



INNOVATION SEARCH OF NEW VENTURES IN A TECHNOLOGY CLUSTER: THE ROLE OF TIES WITH SERVICE INTERMEDIARIES

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In this study, we examine the relationships between new ventures' ties with service intermediaries (i.e., technology service firms, accounting and financial service firms, law firms, and talent search firms) and their product innovation in the context of a technology cluster. Because service intermediaries sit at the intersection of many firms, organizations and industries, they maintain extensive networks in a cluster. We propose that new ventures' ties with service intermediaries enable the ventures to plug into these networks and contribute to the ventures' product innovation by broadening the scope of their external innovation search and reducing their search cost. Moreover, we argue that the positive relationships between new ventures' ties with service intermediaries and their product innovation will become stronger when search in the networks in the cluster is more important to the ventures' product innovation. Based upon a sample of new ventures in a technology cluster in China, our results support these arguments. Copyright © 2009 John Wiley & Sons, Ltd.

INTRODUCTION

New ventures characteristically suffer from the liability of newness because they have not established relationships with outside actors and have limited resources (Stinchcombe, 1965). For this reason, Schoonhoven, Eisenhardt, and Lyman (1990: 177) have explicitly argued that successful product innovation is important for new ventures to gain cash flow for financial independence, to gain external visibility and legitimacy, and to improve the likelihood of survival. This is especially true in technology industries where dynamic

market and technology changes require the ventures to constantly deal with environmental volatility, to increase development speed, and to establish new markets and technologies (Katila and Shane, 2005; Li and Atuahene-Gima, 2001, 2002; Smith, Collins, and Clark, 2005).

The extant literature on innovation has highlighted the importance of search (Cohen and Levinthal, 1990; Fleming, 2001; Katila, 2002; Katila and Ahuja, 2002; Rosenkopf and Nerkar, 2001; Smith, *et al.*, 2005). Innovation search is a problem-solving activity in which firms solve problems through combining knowledge elements to create new products (Katila, 2002). The knowledge space for firm innovation search has both internal sector (i.e., knowledge created within the searching firm) and external sector (i.e., knowledge created by others) (Katila, 2002; Rosenkopf and Nerkar, 2001). Due to new ventures' short history and limited resources, their internal knowledge space can be limited. Thus, it is not surprising

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that the extant literature has emphasized the important role of new ventures' external ties in their innovation, presumably because external ties can facilitate their external innovation search. It has been found that new ventures' ties with established firms (e.g., Baum, Calabrese, and Silverman, 2000; Shan, Walker, and Kogut, 1994; Stuart, 2000) and universities and research institutes (e.g., Baum *et al.*, 2000) have positive impact on their innovation.

While external ties with established firms, universities, and research institutes are important, new ventures may face considerable difficulty in developing ties with these prominent organizations. As noted by Stinchcombe (1965), new ventures may find it difficult to access interfirm networks because they have a short history, lack of a proven performance record, resources, legitimacy, and status. Indeed, recent research on innovation starts to pay attention to the role of service intermediaries (e.g., Hargadon and Sutton, 1997; Howells, 2006; Wolpert, 2002). Service intermediaries refer to professional service organizations that provide firms with supporting services in areas such as accounting and finance, talent search, law, and technology services (e.g., technology commercialization and brokering). Because service intermediaries are potentially available to all firms, they are accessible to new ventures. More important, because service intermediaries sit at the intersection of many firms, organizations, and industries, they can facilitate the exchange of information about innovation among firms (Wolpert, 2002: 78). The role of service intermediaries is particularly critical in technology clusters. Bahrami and Evans (1995) argued that in technology clusters service intermediaries, together with private firms, universities and research institutes, and venture capitalists, form an industrial ecology that facilitates and disciplines the development of technology firms. Saxenian (1990: 96) argued that by sharing costs and risks and pooling technical expertise service intermediaries allow Silicon Valley's specialist firms to continue to innovate and react flexibly.

Despite the potential important role of service intermediaries in new venture innovation, theoretical or empirical work in this area is very limited. To advance the literature, we examine how and under what conditions new ventures' ties with service intermediaries are related to their product

innovation in the context of a technology cluster. We define product innovation as the extent to which new ventures can successfully develop new products with superior quality and in a speedy manner for market penetration. Our premise is that because service intermediaries sit at the intersection of many firms, organizations, and industries, they maintain extensive networks of ties to different parts of the social system of a cluster. Therefore, new ventures' ties with service intermediaries enable the ventures to plug into the networks and contribute to the ventures' product innovation by broadening the scope of their external innovation search and reducing their search cost.

Furthermore, because ties with service intermediaries may contribute to new ventures' product innovation by broadening their external search scope and reducing their search cost, we would expect that these positive effects will be stronger if search in the networks in the cluster in which the ventures reside is more important to the ventures' product innovation. Based upon this argument, we will examine the moderating roles of venture managers' perceived industry growth, the ventures' ties with foreign firms, and the ventures' export. These moderating effects, if supported, can greatly substantiate and provide stronger support to our argument on the effect of ties with service intermediaries on product innovation of new ventures.

Empirically, we will test these relationships with a sample of new ventures in a technology cluster in China. The emergence of a market economy in China alters the opportunities and incentive structures that have been shaped by a centrally planned economy and stimulates the growth of new ventures, particularly in technology industries (Li and Atuahene-Gima, 2001; Li and Hitt, 2006; Lu, 2000). However, China's emerging economy is still characterized by having volatile environments and a lack of institutions and strategic market factors to support business and innovation (Luo, 2003). Because institutional voids often handicap entrepreneurial activities and innovation of new ventures during economic transformation (Li and Zhang, 2007), ties with service intermediaries in China are deemed to play an important role. Thus, China's emerging economy provides a rich context to test the proposition that ties with service intermediaries can contribute to new ventures' product innovation.

THEORY DEVELOPMENT AND HYPOTHESES

Ties with service intermediaries and new venture product innovation in a technology cluster

According to Porter (1998: 78), clusters refer to 'geographic concentrations of interconnected companies and institutions in a particular field.' Clusters, particularly technology clusters, can drive the direction and pace of innovation by making innovation opportunities more visible and providing convenient access to complementary resources and capabilities (Bahrami and Evans, 1995; Porter, 1998; Saxenian, 1990; Zhang, Li, and Schoonhoven, 2009). However, the mere colocation of firms and institutions in a cluster only creates the potential for economic value and does not necessarily ensure its realization (Porter, 1998). For a residing firm to access important resources and information in a cluster and realize the potential economic benefits offered by the cluster, the firm has to be *connected locally* (Owen-Smith and Powell, 2004; Porter, 1998).

McEvily and Zaheer (1999: 1139) argue that in clusters, in addition to interfirm networks, firms are also embedded in their ties with regional institutions. Regional institutions not only provide specific support services but also act as network intermediaries for interaction and information exchange among residing firms (McEvily and Zaheer, 1999). Similarly, Saxenian (1990) pointed out that Silicon Valley is not only distinguished by the concentration of skilled labor and firms, but also by a variety of regional institutions—including Stanford University, trade associations, and a myriad of specialized consulting, market research, public relations, and venture capital firms. These regional institutions as intermediaries provide technical, financial, and networking services that firms usually cannot afford individually, and allow these firms to continue to innovate (Saxenian, 1990). As noted by Porter (1998), fostering ongoing relationships with service intermediaries in a cluster is an important way for firms to tap into the cluster's assets. Empirically, McEvily and Zaheer (1999) found that the level of a firm's ties with regional institutions (i.e., regional industrial extension centers) in a cluster is positively related to the firm's acquisition of competitive advantages. However, we know little about whether ties with a variety of regional institutions (or service intermediaries)

may be related to new ventures' product innovation and if so, under what conditions?

To advance this line of research, this study empirically investigates the relationships between new ventures' ties with service intermediaries and their product innovation in the context of a technology cluster. Built upon the literature on innovation search (Cohen and Levinthal, 1990; Fleming, 2001; Katila, 2002; Katila and Ahuja, 2002; Rosenkopf and Nerkar, 2001), we propose that in a technology cluster, new ventures' ties with service intermediaries can contribute to their product innovation by broadening their external search scope and reducing their search cost.

In today's business environment, which is characterized by globalization, industry convergence, and rapid technology change, 'no company is smart enough to know what to do with every new opportunity it finds, and no company has enough resources to pursue all the opportunities it might execute' (Wolpert, 2002: 80). This is why external innovation search becomes increasingly important; and, because of their limited internal resources, is particularly important for new ventures. Through external innovation search, new ventures become innovative by capturing knowledge spillovers from other firms and organizations (Katila, 2002). However, new ventures can be handicapped in external innovation search. First, new ventures tend to have narrow external search scope because they typically have limited external contacts (Stinchcombe, 1965), and therefore rely upon their immediate personal networks (such as previous working relationships, voluntary connections, and kinship and community ties) for identifying opportunities (Baker and Nelson, 2005; Starr and MacMillan, 1990).

Second, new ventures can be handicapped in external innovation search for the reason of search cost. Because new ventures have limited resources, even modest external search can be too costly for them (in terms of both financial and organizational resources and managerial time). Given these constraints, it is critical for new ventures to balance the needs and the costs of information search for product innovation in a dynamic and uncertain environment (Tushman and Nadler, 1978).

Ties with service intermediaries can help new ventures balance their needs and costs of external innovation search. As an important feature of the local infrastructure of a cluster, service intermediaries uniquely sit at the intersection of many

firms and industries (Wolpert, 2002). Because they interact with a relatively large number of residing firms and organizations, they maintain extensive networks of ties to different parts of the social system of the cluster (McEvily and Zaheer, 1999; Saxenian, 1990). They act as repositories for information, knowledge, and opportunities in the cluster (Wolpert, 2002). If a new venture has close ties with service intermediaries, the specialized network role of service intermediaries enables the venture to plug into the networks in the cluster, through which the venture becomes (indirectly) tied with different parts of the social system of the cluster. In other words, ties with service intermediaries provide an entry ticket for new ventures to join rich networks in the cluster.

More specifically, ties with service intermediaries can broaden new ventures' external search scope. Through their interactions with a relatively large number of firms and organizations in a cluster, service intermediaries can gather and channel information regarding what products other firms offer, what resources and capabilities they have, what problems they face in product innovation, and how they solve problems. As illustrated by Wolpert (2002: 78), 'If company A, for instance, needs outside capabilities to commercialize a technology, it could ask its intermediary to find it a partner. The intermediary would share the information with other intermediaries in its search for an appropriate collaborator. . . .'¹ In other words, service intermediaries' specialized network role enables new ventures to conduct broad external innovation search in the cluster rather than searching only in their immediate personal networks.

A broadened external search scope can contribute to new ventures' product innovation in three major ways. First, innovation is an information-intensive activity. Information regarding other firms' product offerings and innovation activities can make innovation opportunities more visible to new ventures (Ahuja, 2000). Second, a broadened external search scope can enrich a new venture's knowledge pool and provide more choices for the venture to solve problems (Katila and Ahuja, 2002). There is a limit to the number of new products that can be created by using the same set of knowledge elements. Search with a broad scope

can increase a venture's new product introduction by adding new elements in its knowledge pool and thus improve the possibility for it to find new useful combinations of these elements (Katila and Ahuja, 2002). Third, a broadened external search scope can also help new ventures locate external complementary resources and capabilities that are critical for their product innovation (Porter, 1998; Wolpert, 2002). Indeed, new ventures have unique advantage in benefiting from a broad external innovation search. Because new ventures do not have specialized structures and routines that may prevent them from thinking about new uses of existing resources (Katila and Shane, 2005: 816), they are able to integrate and recombine various knowledge elements in external knowledge space to create their new products.

Ties with service intermediaries can also reduce costs associated with locating external sources of information, knowledge, and specialized expertise that are critical for product innovation (McEvily and Zaheer, 1999). Given their extensive networks, ties with service intermediaries constitute information channels that reduce the amount of time and investment required for new ventures to gather external information and knowledge (Shane and Cable, 2002). New ventures with close ties with service intermediaries may source what they need more rapidly, and thus enhance their capacity, speed, and flexibility in product innovation. Reduced search cost can further allow the ventures to dedicate more resources to innovation and quicken the process. As Bahrami and Evans (1995: 68) observed, 'a sophisticated service infrastructure allows start up firms to focus on their chosen steeple of expertise, rather than dissipate their energies across a broad range of peripheral or supporting activities.'

This study examines four specific types of service intermediaries whose significance in technology entrepreneurship has been highlighted in the prior literature and that are also relevant to China—the empirical context of this study. They are: accounting and financial service firms, law firms, talent search firms, and technology service firms.² For example, Atwell (2000) argued that in

¹ Wolpert (2002: 78) further noted, 'The intermediaries can be trusted to maintain confidentiality because if they ever violated the terms of an arrangement no company would hire them again.'

² Although other organizations such as trade associations and government agencies may also provide services to new ventures, their functions involve other components (e.g., lobbying and regulation) and thus are outside the scope of this study. Further, although venture capitalists are a critical type of service

Silicon Valley, accountants not only play their traditional roles as auditors and tax advisors, but also serve as consultants in structuring deals for firms. Bahrami and Evans (1995) noted that accounting firms have specialized high-technology practices and services designed for start-up and high-technology companies. Likewise, financial service firms may not only offer new ventures financial services but may also help the ventures get to know other firms that control financial resources, which can, in turn, increase product innovation speed (Schoonhoven *et al.*, 1990). Suchman (2000) documented that in Silicon Valley, law firms offer both general business advice and legal guidance and also help the ventures structure deals. Wolpert (2002: 82) stated that law firms often learn about best practices, ideas for new inventions, and new ways of doing business from competing and non-competing companies.

Talent search firms are used extensively by start-up and maturing firms to augment management teams and recruit new talents (Bahrami and Evans, 1995). They can facilitate the migration of people across firms, helping build social networks that transcend firms. This enables new ventures to gain access to the knowledge generated by other firms and become acquainted with other firms' strategic moves (Boeker, 1997). Moreover, technology service firms provide services in technology commercialization and brokering. Through technology service firms, new ventures can commercialize their innovation and obtain funding to support their future innovation. Technology service firms also supply new ventures with previously unknown information regarding other firms' technologies and innovation, which has the potential to help the ventures in the development of new products (Bessant and Rush, 1995; Hargadon and Sutton, 1997). Further, technology service firms help new ventures quickly locate external sources of complementary technologies and specialized expertise that are critical to implement their product innovation (Howells, 2006).

While these service intermediaries provide different services, they share a common feature in their specialized network role. In this study, we are *not* arguing that specific services offered by these

intermediaries will be directly used in new ventures' product innovation.³ Rather, we argue that the specialized network role of service intermediaries makes it possible for new ventures with close ties to them to broaden their external search scope and reduce their search cost. Commonly, all ties with different types of service intermediaries bring in directory information, networking opportunities, and intermediary introduction. Distinctively, they render different information, knowledge, and advice in respective professional fields, which in turn help the ventures better establish and develop a more aligned interdependence between innovation and other supporting activities. Although we are not aware of any studies that specifically examine service intermediaries in the Chinese context, we expect that the effect of ties with service intermediaries will be strong there. Because Chinese ventures face a higher level of resource constraints compared with their Western counterparts (Li and Atuahene-Gima, 2001), they have a stronger need to search in external knowledge space. Considering that strategic factor markets have not yet been well developed in China, ties with service intermediaries can play an important role in new ventures' external search. Furthermore, Chinese culture strongly favors ties or *guanxi*. Ties with external actors have been an important strategy for Chinese firms to overcome their resource obstacles (Li and Zhang, 2007; Luo, 2003; Peng and Luo, 2000). Particularly, the four types of service intermediaries examined in this study are critical to entrepreneurial activities and innovation in China as they, respectively, promote or curtail the crucial constraints faced by new ventures (i.e., financial, human capital, legal, and technological services). Therefore, we propose that:

*Hypothesis 1: Ties with service intermediaries—
(a) technology service firms, (b) accounting and
financial service firms, (c) law firms, and (d)*

intermediaries in Silicon Valley and its like (Saxenian, 1990; Suchman, 2000), the venture capital industry is at the emerging stage in China; thus, venture capitalist firms are not included in this study.

³ Specific services provided by service intermediaries probably may not be directly used in new ventures' product innovation since these services and product innovation fall in different domains. However, because service intermediaries are channels of access to resources and information of various kinds, we are not excluding the possibility that ties with service intermediaries may help access complementary assets that do contribute directly to product innovation.

*talent search firms—will be positively related to new ventures' product innovation.*⁴

The contingent value of ties with service intermediaries

The logic underlying Hypothesis 1 is that ties with service intermediaries contribute to new ventures' product innovation by broadening their external search scope and reducing their search cost. This logic suggests that the value of ties with service intermediaries in product innovation will depend on the extent to which new ventures rely upon search in the networks within the cluster for their product innovation. The reason of this is that when new ventures rely upon search in the networks to locate information, knowledge, and specialized expertise for their product innovation, their ties with service intermediaries matter more to their product innovation by affecting the scope of their external search and their search cost. In contrast, when new ventures have alternative sources of innovation search and rely less upon the networks in the cluster for innovation search, the value of ties with service intermediaries in product innovation will become limited. Based upon this argument, we examine the moderating effects of three contextual variables: perceived industry growth, new ventures' ties with foreign firms, and new ventures' export.

The moderating role of perceived industry growth

Perceived industry growth refers to the level of managers' perceived growth of their principal industry within the last three years (Li and Atuahene-Gima, 2002). Managers' perceived industry growth affects the level of managerial discretion—or latitude of action—that managers perceive to have in their strategic decision making (Hambrick and Finkelstein, 1987). High industry growth is associated with more market opportunities, greater competitive variation, and expanded options for firms (Datta, Guthrie, and Wright, 2005; Hambrick and Finkelstein, 1987). Thus, managers who perceive high industry growth tend to believe that they have greater opportunities for decision making freedom. Also, industry growth

affects the level of resource munificence in the environment. Resources are more available in high growth industries (McDougall *et al.*, 1994; Romanelli, 1989) and therefore managers who perceive high industry growth are less concerned with resource constraints.

We argue that the positive relationships between ties with service intermediaries and new venture product innovation will become weaker when perceived industry growth is high rather than low. First, as noted above, when perceived industry growth is high, new venture managers tend to believe that there exists a wide range of opportunities and options that their ventures can pursue for product innovation, thus, reducing their motivation to search what other firms are doing and how they are doing it, and discouraging them to follow other firms' actions in their own ventures' product innovation. Also, when perceived industry growth is high, it appears that the industry resides in a very early phase of an industry life cycle. In this situation, managers tend to observe a high level of causal ambiguity about innovation (Reed and DeFillippi, 1990) regarding which direction and option of innovation has a better chance to succeed, which can further discourage new ventures to follow and imitate other firms' innovation activities. Thus, when perceived industry growth is high, new ventures tend to pursue their own way of product innovation, and external search in the networks in the cluster in which they reside becomes less important in directing their product innovation.

Second, when perceived industry growth is high, new venture managers are less concerned with resource constraints (McDougall *et al.*, 1994; Romanelli, 1989). Managers tend to feel that external resource holders are willing to support innovation activities and more money will chase new ventures with innovation opportunities. In this situation, new ventures become less concerned about the cost of external innovation search. For these reasons, when perceived industry growth is high, the value of ties with service intermediaries in terms of both broadening new ventures' external search scope and reducing their search cost decreases. Accordingly, the positive relationships between ties with service intermediaries and new venture product innovation will become weaker.

One may argue that ties with service intermediaries could become more important to new ventures' product innovation in a faster growing

⁴ In empirical models, we will examine the combined measure of ties with multiple service intermediaries as well as the ties with each of these service intermediaries.

industry so as to better leverage such opportunities via support from service intermediaries. As we argued earlier, ties with service intermediaries contribute to product innovation *not* because their specific services can be directly used for innovation, but because their specialized network role enables new ventures to broaden external search scope and reduce search cost. When perceived industry growth is high, although the services provided by these intermediaries are still important, the information regarding other firms' innovation activities channeled by ties with these intermediaries becomes less important to the focal venture's product innovation. Consistent with our argument, Li and Atuahene-Gima (2002) found that perceived industry growth is negatively related to Chinese ventures' external collaboration. Therefore, we propose that:

Hypothesis 2: The positive relationships between ties with service intermediaries—(a) technology service firms, (b) accounting and financial service firms, (c) law firms, and (d) talent search firms—and new ventures' product innovation will be weaker as perceived industry growth is higher.

The moderating role of ties with foreign firms

Given the significant gaps between emerging economy firms and foreign entrants in technology and marketing capabilities, emerging economy firms often engage in learning through partnerships with foreign entrants (Hitt *et al.*, 2000). Indeed, ties with foreign firms are considered to be one of the most prominent ties in this context (Li and Atuahene-Gima, 2002). In particular, prior research on new ventures in emerging economies has highlighted the importance of ties with foreign firms through the adoption of agency businesses for foreign firms, defined as a downstream alliance 'by which a firm markets and distributes a foreign firm's products and services' in their home country (Li and Atuahene-Gima 2002: 470). Bruton and Rubanik (1997) noted that it is common for Russian ventures to import and wholesale the products of foreign firms. Lu (2000) also observed that Chinese ventures tend to build this type of downstream alliance with foreign partners for growth. Li and Atuahene-Gima (2002) examined the antecedents and consequences of this type of alliance and found that it is positively related to new venture financial

performance but negatively related to new venture innovation in China.

We argue that the positive relationships between ties with service intermediaries and product innovation will become weaker if new ventures adopt agency businesses for foreign firms, because new ventures often act as a domestic agent by focusing on distributing the foreign firms' products and services in the domestic market (Li and Atuahene-Gima, 2002). Most innovation work has been done by the foreign partners, and the role of new ventures mainly focuses on distribution and sales. Thus, search of other firms' innovation activities in the cluster in which they reside is not important to them. Therefore, the value of their ties with service intermediaries in product innovation becomes less important to these ventures.

Moreover, even if new ventures that adopt agency business for foreign firms conduct product innovation, their ties with the foreign partners represent an important source for their innovation search. Previous studies have shown that new ventures' ties with established firms can provide critical resources and capabilities to new ventures and have a positive impact on their innovation (Baum *et al.*, 2000; Shan *et al.*, 1994; Stuart, 2000). Similarly, in the context of China's emerging economy, new ventures' ties with foreign firms can serve as channels of access to resources of various kinds. Being an agent for foreign firms to distribute and market their products in China enables Chinese ventures to learn from their foreign partners and gain access to the foreign partners' technology, management, and marketing skills that could potentially be used for the ventures' own product innovation (Li and Atuahene-Gima, 2002). Further, the adoption of agency business for foreign firms in China usually is a profitable business (Li and Atuahene-Gima, 2002), which can help the ventures accumulate financial resources to support their product innovation. Since ties with foreign firms through adopting agency business represent an important alternative source for new ventures' external innovation search, they can decrease the value of ties with service intermediaries in product innovation. Based on the above discussion, we propose that:

Hypothesis 3: The positive relationships between ties with service intermediaries—(a) technology service firms, (b) accounting and financial service firms, (c) law firms, and (d) talent search

firms—and new ventures' product innovation will be weaker when the ventures adopt agency business for foreign firms than when they do not.

The moderating role of new venture export

Whether or not a new venture exports reflects its market focus. If a new venture does not export, it focuses on developing new products to penetrate domestic markets. If it does export, its focus shifts, at least partially, to international markets. We argue that the positive relationships between ties with service intermediaries and new venture product innovation will become weaker when new ventures export than when they do not. When new ventures do not export, they emphasize reaping benefits from pent up indigenous demands in the domestic markets (Luo and Park, 2001). In this situation, what products domestic customers want and what products other firms offer for domestic markets are critical in deciding new ventures' product innovation direction and speed. These ventures tend to closely interact with and follow domestic customers and domestic competitors for innovation search. As a result, ties with service intermediaries play an important role in their external innovation search and are critical for these ventures to understand domestic market demands and competition.

In contrast, if new ventures export part or all of their products to international markets, they have both need and opportunity to search in international markets for their product innovation. They need to understand what customers in international markets want and what products international competitors offer. Their participation in international markets also provides an opportunity for them to observe international competitors' product offerings and imitate them in their own product innovation—or, in other words, they can capture knowledge spillover in international markets. Moreover, since domestic markets of an emerging economy like China typically lag behind international markets in terms of technology advancement, design sophistication, and quality standards, new ventures can easily modify their products that are developed for international markets for domestic markets (however, it would be very difficult for them to modify their products that are developed for domestic markets for international markets). Therefore, new ventures' participation in international markets through export provides them an

important alternative source for their external innovation search, which may decrease the value of ties with service intermediaries in their product innovation. Therefore, we propose:

Hypothesis 4: The positive relationships between ties with service intermediaries—(a) technology service firms, (b) accounting and financial service firms, (c) law firms, and (d) talent search firms—and new ventures' product innovation will be weaker when the ventures export than when they do not.

METHODOLOGY

Sample and data collection

In 2001, we collected our data in the Pearl River Delta Torch High-Technology Geographical Cluster in Guangdong Province, one of the largest technology clusters in China. We randomly selected 500 new ventures (eight years old or younger) as the sample frame from a list of technology firms compiled by the Department of Science and Technology in Guangdong Province. All of the ventures are manufacturing firms, and they met the three criteria used to define a technology firm in China (Li and Atuahene-Gima, 2001): (1) its founding team must be composed of engineers or scientists, (2) thirty percent or more of its employees must be technical employees, and (3) it must spend three percent or more of total sales on research and development (R&D).

The questionnaire was originally prepared in English and then translated into Chinese by two scholars competent in both languages and with substantial research experience in the subject area in China. To avoid cultural bias and ensure validity, the Chinese version was back-translated into English, and we paid special attention to detecting any misunderstandings that might arise due to translation. The questionnaire was further pretested with eight founding members of six new ventures. Items that were identified as being problematic were revised or eliminated.

We administered the questionnaire on-site. A trained research assistant scheduled appointments, presented the respondents with the questionnaires, answered general questions, and collected the completed questionnaires. A major concern in survey research is that a single respondent may answer

all of the questions in a consistent manner that can result in common method bias (Podsakoff *et al.*, 2003). To reduce the potential for this bias, we designed the questionnaire to include two separate parts. Part I contained questions regarding environments, the adoption of agency business for foreign firms, export, and product innovation. Part II contained questions regarding ties with service intermediaries and organizational demography. For each venture, we invited two top managers to participate, with one completing Part I and the other completing Part II, on a random basis. Such a design can also require the respondents to fill out a shorter version of the questionnaire (i.e., only one part of the questionnaire), thus reducing their response burden and improving their response accuracy.

We obtained data from 202 firms, with an effective participation rate of 40.4 percent. Of the responding ventures, 44 percent were in the electronic information industry, 24 percent in the new energy and new material industries, 21 percent in the pharmaceutical and bioengineering industries, and 11 percent in the integrated optical-mechanical and electric products industries. To assess the non-response bias, we compared the responding ventures with the nonresponding ventures and found no significant differences in venture size and age.

The profiles of the two respondents from each venture are listed in the Appendix. These respondents had positions of managing director/chief executive officer (CEO), business manager, or product manager in the ventures. The mean of their involvement in strategic decision making was 4 on a five-point scale (1 = very uninvolved and 5 = very highly involved). Average working experience in their current industries was 6.2 years. These data suggest that the respondents were experienced and knowledgeable about the issues under study, which increased our confidence in the quality of the data. The two respondents from each venture did not differ significantly in terms of their positions in the firm, average working experience in the current industry, or average participation level in strategic decision making. However, they differed in terms of age and education. In order to check the consistency between the judgments of the two respondents in each venture, we examined the correlations between their responses (Nunnally and Bernstein, 1994) with regard to (1) whether the firm has adopted agency business for foreign firms, and (2) R&D spending on new

products (these two questions were answered by both respondents). The correlations of these two questions between the two respondents are 0.83 ($p < 0.001$) and 0.71 ($p < 0.001$), respectively. The high levels of interrater reliability suggest that responses from different individuals in the same venture are consistent, providing validation of our subjective measures.

Measures

All of the perceptual measures were rated based on a five-point Likert scale (1 = not at all and 5 = very much). For multi-item constructs, we averaged the items to create the scores for the constructs.

Dependent variable

We used five items to measure *product innovation*. In order to provide an anchor for the respondents to answer the questions, we asked them to rate the extent to which their ventures were successful *relative to their major competitors* in terms of (1) frequently introducing new products, (2) being first in new product introductions in the market, (3) quickly launching new products into the market, (4) developing new products with superior quality, and (5) using new products to penetrate markets. This scale highlights the two key components used for assessing the performance of new products: quality and speed (Brown and Eisenhardt 1995), which have also been emphasized in Lu's (2000) study of Chinese technology firms. We collected data on the percentage of total sales attributed to new products over the past three years, and its correlation with product innovation was 0.26 ($p < 0.001$), which provided evidence to support the external validity of this construct.

Predictors

To measure *ties with service intermediaries*, we asked the respondents to indicate the extent to which their ventures had close relationships with (1) technology service firms (i.e., technology commercialization and brokering), (2) accounting and financial service firms, (3) law firms, and (4) talent search firms. McEvily and Zaheer (1999) used a similar approach to measure firms' ties with

regional institutions in a cluster. We created a composite measure of *ties with multiple service intermediaries* by averaging these four items. We also used ties with each of the four types of service intermediaries as a predictor in empirical models. This subjective measure captures the extent of new ventures' ties with service intermediaries. Our use of these general questions rather than the name-generator approach to measuring ties is consistent with previous studies on ties in the Chinese context (e.g., Luo, 2003; Peng and Luo, 2000; Xin and Pearce, 1996). As Peng and Luo noted, the name-generator approach is not effective in the Chinese context because 'ties were regarded as a personal and business secret, and some respondents were reluctant to disclose such contacts' (Peng and Luo, 2000: 491).

Perceived industry growth was measured by three items adapted from McDougall *et al.* (1994). The respondents were asked to indicate the extent to which they agreed with the following statements regarding their principal industry in the last three years: (1) There has been high growth in demand in this industry; (2) This industry offered many attractive opportunities for future growth; and (3) Growth opportunities in this industry have been abundant. It would be better if we could use archival data of industry growth to validate our subjective ratings. However, the industry data available in China is at such a gross level that one would lose any significant meanings since most of the sampled firms would fall into very few categories. Furthermore, the high-technology industries we studied are emerging in China and most of the ventures in these industries are relatively small; thus, it is not surprising that even ventures in the same industry category may focus on different niches of the industry. Therefore, industry-level archival data become less relevant in our research setting. Indeed, our use of perceptual measures is consistent with a strong research tradition that suggests that environmental conditions affect firm decisions only when they are perceived or interpreted by decision makers (e.g., Li and Atuahene-Gima, 2002; Luo and Park, 2001; Weick, 1969). As Luo and Park argued, 'Firms interpret the same environmental attributes differently and thus respond with different strategies. Therefore, the objective reality of the physical environment may be less important in determining organizational actions' (Luo and Park, 2001: 153).

To measure *the adoption of agency business for foreign firms*, we asked the respondents to indicate whether his or her firm has been involved in any business as an agent to market and distribute a foreign firm's products and services in China (Li and Atuahene-Gima, 2002). The variable was dummy coded (1 = yes, 0 = no). To measure *export*, we asked the respondents to indicate whether his or her firm has exported products out of China. The variable was also dummy coded (1 = yes, 0 = no).

Controls

Following Li and Atuahene-Gima (2002), we controlled for the following variables: venture age (i.e., the number of years since founding), founding team size (number of founding team members in the venture), venture size (the natural log of the number of full-time employees in 2000), foreign invested venture (1 = yes, 0 = no), and venture origin (independent venture = 0 versus corporate venture = 1). We also controlled for *environmental uncertainty*, which was measured by three items adapted from Miller (1987). These items reflect the speed of change and predictability about technology and product market conditions in the ventures' principal industries. The respondents were asked to rate the degree to which they agreed with the following statements regarding their principal industry over the past three years: (1) It has been difficult to forecast how technologies will change in this industry, (2) Competitors' actions have been highly unpredictable, and (3) Product market conditions have been changing very fast. Finally, because our sample included ventures in four industries, we created three industry dummy variables with the integrated optical industry as the base group.

Adequacy of the measures: reliability, validity, and common method variance

We took several steps to ensure data validity and reliability. As noted earlier, we pretested the survey with eight founding members of six new ventures. In the questionnaire itself, we used previously validated measurement items whenever possible to help ensure the validity of our measures. We assessed the reliability of the multi-item constructs with Cronbach's alpha, and all scales except environmental uncertainty had reliabilities greater than the recommended 0.70 (see Table 1). The

Table 1. Construct measurement and confirmatory factor analysis results

Item description summary	Standardized loading	t-value
Product innovation (Brown and Eisenhardt, 1995; and Lu, 2000) ($\alpha = 0.90$)		
Rate the extent to which your venture was successful relative to your major competitors in terms of the following:		
1. Frequently introducing new products	0.64	8.93
2. Being first in new product introductions in the market	0.61	8.06
3. Quickly launching new products into the market	0.75	11.08
4. Developing new products with superior quality	0.69	10.02
5. Using new products to penetrate markets	0.70	9.95
Ties with service intermediaries (newly developed items) ($\alpha = 0.80$)		
Indicate the extent to which your venture had close relationships with the following:		
1. Technology service firms	0.74	11.91
2. Accounting and financial service firms	0.90	15.59
3. Law firms	0.89	15.12
4. Talent search firms	0.63	9.23
Perceived industry growth (Li and Atuahene-Gima, 2001) ($\alpha = 0.78$)		
Rate the degree to which each of these statements describes your principal industry over the last three years:		
1. There has been high growth in demand in this industry.	0.70	9.88
2. This industry offered many attractive opportunities for future growth.	0.70	9.89
3. Growth opportunities in this industry have been abundant.	0.82	11.75
Environmental uncertainty (Miller, 1987) ($\alpha = 0.63$)		
Rate the degree to which each of these statements describes your principal industry over the last three years:		
1. It has been difficult to forecast how technologies will change in this industry.	0.67	7.08
2. Competitors' actions have been highly unpredictable.	0.55	6.24
3. Product market conditions have been changing very fast.	0.60	6.64
Model fit index		
$\chi^2 = 130.28$, $p = 0.00$; $\chi^2/df = 1.61$; GFI = 0.92; CFI = 0.95; IFI = 0.95; RMSEA = 0.05		

alpha for environmental uncertainty is 0.63, which is generally acceptable for questionnaire scales. Considering the face validity of this factor and the strong factor loadings, we believed that it was reasonable to use this factor as a control in the subsequent analysis (c.f. Li and Atuahene-Gima, 2002).

We conducted a confirmatory factor analysis to assess the convergent and discriminant validity of the multi-item constructs. As presented in Table 1, results of the confirmatory factor analysis indicated that the measurement model fits the data well ($\chi^2 = 130.28$, $p = 0.00$; $\chi^2/df = 1.61$, goodness-of-fit index (GFI) = 0.92, comparative fit index (CFI) = 0.95, incremental fit index (IFI) = 0.95, root mean square error of approximation (RMSEA) = 0.05), all of which confirmed the unidimensionality of each construct in the model. Convergent validity is observed when the path coefficients from the latent constructs to their corresponding manifest indicators are statistically significant (i.e., $t > 2.0$) (Anderson and Gerbing, 1988). All

items loaded significantly on their corresponding latent construct, with the lowest t -value being 6.24, thereby providing evidence of convergent validity.

We used two methods to assess discriminant validity. First, because 95 percent confidence bands around the ϕ s did not contain a value of one, we concluded that the constructs possessed discriminant validity (Anderson and Gerbing, 1988). Second, we conducted a chi-square difference test for all of the multi-item constructs in pairs to see if they were distinct from one another. The process involved collapsing each pair of constructs into a single model and comparing its fit with that of a two-construct model (Anderson and Gerbing, 1988). In every case, a two-factor model had a better fit than a single-factor model, thus supporting the discriminant validity of the constructs.

As in most survey research, the use of perceptual data for both independent and dependent variables in this study may raise the concerns of common method variance. Although a number of studies have suggested that common method

variance may not be as much of an artifact as is commonly assumed (e.g., Avolio, Yammarino, and Bass, 1991; Spector, 1987), Podsakoff *et al.*, (2003). Based on a careful examination of the literature, Podsakoff *et al.* (2003: 900) argued that common method variance is often a problem in behavioral research and researchers should implement measures to control for it. Following Podsakoff *et al.*'s (2003) recommendation, we have integrated both procedural methods and statistical techniques to reduce the potential of common method variance. Regarding procedural methods, as noted earlier, we used two respondents rather than a single respondent in each venture for data collection. As Podsakoff *et al.* (2003: 887) noted, collecting the measures of variables from different sources 'makes it impossible for the mind set of the source or rater to bias the observed relationship between the predictor and criterion variable.' Also, we assured the respondents that their answers were confidential and that there were no right or wrong answers to the questions in the survey. These procedures likely reduce the respondents' evaluation apprehension and 'make them less likely to edit their responses to be more socially desirable, lenient, acquiescent, and consistent with how they think the researcher wants them to respond' (Podsakoff *et al.* 2003: 888).

Regarding statistical techniques, we used Harman's one-factor test to check for the presence of common method variance (Podsakoff and Organ, 1986). Significant common method variance would result in one general factor accounting for the majority of covariance in the variables. We subjected all of the key variables to a factor analysis (the four multi-item constructs in Table 1). The analysis resulted in four factors with eigenvalues greater than one, with the first factor accounting for only 27 percent of total variance. This result suggests that common method variance is unlikely to have caused any significant relationships among variables in our study. Further, we followed the latent variable approach suggested by Podsakoff *et al.* (2003: 894) to control for the effects of an unmeasured latent methods factor. We allowed the items to load on their theoretical constructs, as well as on a latent common methods variance factor. Then we examined the significance of the structural parameters both with and without the latent common methods variance factor in the model. We found that all significant relationships held after controlling for the latent common methods

variance factor, providing evidence that common method variance is not an issue in this study (Li, Bingham, and Umphress, 2007).

Furthermore, our interaction hypotheses, if supported, can provide additional evidence that common method variance is not an issue in this study. As Aiken and West (1991) pointed out, supported interaction hypotheses are less subjective to the common method variance because it is unlikely that respondents would have an 'interaction-based theory' in their minds that could systematically bias their responses to produce these results. In this study, since we used two respondents in each venture, we do not believe that the two different respondents would collectively have an 'interaction-based theory' in their minds to produce the significant interaction results.

Finally, one potential question of the survey methodology is how to compare responses across respondents. We have addressed this issue to the extent possible in this paper. First, as discussed earlier, we have taken several procedural methods to ensure that the respondents are knowledgeable and experienced, thus capable of providing valid and accurate assessment. Second, we used two different respondents in each venture. The high levels of interrater reliability suggest that the respondents have used their venture's real situations as the anchor to answer survey questions. Third, it is possible that managers' perceptions and actions may vary systematically across firms with different attributes. To take into account this possibility, we have controlled for several important firm attributes as discussed above.

Data analysis

Adoption of agency business for foreign firms was used as a moderating variable in this study. However, not all the ventures have the chance of adopting agency businesses for foreign firms. Hence, new ventures with agency business for foreign firms may differ from those without this business. In this study, we used Heckman's selection model to account for this self-selection effect (Heckman, 1979; Shaver, 1998). In essence, Heckman's selection model is a two-stage procedure (Heckman, 1979). In the first stage, probit regression was used to estimate the probability that a venture adopts agency business for foreign firms as a function of venture age, founding team size, venture size, foreign owned venture, venture origin, environmental

uncertainty, perceived industry growth, export, and three industry dummies.

Based upon the results of the first-stage model, we predicted and saved the value for the inverse Mill's ratio (λ_i). The inverse of Mill's ratio is the monotone decreasing function of the probability that a venture is selected into agency business for foreign firms. The inverse of Mill's ratio was then included as a regressor in the second-stage models to estimate a venture's product innovation (Heckman, 1979; Shaver, 1998). This two-stage procedure can generate consistent and asymptotically efficient estimates (Heckman, 1979).

RESULTS

Table 2 presents the means, standard deviations, and correlations among the variables examined in the study. Table 3 presents the results of the regression models. Model 1 only included controls.⁵ Model 2 added the main effects of ties with multiple service intermediaries and the moderating variables: perceived industry growth, the adoption of agency business for foreign firms, and export. Model 3 added the interaction terms. To reduce the potential problem of multicollinearity, predictor and moderator variables (except those that are dummy variables) were mean-centered prior to the creation of interaction terms (Aiken and West, 1991). To examine ties with each type of service intermediaries, we repeated Models 2 and 3 for ties with technology service firms in Models 2a and 3a, for ties with accounting and financial service firms in Models 2b and 3b, for ties with law firms in Models 2c and 3c, and for ties with talent search firms in Models 2d and 3d, respectively.

Hypothesis 1 proposes that ties with service intermediaries are positively related to product innovation. The results in Model 2 suggest that ties with multiple service intermediaries are positive and significant ($b = 0.15, p < 0.05$). This predictor accounts for two percent of variance in product innovation ($p < 0.05$), and its one unit increase would increase product innovation by 0.15 units.

⁵ Heckman's two-stage models do a particularly good job as estimation when there is at least one variable that may be considered an 'instrument' that is a good predictor in the first stage but not in the second stage of the model. In this study, the industry dummy variables were included as the 'instrument' variables in the first stage but not in the second stage of the model.

Table 2. Descriptive statistics and Pearson correlation matrix^a (N = 202)

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Product innovation	2.86	1.03	—													
2. Ties with multiple service intermediaries	2.48	1.03	0.26	—												
3. Ties with technology service firms	2.47	1.24	0.27	0.90	—											
4. Ties with accounting/financial service firms	2.22	1.11	0.20	0.80	0.68	—										
5. Ties with law firms	2.41	1.23	0.25	0.92	0.80	0.66	—									
6. Ties with talent search firms	2.83	1.24	0.15	0.79	0.59	0.42	0.66	—								
7. Perceived industry growth	3.57	0.80	0.05	0.23	0.22	0.22	0.22	0.13	—							
8. Agency business for foreign firms	0.47	0.50	-0.07	0.04	0.10	-0.10	0.07	0.06	0.15	—						
9. Export	0.43	0.50	0.29	0.34	0.28	0.32	0.31	0.24	0.00	0.05	—					
10. Venture age	5.25	2.88	-0.01	-0.04	-0.04	-0.03	0.00	-0.06	0.01	0.07	0.04	—				
11. Founding team size	4.95	3.92	0.08	-0.07	-0.09	-0.08	-0.09	0.02	0.00	-0.13	-0.09	0.02	—			
12. Venture size	3.50	1.65	0.34	0.06	0.03	0.02	0.02	0.14	-0.01	0.07	0.20	0.11	0.31	—		
13. Foreign invested venture	0.11	0.31	0.16	-0.08	-0.08	-0.01	0.05	-0.10	-0.06	-0.08	0.21	-0.03	0.13	0.19	—	
14. Venture origin	0.30	0.45	0.09	0.06	0.06	-0.05	0.08	0.11	-0.12	-0.09	0.05	-0.01	0.04	0.20	0.05	—
15. Environmental uncertainty	3.33	0.77	0.07	0.07	0.06	0.07	0.10	0.00	-0.02	0.03	0.07	-0.13	-0.05	-0.12	-0.03	0.05

^a Correlations that are 0.14 or larger are significant at the level of $p < 0.05$.

Table 3. Results of OLS regression^{a,b} (N = 202)

Variables	Model 1	Model 2	Model 3	Model 2a	Model 3a	Model 2b	Model 3b	Model 2c	Model 3c	Model 2d	Model 3d				
<i>Controls</i>															
Venture age	-0.04	-0.02	-0.03	-0.02	-0.02	-0.02	-0.05	-0.02	-0.04	-0.02	-0.02				
Founding team size	0.00	-0.03	-0.03	-0.02	-0.02	-0.04	-0.05	-0.03	-0.02	-0.04	-0.03				
Venture size	0.33***	0.34***	0.35***	0.33***	0.36***	0.34***	0.34***	0.34***	0.35***	0.33***	0.34***				
Foreign invested venture	0.10	0.06	0.06	0.07	0.07	0.05	0.04	0.06	0.05	0.05	0.05				
Venture origin	0.02	-0.03	-0.08	-0.03	-0.06	-0.02	-0.07	-0.04	-0.08	-0.03	-0.04				
Environmental uncertainty	0.12†	0.11†	0.16*	0.10	0.16*	0.12†	0.14*	0.11†	0.14*	0.12†	0.14*				
Inverse of Mill's ratio (λ)	-0.05	0.06	0.09	0.03	0.09	0.06	0.11	0.05	0.08	0.05	0.05				
<i>Predictors</i>															
	<i>Multiple service intermediaries</i>			<i>A. Technology service firms</i>			<i>B. Accounting and financial service firms</i>			<i>C. Law firms</i>			<i>D. Talent search firms</i>		
Ties with service intermediaries (TSI)	0.15*	0.17**	0.18**	0.18**	0.20**	0.10†	0.14*	0.16**	0.19**	0.05	0.07				
Perceived industry growth	0.06	0.07	0.05	0.05	0.06	0.07	0.09	0.06	0.05	0.08	0.08				
Agency business for foreign firms	-0.10	-0.09	-0.11†	-0.10	-0.10	-0.09	-0.09	-0.10	-0.11†	-0.10	-0.10				
Export	0.17*	0.19**	0.17*	0.17*	0.17*	0.19**	0.21**	0.17*	0.18**	0.21**	0.22**				
TSI* perceived industry growth	-0.19**	-0.19**	-0.19**	-0.19**	-0.19**	-0.24***	-0.24***	-0.15**	-0.15**	-0.09†	-0.09†				
TSI* agency business for foreign firms	-0.16**	-0.16**	-0.16**	-0.17**	-0.17**	-0.11*	-0.11*	-0.15**	-0.15**	-0.10†	-0.10†				
TSI* export	-0.12*	-0.12*	-0.12*	-0.09†	-0.09†	-0.10†	-0.10†	-0.17**	-0.17**	-0.03	-0.03				
F value	4.80***	4.88***	5.46***	5.16***	5.77***	4.55***	4.98***	4.95***	5.63***	4.40***	3.79***				
R squared	0.15	0.22	0.29	0.23	0.30	0.21	0.27	0.22	0.30	0.20	0.22				
Adjusted R squared	0.12	0.18	0.24	0.19	0.25	0.16	0.22	0.18	0.24	0.15	0.16				
Increased R squared	—	0.07**	0.07***	0.08***	0.07***	0.06**	0.06***	0.07***	0.08***	0.05*	0.01				

Significance level: † p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001 (one-tailed tests for hypothesized effects and two-tailed tests for controls).

^aStandardized coefficients reported. ^bIn Models 2a–3d, we tested ties with each of the service intermediaries separately. Because of space limit, in this table ties with service intermediaries referred to ties with multiple service intermediaries in Models 2 and 3, ties with technology service firms in Models 2a and 3a, ties with accounting and financial service firms in Models 2b and 3b, ties with law firms in Models 2c and 3c, and ties with talent search firms in Models 2d and 3d.

Similarly, the results in Models 2a, 2b, and 2c suggest that ties with technology service firms ($b = 0.18$, $p < 0.01$), ties with accounting and financial service firms ($b = 0.10$, $p < 0.10$), and ties with law firms ($b = 0.16$, $p < 0.01$) are positive and significant. But ties with talent search firms are not significant ($b = 0.05$, n.s., Model 2d). Thus, Hypothesis 1 is supported for ties with technology service firms, accounting and financial service firms, and law firms, but not for ties with talent search firms.

Hypothesis 2 proposes that the positive relationships between ties with service intermediaries and product innovation are weaker when perceived industry growth is higher. The results in Model 3 suggest that the interaction term between perceived industry growth and ties with multiple service intermediaries is negative and significant ($b = -0.19$, $p < 0.01$). To facilitate interpretation, we plotted this significant interaction effect in Figure 1. In order to create this figure, all variables in Model 3 except ties with multiple service intermediaries and perceived industry growth were constrained to means. Ties with multiple service intermediaries and perceived industry growth took the values of one standard deviation below and above the mean. As shown in Figure 1, ties with multiple service intermediaries have a positive relationship with product innovation when perceived industry growth is low; but this positive relationship disappears when perceived industry growth is high.

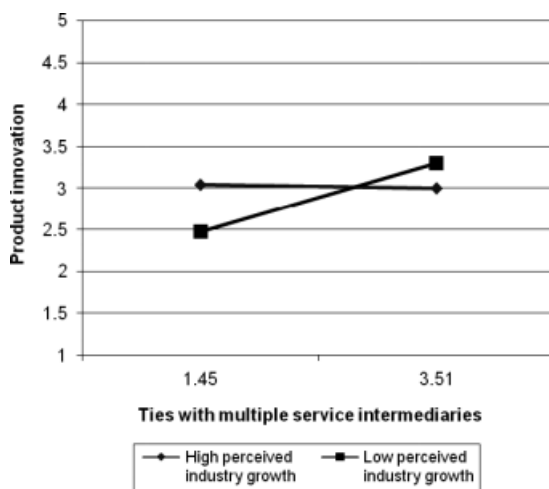


Figure 1. Ties with multiple service intermediaries and product innovation—the moderating role of perceived industry growth.

The size of the interaction effect is reflected in the difference between the R^2 of models without vs. with the interaction term (Jaccard, Turrisi, and Wan, 1990). The models with and without the interaction of perceived industry growth and ties with multiple service intermediaries are 0.22 and 0.26, respectively, which means that the interaction effect accounts for four percent ($p < 0.01$) of variance in product innovation. Jaccard *et al.* (1990) suggested that a significant interaction effect should be further analyzed and interpreted as a conditional effect on the main effect. We calculated the simple slopes of product innovation on ties with multiple service intermediaries conditional on the (high vs. low) levels of perceived industry growth (Aiken and West, 1991). When perceived industry growth is high, the simple slope is -0.02 (n.s.), which means that change in ties with multiple service intermediaries has no impact on product innovation. When perceived industry growth is low, the simple slope is 0.40 ($p < 0.001$), which means that one unit increase in ties with multiple service intermediaries would increase product innovation by 0.40 units.

The results in Models 3a, 3b, 3c, and 3d suggest that perceived industry growth's interactions with ties with technology service firms ($b = -0.19$, $p < 0.01$), with ties with accounting and financial service firms ($b = -0.24$, $p < 0.001$), with ties with law firms ($b = -0.15$, $p < 0.01$), and with ties with talent search firms ($b = -0.09$, $p < 0.10$) are negative and significant. The plots and slope analyses of these interaction effects are consistent with those discussed above (available from the authors upon request). Hence, these results support Hypothesis 2.

Hypothesis 3 proposes that the positive relationships between ties with service intermediaries and product innovation are weaker for new ventures adopting agency business for foreign firms than for those without this business. The results in Model 3 suggest that the interaction term between adoption of agency business for foreign firms and ties with multiple service intermediaries is negative and significant ($b = -0.16$, $p < 0.01$). This interaction effect accounts for two percent ($p < 0.05$) of variance in product innovation. This significant interaction effect is plotted in Figure 2 (the adoption of agency business for foreign firms took the values of one and zero). As shown in Figure 2, ties with multiple service intermediaries have a positive relationship with product innovation in new

ventures that do not adopt agency business for foreign firms. Its simple slope is 0.36 ($p < 0.001$), meaning that one unit increase in ties with multiple service intermediaries would increase product innovation by 0.36 units. In contrast, this positive relationship disappears in new ventures that adopt agency business for foreign firms (its simple slope is 0.00, n.s.).

The results in Models 3a, 3b, 3c, and 3d suggest that the interactions of adoption of agency business for foreign firms with ties with technology service firms ($b = -0.17$, $p < 0.01$), with ties with accounting and finance service firms ($b = -0.11$, $p < 0.05$), with ties with law firms ($b = -0.15$, $p < 0.01$), and with ties with talent search firms ($b = -0.10$, $p < 0.10$) are negative and significant. The plots and slope analyses of these significant interaction effects are consistent with those discussed above. Hence, Hypothesis 3 is supported.

Hypothesis 4 proposes that the positive relationships between ties with service intermediaries and product innovation are weaker for new ventures that export than for those that do not. The results in Model 3 suggest that the interaction term between export and ties with multiple service intermediaries is negative and significant ($b = -0.12$, $p < 0.05$). This interaction effect accounts for two percent ($p < 0.05$) of variance in product innovation. This significant interaction effect is plotted in Figure 3 (export took the values of one and zero). As shown in Figure 3, ties with multiple service intermediaries have a positive relationship with product

innovation in new ventures that do not export. Its simple slope is 0.24 ($p < 0.01$), meaning that one unit increase in ties with multiple service intermediaries would increase product innovation by 0.24 units. In contrast, this positive relationship disappears in new ventures that export (its simple slope is -0.08 , n.s.).

The results in Models 3a, 3b, and 3c suggest that the interactions of export with ties with technology service firms ($b = -0.09$, $p < 0.10$), with ties with accounting and finance service firms ($b = -0.10$, $p < 0.10$), and with ties with law firms ($b = -0.17$, $p < 0.01$) are negatively related to product innovation. The plots and slope analyses of these significant interaction effects are consistent with those discussed above. But the interaction of export with ties with talent search firms is not significant ($b = -0.03$, n.s.). Hence, Hypothesis 4 received modest support.

DISCUSSION AND CONCLUSION

In this study, we examined the relationships between new ventures' ties with service intermediaries and their product innovation. With data on a sample of new ventures from a technology cluster in China, we found that ties with a variety of service intermediaries (i.e., technology service firms, accounting and financial service firms, and law firms) have significant positive relationships with new ventures' product innovation. We also found that these positive relationships disappear when managers' perceived industry growth is higher,

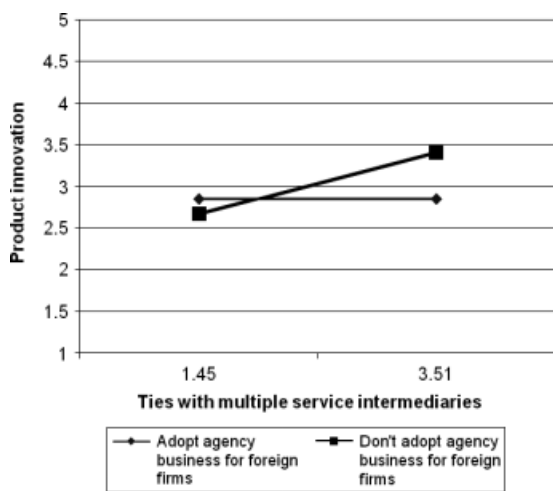


Figure 2. Ties with multiple service intermediaries and product innovation—the moderating role of adopting agency business for foreign firms.

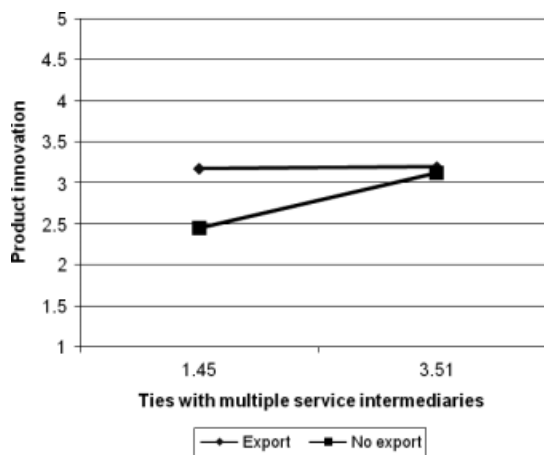


Figure 3. Ties with multiple service intermediaries and product innovation—the moderating role of export.

when new ventures adopt agency businesses for foreign firms, and when the new ventures export. These results suggest that the value of ties with service intermediaries in product innovation cannot be determined in a vacuum, but rather is context specific, depending upon the extent to which new ventures rely upon search in the networks of the cluster in which they reside for their product innovation.

The insignificant result related to ties with talent search firms deserves further exploration because it is in contrast to Bahrami and Evans's (1995) observation that talent search firms play a significant role in technology startups in Silicon Valley. One possible interpretation is that different from Silicon Valley, the labor market in China has not been well developed. Professional talent search firms are still new and they may not be able to help new ventures plug into the networks in the cluster in which the ventures reside. We acknowledge this is speculative. However, we believe that it is important for future research to explore how institutional contexts may shape the extent to which ties with service intermediaries matter to new ventures.

Contributions

Contributions to research on innovation search. Our findings contribute to a better understanding of innovation search, particularly in the context of new ventures. The extant literature on innovation has highlighted the importance of search: search of both new and old knowledge, and search of both familiar and unfamiliar knowledge (Fleming, 2001; Katila, 2002; Katila and Ahuja, 2002; Rosenkopf and Nerkar, 2001). While a combination of old and familiar knowledge components can contribute to firm innovation by increasing innovation reliability and predictability (Fleming, 2001; Katila and Ahuja, 2002), cumulative use of combination can hurt firm innovation (Fleming, 2001). Thus it is important for firms to search a greater variety of knowledge. However, it is difficult for firms to explore new regions of the essentially infinite knowledge space (Fleming, 2001). This is particularly true for new ventures that have limited resources and external contacts. Thus, the importance and the difficulty of search of a greater variety of knowledge constitute a dilemma. Then why do some new ventures perform better than others in external innovation search? Our results provide

an explanation to this important question and suggest that new ventures may solve this dilemma by better using their ties with service intermediaries. Sitting at the intersection of many firms, organizations, and industries, service intermediaries are in a unique position to help new ventures broaden their external innovation search scope without involving too much search cost.

Our findings also contribute to the understanding of context specificity of innovation search. As noted by Katila (2002), how firms search cannot be studied in isolation from where they search. Our findings suggest that ties with service intermediaries have no relationships with new ventures' product innovation when the ventures adopt agency business for foreign firms and when they export. When new ventures adopt agency business activities for foreign firms, they either do not do much product innovation, or if they do, they have opportunities to search in the knowledge space of their foreign partners. Similarly when new ventures export, they may be able to search in the knowledge space of international markets. In either of these situations, new ventures are less likely to search in the networks in the cluster in which they reside, and thus their ties with service intermediaries become less relevant to their product innovation. Therefore, our findings provide evidence to support the argument that how firms search depends upon where they search.

Contributions to research on external ties of new ventures. To the best of our knowledge, this study is the first to systematically examine the role of ties with service intermediaries in new venture innovation. This focus is different from previous studies that have typically examined the role of ties with prominent organizations, such as ties with established firms (e.g., Baum *et al.*, 2000; Shan *et al.*, 1994; Stuart, 2000) and with universities and research institutes (e.g., Baum *et al.*, 2000), in new venture innovation. While ties with these prominent organizations may enable new ventures to access their resources and capabilities, ties with service intermediaries enable new ventures to search a broader range of firms, organizations, and industries. One may argue that service intermediaries only provide new ventures supporting services, which are neither rare nor inimitable. However, it has to be recognized that the specialized network role of service intermediaries can contribute to product innovation by facilitating new

ventures' external innovation search. Our results are in line with McEvily and Zaheer's (1999) finding that linkages with regional institutions (i.e., regional industrial extension centers) in a cluster contribute to firms' acquisition of competitive capabilities. Put together, these results suggest that future research needs to look beyond new ventures' ties with a few prominent organizations and to pay more attention to a broader set of external ties in which the ventures are embedded.

Our study also contributes to this literature by examining how different types of external ties may jointly influence product innovation of new ventures, an area largely ignored in prior research. Arora and Gambardella (1990), for example, suggest that pharmaceutical firms' ties with small biotechnology firms and with universities represent complementary strategies for innovation. Baum *et al.* (2000) noted that multiple networks with similar partners may yield fewer benefits than networks with differentiated partners because same-type networks can bring in redundant resources and information. However, these studies did not empirically test how different types of external ties *jointly* affect new venture innovation. A related but different study is the work by Ahuja (2000), which examines the joint effect of direct ties and indirect ties on firm (not specifically new venture) innovation. He found that the impact of indirect ties on a firm's innovation output will be lower when the firm has a greater number of direct ties. Our findings that ties with foreign firms mitigate the value of ties with service intermediaries in new venture product innovation parallel Ahuja's (2000) findings. That is, the substitution effect may occur not only between direct ties and indirect ties (Ahuja, 2000) but also between different types of direct ties, or more specifically between ties with foreign firms and ties with service intermediaries.

Contributions to research on emerging economies. In addition, our findings advance the research on firm strategies in emerging economies. Recent studies have suggested that firms in emerging economies such as China, Eastern Europe, and the former Soviet republics have extensive reliance on external ties (e.g., Luo, 2003; Xin and Pearce, 1996). Several scholars have examined firms' external ties with governmental officials (Li and Atuahene-Gima, 2001; Li and Zhang, 2007; Peng and Luo, 2000; Xin and Pearce, 1996), ties with

other firms (Peng and Luo, 2000), and ties with foreign firms (Li and Atuahene-Gima, 2002). As valuable as that work is, we add to the literature by showing that ties with service intermediaries represent an important strategy for new ventures in China's emerging economy. Because strategic factor markets and institutional infrastructures to support entrepreneurial activities and innovation have not yet been well developed in China, ties with service intermediaries can substitute such institutional voids and serve as a conduit for a wide range of information, resources, and opportunities

Managerial implications. In both academic literature and popular press, new venture managers have long been advised to establish external ties with prominent organizations such as established firms, universities, and research institutes. Our study highlights the important role of ties with service intermediaries in new ventures. Although service intermediaries are potentially accessible to all ventures, not all ventures are connected to service intermediaries to the same extent or benefit from them to the same degree. Our results demonstrate that close ties with service intermediaries can contribute to new ventures' product innovation. For example, through close ties with service intermediaries, new ventures can visualize new opportunities, new ideas, and best practices for doing businesses synthesized from information and insights provided by these intermediaries. Our findings suggest that new venture managers need to break out of the innovation box and learn how to leverage their ties with service intermediaries for the purpose of innovation search. Our results also show that the value of ties with service intermediaries in new venture product innovation will depend upon the extent to which the ventures rely upon search in the networks in the cluster in which they reside for their product innovation. The more new ventures rely upon search in the networks in the cluster, the more valuable their close ties with service intermediaries. Overall, our study provides managerial insights about how and when new ventures can benefit from their ties with service intermediaries.

Limitations and future research directions

Our study has limitations that should be addressed in future research. First, this study is cross-sectional in design. While we have proposed

that ties with service intermediaries are positively related to new ventures' product innovation, it is possible that the direction of causality may be reversed. However, for the following reasons we believe that the reversed causality is not a significant concern in this study. (1) Findings in the extant literature generally support the idea that external ties enhance innovation output rather than innovation output attracts external ties (Shan *et al.*, 1994: 393). (2) The significant results of our interaction hypotheses are difficult to interpret from the reversed causality and thus offer stronger support to our theory (Simons and Peterson, 2000: 109). (3) Our field interviews suggest that in many Chinese new ventures ties with service intermediaries were in place prior to developing new products because these ties are more convenient, easier, and less costly to establish. Nonetheless, a longitudinal design, cross-validation of the findings, and more sources of data would enable us to further assess the causality of the hypothesized relationships.

Second, our sample only included new ventures in a single Chinese technology cluster. Zhang, Li, and Schoonhoven (2009) have noted that in China there are different types of technology clusters with different growth rates. Thus, replications of our model with new ventures in different clusters in China are needed for more confident generalization. Also, as we discussed earlier, the value of ties with service intermediaries is highly context specific. For example, because institutional voids may handicap Chinese firms' innovation during economic transformation, ties with service intermediaries play a crucial role in this context. We believe that it is important for future research to explore how institutional and cultural contexts may shape the extent to which ties with service intermediaries matter to new ventures and even contribute to the growth of technology clusters on a cross-country basis.

Finally, we used perceptual scales to measure new ventures' ties with service intermediaries. Future research may operationalize such ties with other measures such as the number, frequency, and quality of these ties and the status of the service intermediaries. For example, ties with high-end service intermediaries may add greater value to innovation performance than ties with low-end intermediaries. Although we did not have detailed information about the status of service intermediaries, our field interviews suggest that the Chinese

government has tried to control the quality of the service intermediaries within the technology clusters by certifying the qualifications of the intermediaries. Also, future research could examine factors explaining why Chinese technology ventures establish ties with service intermediaries in the first place. It has been observed that Chinese firms in general are reticent to value professional services in a way comparable to their Western counterparts. Then, why do some Chinese technology ventures value service intermediaries more and have closer ties with them than others? This should be interesting to explore in the future.

While the literature has highlighted the critical role of external ties in new ventures, most of the studies have focused on ties with prominent organizations. Research has devoted far less attention to exploring the role of ties with less prominent organizations such as ties with service intermediaries. To this end, we take an initial step by examining how new ventures' ties with service intermediaries are linked to their product innovation in the context of a technology cluster. Our findings show that ties with service intermediaries contribute to product innovation in new ventures and that these relationships become stronger when the ventures rely more upon search in the networks of the cluster in which they reside for their product innovation. These results suggest that despite their liability of newness, new ventures can create more from less by accessing a wide range of information, resources, and opportunities through their ties with service intermediaries within the cluster. We hope that our findings can contribute to a better understanding of how new ventures use their external ties for external innovation search. We encourage future research to pay more attention to a broader set of external ties in which new ventures are embedded.

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APPENDIX: PROFILES OF THE TWO RESPONDENTS FROM EACH VENTURE IN OUR SURVEY

Profile	First respondent	Second respondent
Gender		
Male	71.8%	69.6%
Female	28.2%	30.4%
Age		
29 or less	29.2%	58%
30–40	47.5%	28%
41–50	20.3%	12%
51 and above	3.0%	2%
Level of education		
Less than Bachelor Degree	33.2%	14.3%
Bachelor Degree	55.9%	54.0%
Master Degree	7.9%	23.8%
Ph.D. Degree	3%	7.9%
Position		
Managing director, CEO	29.2%	29.2%
Business manager	21.3%	20.3%
Functional manager	49.5%	50.5%
Average work experience in the current industry	6.3 years	6.0 years
Average participation level in strategic decision making	4.0 (on a five-point scale)	4.0 (on a five-point scale)