/

Bozeman, B., & Gaughan, M. (2007). Impacts of grants and contracts on academic researchers' interactions with industry. *Research Policy*, *36*(5), 694–707. https://doi.org/10.1016/j.respol.2007.01.007

Brozovic, D. (2018). Strategic flexibility: A review of the literature. *International Journal of Management Reviews*, *20*(1), 3–31. https://doi.org/10.1111/ijmr.12111

Cankurtaran, P., Langerak, F., & Griffin, A. (2013). Consequences of new product development speed: A meta-analysis. *Journal of Product Innovation Management*, *30*(3), 465–486. https://doi.org/10.1111/jpim.12011

Carroll, G. R. (1985). Concentration and specialization: Dynamics of niche width in populations of organizations. *American Journal of Sociology*, *90*(6), 1262–1283. https://doi.org/10.1086/228210

Carroll, G. R., & Swaminathan, A. (2000). Why the microbrewery movement? Organizational dynamics of resource partitioning in the US brewing industry. *American Journal of Sociology*, *106*(3), 715–762. https://doi.org/10.1086/318962

Carson, S. J., Wu, T., & Moore, W. L. (2012). Managing the trade-off between ambiguity and volatility in new product development. *Journal of Product Innovation Management*, *29*(6), 1061–1081. https://doi.org/10.1111/j.1540-5885.2012.00950.x

Chadwick, C., Super, J. F., & Kwon, K. (2015). Resource orchestration in practice: CEO emphasis on SHRM, commitment-based HR systems, and firm performance. *Strategic Management Journal*, *36*(3), 360–376. https://doi.org/10.1002/smj.2217

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press.

Churchill, G. A., Jr. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research*, *16*(1), 64–73. https://doi.org/10.1177/002224377901600110

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(1), 128–152. https://doi.org/10.2307/2393553

Collins, C. J., & Smith, K. G. (2006). Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms. *Academy of Management Journal*, *49*(3), 544–560. https://doi.org/10.5465/amj.2006.21794671

Combe, I. A., Rudd, J. M., Leeflang, P. S., & Greenley, G. E. (2012). Antecedents of strategic flexibility: Management cognition, firm resources and strategic options. *European Journal of Marketing*, *46*(10), 1320–1339. https://doi.org/10.1108/03090561211248053

Combs, J. G., Ketchen, D. J., Jr., Ireland, R. D., & Webb, J. W. (2011). The role of resource flexibility in leveraging strategic resources. *Journal of Management Studies*, *48*(5), 1098–1125. https://doi.org/10.1111/j.1467-6486.2009.00912.x

Crook, T. R., Ketchen, D. J., Jr., Combs, J. G., & Todd, S. Y. (2008). Strategic resources and performance: A meta-analysis. *Strategic Management Journal*, *29*(11), 1141–1154. https://doi.org/10.1002/smj.703

Darroch, J., & McNaughton, R. (2002). Examining the link between knowledge management practices and types of innovation. *Journal of Intellectual Capital*, *3*(3), 210–222. https://doi.org/10.1108/14691930210435570

Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: Exploring the phenomenon. *R&d Management*, *39*(4), 311–316. https://doi.org/10.1111/j.1467-9310.2009.00570.x

Fisher, G. (2020). Why every business professor should write practitioner-focused articles. *Business Horizons*, *63*(4), 417–419. https://doi.org/10.1016/j.bushor.2020.03.004

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Foss, N. J., Laursen, K., & Pedersen, T. (2011). Linking customer interaction and innovation: The mediating role of new organizational practices. *Organization Science*, *22*(4), 980–999. https://doi.org/10.1287/orsc.1100.0584

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal*, *47*(2), 209–226. https://doi.org/10.5465/20159573

Hewitt-Dundas, N. (2006). Resource and capability constraints to innovation in small and large plants. *Small Business Economics*, *26*(3), 257–277. https://doi.org/10.1007/s11187-005-2140-3

Hoskisson, R. E., Eden, L., Lau, C. M., & Wright, M. (2000). Strategy in emerging economies. *Academy of Management Journal*, *43*(3), 249–267. https://doi.org/10.5465/1556394

Jeong, I., Pae, J. H., & Zhou, D. (2006). Antecedents and consequences of the strategic orientations in new product development: The case of Chinese manufacturers. *Industrial Marketing Management*, *35*(3), 348–358. https://doi.org/10.1016/j.indmarman.2005.06.010

Jiménez-Jiménez, D., & Sanz-Valle, R. (2011). Innovation, organizational learning, and performance. *Journal of Business Research*, *64*(4), 408–417. https://doi.org/10.1016/j.jbusres.2010.09.010

Jourdan, J., & Kivleniece, I. (2017). Too much of a good thing? The dual effect of public sponsorship on organizational performance. *Academy of Management Journal*, *60*(1), 55–77. https://doi.org/10.5465/amj.2014.1007

Kato, M., Okamuro, H., & Honjo, Y. (2015). Does founders' human capital matter for innovation? Evidence from Japanese start-ups. *Journal of Small Business Management*, *53*(1), 114–128. https://doi.org/10.1111/jsbm.12094

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford publications.

Kuester, S., Homburg, C., & Hess, S. C. (2012). Externally directed and internally directed market launch management: The role of organizational factors in influencing new product success. *Journal of Product Innovation Management*, *1*(29), 38–52. https://doi.org/10.1111/j.1540-5885.2012.00968.x

Kumar, N., Stern, L. W., & Anderson, J. C. (1993). Conducting interorganizational research using key informants. *Academy of Management Journal*, *36*(6), 1633–1651. https://doi.org/10.5465/256824

Lant, T. K., Milliken, F. J., & Batra, B. (1992). The role of managerial learning and interpretation in strategic persistence and reorientation: An empirical exploration. *Strategic Management Journal*, *13*(8), 585–608. https://doi.org/10.1002/smj.4250130803

Lau, A. K., Tang, E., & Yam, R. C. (2010). Effects of supplier and customer integration on product innovation and performance: Empirical evidence in Hong Kong manufacturers. *Journal of Product Innovation Management*, *27*(5), 761–777. https://doi.org/10.1111/j.1540-5885.2010.00749.x

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, *27*(2), 131–150. https://doi.org/10.1002/smj.507

Laursen, K., & Salter, A. J. (2014). The paradox of openness: Appropriability, external search and collaboration. *Research Policy*, *43*(5), 867–878. https://doi.org/10.1016/j.respol.2013.10.004

Ledwith, A. (2000). Management of new product development in small electronics firms. *Journal of European Industrial Training*, *24*(2–3), 137–148. https://doi.org/10.1108/03090590010321106

Li, Y., & Vanhaverbeke, W. (2009). The effects of inter-industry and country difference in supplier relationships on pioneering innovations. *Technovation*, *29*(12), 843–858. https://doi.org/10.1016/j.technovation.2009.08.001

Lim, K., Chesbrough, H., & Ruan, Y. (2010). Open innovation and patterns of R&D competition. *International Journal of Technology Management*, *52*(3/4), 295–321. https://doi.org/10.1504/IJTM.2010.035978

Lin, H. E., McDonough, E. F., III, Lin, S. J., & Lin, C. Y. Y. (2013). Managing the exploitation/exploration paradox: The role of a learning capability and innovation ambidexterity. *Journal of Product Innovation Management*, *30*(2), 262–278. https://doi.org/10.1111/j.1540-5885.2012.00998.x

Love, J. H., Roper, S., & Vahter, P. (2014). Learning from openness: The dynamics of breadth in external innovation linkages. *Strategic Management Journal*, *35*(11), 1703–1716. https://doi.org/10.1002/smj.2170

Luca, L. M. D., & Atuahene-Gima, K. (2007). Market knowledge dimensions and cross-functional collaboration: Examining the different routes to product innovation performance. *Journal of Marketing*, *71*(1), 95–112. https://doi.org/10.1509/jmkg.71.1.95

Lynn, G. S., & Akgün, A. E. (1998). Innovation strategies under uncertainty: A contingency approach for new product development. *Engineering Management Journal*, *10*(3), 11–18. https://doi.org/10.1080/10429247.1998.11414991

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods*, *4*(1), 84–99. https://doi.org/10.1037/1082-989X.4.1.84

Markovic, S., & Bagherzadeh, M. (2018). How does breadth of external stakeholder co-creation influence innovation performance? Analyzing the mediating roles of knowledge sharing and product innovation. *Journal of Business Research*, *88*, 173–186. https://doi.org/10.1016/j.jbusres.2018.03.028

McEvily, B., & Marcus, A. (2005). Embedded ties and the acquisition of competitive capabilities. *Strategic Management Journal*, *26*(11), 1033–1055. https://doi.org/10.1002/smj.484

Moye, N. A., & Langfred, C. W. (2004). Information sharing and group conflict: Going beyond decision making to understand the effects of information sharing on group performance. *International Journal of Conflict Management*, *15*(4), 381–410. https://doi.org/10.1108/eb022919

Nadkarni, S., & Narayanan, V. K. (2007). Strategic schemas, strategic flexibility, and firm performance: The moderating role of industry clockspeed. *Strategic Management Journal*, *28*(3), 243–270. https://doi.org/10.1002/smj.576

Narasimhan, R., Swink, M., & Kim, S. W. (2006). Disentangling leanness and agility: An empirical investigation. *Journal of Operations Management*, *24*(5), 440–457. https://doi.org/10.1016/j.jom.2005.11.011

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychological Theory*. MacGraw-Hill.

Papke, L. E., & Wooldridge, J. M. (1996). Econometric methods for fractional response variables with an application to 401 (k) plan participation rates. *Journal of Applied Econometrics*, *11*(6), 619–632. https://doi.org/10.1002/(SICI)1099-1255(199611)11:6<619::AID-JAE418>3.0.CO;2-1

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management*, *12*(4), 531–544. https://doi.org/10.1177/014920638601200408

Rajalo, S., & Vadi, M. (2017). University-industry innovation collaboration: Reconceptualization. *Technovation*, *62*, 42–54. https://doi.org/10.1016/j.technovation.2017.04.003

Sáenz, J., Aramburu, N., & Blanco, C. E. (2012). Knowledge sharing and innovation in Spanish and Colombian high-tech firms. *Journal of Knowledge Management*, *16*(6), 919–933. https://doi.org/10.1108/13673271211276191

Schneider, C., & Veugelers, R. (2010). On young highly innovative companies: Why they matter and how (not) to policy support them. *Industrial and Corporate Change*, *19*(4), 969–1007. https://doi.org/10.1093/icc/dtp052

Shinkle, G. A., & McCann, B. T. (2014). New product deployment: The moderating influence of economic institutional context. *Strategic Management Journal*, *35*(7), 1090–1101. https://doi.org/10.1002/smj.2132

Simons, T. L., & Peterson, R. S. (2000). Task conflict and relationship conflict in top management teams: The pivotal role of intragroup trust. *Journal of Applied Psychology*, *85*(1), 102–111. https://doi.org/10.1037/0021-9010.85.1.102

Sirmon, D. G., Hitt, M. A., & Ireland, R. D. (2007). Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of Management Review*, *32*(1), 273–292. https://doi.org/10.5465/amr.2007.23466005

Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource orchestration to create competitive advantage: Breadth, depth, and life cycle effects. *Journal of Management*, *37*(5), 1390–1412. https://doi.org/10.1177/0149206310385695

Song, J., Almeida, P., & Wu, G. (2003). Learning–by–hiring: When is mobility more likely to facilitate interfirm knowledge transfer? *Management Science*, *49*(4), 351–365. https://doi.org/10.1287/mnsc.49.4.351.14429

Song, M., & Montoya-Weiss, M. M. (2001). The effect of perceived technological uncertainty on Japanese new product development. *Academy of Management Journal*, *44*(1), 61–80. https://doi.org/10.5465/3069337

Souitaris, V. (2002). Firm–specific competencies determining technological innovation: A survey in Greece. *R&D Management*, *32*(1), 61–77. https://doi.org/10.1111/1467-9310.00239

Stanko, M. A., Molina-Castillo, F. J., & Munuera-Aleman, J. L. (2012). Speed to market for innovative products: Blessing or curse? *Journal of Product Innovation Management*, *29*(5), 751–765. https://doi.org/10.1111/j.1540-5885.2012.00943.x

Swink, M., Talluri, S., & Pandejpong, T. (2006). Faster, better, cheaper: A study of NPD project efficiency and performance tradeoffs. *Journal of Operations Management*, *24*(5), 542–562. https://doi.org/10.1016/j.jom.2005.09.004

Tartari, V., Perkmann, M., & Salter, A. (2014). In good company: The influence of peers on industry engagement by academic scientists. *Research Policy*, *43*(7), 1189–1203. https://doi.org/10.1016/j.respol.2014.02.003

Tellis, G. J., & Johnson, J. (2007). The value of quality. *Marketing Science*, *26*(6), 758–773. https://doi.org/10.1287/mksc.1070.0286

Templeton, G. F., Lewis, B. R., & Snyder, C. A. (2002). Development of a measure for the organizational learning construct. *Journal of Management Information Systems*, *19*(2), 175–218. https://doi.org/10.1080/07421222.2002.11045727

Van de Vrande, V., De Jong, J. P., Vanhaverbeke, W., & De Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, *29*(6–7), 423–437. https://doi.org/10.1016/j.technovation.2008.10.001

Vanhaverbeke, W. (2017). *Managing open innovation in SMEs*. Cambridge University Press.

Vanhaverbeke, W., Chesbrough, H., & West, J. (2014). Surfing the new wave of open innovation research. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *New frontiers in open innovation* (pp. 281–294). Oxford University Press.

Vega-Jurado, J., Gutiérrez-Gracia, A., Fernández-de-Lucio, I., & Manjarrés-Henríquez, L. (2008). The effect of external and internal factors on firms' product innovation. *Research Policy*, *37*(4), 616–632. https://doi.org/10.1016/j.respol.2008.01.001

Von Hippel, E. (2001). Innovation by user communities: Learning from open-source software. *MIT Sloan Management Review*, *42*(4), 82. https://sloanreview.mit.edu/article/innovation-by-user-communities-learning-from-opensource-software/

Von Zedtwitz, M. (2005). International R&D strategies of TNCs from developing countries: The case of China. In *Globalization of R&D and developing countries, Proceedings of the Expert Meeting Geneva 24–26 January 2005,* United Nations (Eds.), UNCTAD/ITE/IIA/2005/6.

Voss, G. B., & Voss, Z. G. (2013). Strategic ambidexterity in small and medium-sized enterprises: Implementing exploration and exploitation in product and market domains. *Organization Science*, *24*(5), 1459–1477. https://doi.org/10.1287/orsc.1120.0790

Ward, P. T., Bickford, D. J., & Leong, G. K. (1996). Configurations of manufacturing strategy, business strategy, environment and structure. *Journal of Management*, *22*(4), 597–626. https://doi.org/10.1177/014920639602200404

Wei, Y., O'Neill, H., Lee, R. P., & Zhou, N. (2013). The impact of innovative culture on individual employees: The moderating role of market information sharing. *Journal of Product Innovation Management*, *30*(5), 1027–1041. https://doi.org/10.1111/j.1540-5885.2012.01000.x

Wei, Z., Yi, Y., & Guo, H. (2014). Organizational learning ambidexterity, strategic flexibility, and new product development. *Journal of Product Innovation Management*, *31*(4), 832–847. https://doi.org/10.1111/jpim.12126

West, J., & Bogers, M. (2014). Leveraging external sources of innovation: A review of research on open innovation. *Journal of Product Innovation Management*, *31*(4), 814–831. https://doi.org/10.1111/jpim.12125

White, R. E., Pearson, J. N., & Wilson, J. R. (1999). JIT manufacturing: A survey of implementations in small and large US manufacturers. *Management Science*, *45*(1), 1–15. https://doi.org/10.1287/mnsc.45.1.1

Wooldridge, B., Schmid, T., & Floyd, S. W. (2008). The middle management perspective on strategy process: Contributions, synthesis, and future research. *Journal of Management*, *34*(6), 1190–1221. https://doi.org/10.1177/0149206308324326

Wu, W. P. (2008). Dimensions of social capital and firm competitiveness improvement: The mediating role of information sharing. *Journal of Management Studies*, *45*(1), 122–146. https://doi.org/10.1111/j.1467-6486.2007.00741.x

Wynarczyk, P., Piperopoulos, P., & McAdam, M. (2013). Open innovation in small and medium-sized enterprises: An overview. *International Small Business Journal*, *31*(3), 240–255. https://doi.org/10.1177/0266242612472214

Xu, Q., Chen, J., Shou, Y., & Liu, J. (2012). *Leverage innovation capability: Application of total innovation management in China's SMEs' study*. World Scientific.

Yam, R. C., Lo, W., Tang, E. P., & Lau, A. K. (2011). Analysis of sources of innovation, technological innovation capabilities, and performance: An empirical study of Hong Kong manufacturing industries. *Research Policy*, *40*(3), 391–402. https://doi.org/10.1016/j.respol.2010.10.013

Zeng, S. X., Xie, X. M., & Tam, C. M. (2010). Relationship between cooperation networks and innovation performance of SMEs. *Technovation*, *30*(3), 181–194. https://doi.org/10.1016/j.technovation.2009.08.003

Zhang, J., & Wu, W. P. (2017). Leveraging internal resources and external business networks for new product success: A dynamic capabilities perspective. *Industrial Marketing Management*, *61*, 170–181. https://doi.org/10.1016/j.indmarman.2016.06.001

Zhang, Y., & Li, H. (2010). Innovation search of new ventures in a technology cluster: The role of ties with service intermediaries. *Strategic Management Journal*, *31*(1), 88–109. https://doi.org/10.1002/smj.806

Zhou, K. Z., & Wu, F. (2010). Technological capability, strategic flexibility, and product innovation. *Strategic Management Journal*, *31*(5), 547–561. https://doi.org/10.1002/smj.830

Zobel, A. K. (2017). Benefiting from open innovation: A multidimensional model of absorptive capacity. *Journal of Product Innovation Management*, *34*(3), 269–288. https://doi.org/10.1111/jpim.12361