Are External and Internal R&D Complementary or Substitute for the Product Innovation of International Joint Ventures in China?

Di ZHU*

School of Marketing and Logistics Management, Nanjing University of Finance & Economics, China

*Corresponding author

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Abstract. The product innovation of international joint ventures (IJVs) is often seen as an outcome of the combinative capability to synergize and apply different knowledge components from both foreign and local partners. In the era of open innovation, it becomes more common for the IJVs to conduct the internal (in-house) R&D and external R&D beyond the firm boundaries simultaneously. Such external R&D includes contracting or joint R&D programs with the local business partners and research universities or institutes. In this study, we argue that in an emerging market like China, due to the market ambiguity and cultural barriers, there exists a substitute effect between external and internal R&D for product innovation of IJVs. However, a high combinative capability of IJV will mitigate the substitute effect such as the local partner diversity of IJVs is high and the foreign partners of IJVs are from Hong Kong, Macau and Taiwan (HMT). On the contrary, the local market uncertainty will strengthen the substitute effect. We find support for these hypotheses with a unique dataset of IJVs in China from 2002 to 2006. Discussions will be provided.

Introduction

The popularity of open innovation suggests that tapping and utilizing the external knowledge beyond firm boundaries are as important as a firm’s internal knowledge development (Chesbrough, 2003; Laursen & Salter, 2006). It becomes more common for firms to conduct external R&D, referring as “the contractually agreed, non-gratuitous and temporary performance of R&D tasks for a client primarily by private contract research and technology organizations, but also by some private non-profit and related hybrid organizations” (Howells, 1999). The multinational firms, which have “superior efficiency as an organizational vehicle by which to transfer … knowledge across borders” (Kogut & Zander, 1993: 625), are active to offshore their R&D activities not only in the form of in-house R&D but also by doing external R&D. For instance, Ford Motor in China has established a large number of collaborations with China's educational and research institutes to provide training opportunities, research fund and facilities to facilitate both basic and applied research in the automotive sector. In Chongqing, the city where Ford's passenger car joint venture Changan Ford Mazda Automobile is located, Ford Motor Company entered into a strategic alliance with Chongqing University to increase collaboration on research, development and utilization of automotive technologies. Product innovation is often seen as a result fo a firm’s combinative capability to synergize and apply different knowledge components from both internal and external learning (Kogut & Zander, 1992). Given the popularity of such external R&D, a critical yet underexplored question coming from this stream of research is: are internal R&D and external R&D, complementary or substitute in product innovation?

Although much of research has been taken to examine the relationship between internal and external R&Ds with both complementary (e.g., Cassiman & Veugelers, 2006; Schmiedeberg, 2008; Tsai & Wang, 2008; Veugelers, 1997) and substitute effect (e.g., Blonigen & Taylor, 2000; Higgins & Rodriguez, 2006; Laursen & Salter, 2006; Watkins & Paff, 2009) on innovation performance, the underlying mechanisms remain unclear, which further impedes the examination on what factors could buffer or strengthen the interactive relationship. In this study, we pay special attention to the IJVs in an emerging market. This is mainly due to the following two reasons. On one hand, most of
the work on the product innovation of IJVs in an emerging market has largely focused on the how the foreign firms transfer the knowledge to the local market because local firms in emerging markets have low innovative capability (e.g.: Khan, Shenkar, & Lew, 2015; Zhao, Anand, & Mitchell, 2005). However, the popularity of external R&D into the local agents outside the firm boundaries suggests that certain knowledge is also transferred from local market to the foreign partners as well, but the outcome and its interactions with the internal knowledge of IJVs remain underexplored. On the other hand, most of the previous work on the interaction between internal and external R&D are taken in the developed markets, there is lack of an understanding how it works in an emerging market. This is an important question because the external knowledge is socially embedded, and the institutional context definitely affects the translation and the application of it (Kogut & Zander, 1992).

Our study mainly has the two following contributions. First, our study contributes to the literature on the firm’s knowledge combinative capability, by explicating the factors influencing the combinative capability that directly affects the interactive relationship between internal and external R&D. Typically, by utilizing our context, we empirically test how the organizational form, the corporate culture and environmental characteristics affect the combinative capability, which is hard to spin down (Kogut & Zander, 1992). Second, our study extends the understanding of IJVs in emerging markets in the era of open innovation. Although IJVs are often supposed to have the advantages to combine different sources of knowledge, our findings indicate that doing external R&D may have conflict with the internal R&D. However, such a substitution can be mitigated or removed by the equity design of the IJVs to improve its combinative capability.

Theory and Hypothesis

Knowledge combinative capability: external versus internal R&D

Firms increasingly rely on a combination of internal and external sourcing (Capron & Mitchell, 2009; Chesbrough, 2003; Parmigiani & Mitchell, 2009). The conventional wisdom views external R&D and internal R&D as complements to firm innovation performance. By supplying internal knowledge, external R&D brings novel ideas beyond the firm’s boundaries, and promote the innovation performance. For instance, Becker and Dietz (2004) found that in the German manufacturing industry, R&D collaboration complements internal resources and enhances product innovation implementation. Cassiman and Veugelers (2006) found that the external knowledge acquisition and internal learning are complements to the productivity of “innovation active” firms. Recent studies have started to pay attention to the barriers of combining external R&D investment, such as the cognitive costs to screening the external environment and the transactions costs to negotiate with the R&D partners (Berchicci, 2013; Cassiman & Valentini, 2016; Grimpe & Kaiser, 2011), which might destroy the innovation performance.

Gaining external knowledge is far from straightforward, not mentioning to the utilization of such knowledge. In general, the complementary relationship as argued in the previous literature is built on two premises. First, the external knowledge is easy to mobile and transferred easily. This contradicts to the knowledge-based view that suggests knowledge is immobile and transfer of knowledge faces barriers (Attewell, 1992). Kogut and Zander (1992) also pointed the “inertness of knowledge” to indicate the difficulty of the knowledge mobility. Second, the complementary relationship assumes that a high knowledge combinative capability, described as the capability to "generate new combinations of existing knowledge" and "to exploit its knowledge of the unexplored potential of the technology" (Kogut & Zander, 1992: 391) is always available and effective. However, related literature suggests that a firm’s knowledge combinative capability varies and is affected by several factors such as organizational forms, corporate culture and environment (Kogut & Zander, 1992). Therefore, these two assumptions impede the further explication of the underlying mechanisms behind the interactive relationship and limit our understandings. Since the external knowledge is socially embedded, a detailed examination of the context is prerequisite to understand the relationship between how the utilization of external R&D.
The Joint effect of External and Internal R&D of IJVs in China

After China joins the WTO, faced by the intense competition, both Chinese government and firms realized the importance of technological innovation. As the latecomers in innovation and with strong learning orientation, Chinese government provide lots of benefits for the multinational firms to locate their R&D activities in China. The joint programs R&D programs between foreign firms and local agents such as local firms and research institutions are highly encouraged by the Chinese government. The mounting evidence has showed that IJVs in China actively contract their R&D activities with local universities and local firms. Product innovation of IJVs is often seen as the combinative capability to apply the knowledge from both the foreign and local partners (Li & Zhou, 2008). While IJVs takes the external R&D investment in addition to the internal investment within the IJVs, whether such external R&D investment and internal R&D complements or substitutes for product innovation remains unknown. This question is crucial to IJVs given that with the resources and knowledge from local partners, IJVs shall have capabilities to internalize the R&D activities, rather than take external R&D.

We propose a substitute relationship with the following two arguments provided. the market for knowledge of emerging markets is imperfect and characterized by ambiguity, which may prevent the IJVs from having the right R&D investment decisions and obtaining the accurate knowledge from external R&D. With the information asymmetry, the “fools rush in” is pervasive in the emerging markets. Cooperating with the local agents that are too eager to innovate but have low market screening and innovation capability will cost much attention from IJVs and it is highly possible that such joint R&D programs go to the wrong direction initially. When market is ambiguous, the interpretation of the knowledge from external R&D is also not easy. Thus, in such situations, doing the external R&D only consume the scarce resources such as attention and human capital from the internal R&D, destroying the efficiencies of internal R&Ds.

Therefore, we predict that:

**Hypothesis 1:** The simultaneous external R&D and internal R&D has a negative effect on IJV’s product innovation in China.

**Local partner diversity**

The local partner of the IJVs play a crucial role in assisting the foreign partners understand the local market in China (Zhou & Li, 2009). In our context, we highlight the local partner diversity, which is associated with a more comprehensive understanding of the Chinese market (Chen, Li, Shapiro & Zhang, 2011). The local partners in China generally can be categorized into: state partners or private partners. The state partners refer to the partners such as state-owned firms and research institutes, which is backed up by the Chinese central or regional government. State partners often have the first-hand information and deep understandings about the government issues and policy change. Compared with the state partners, the private partners have high pressure to profit, thus paying more attention and having a better understanding of the market. Due to their different expertise, having both will improve the IJV’s combinative capability. First, the high local partner diversity enables the IJVs to better scrutinize the market, reducing negative effect of market ambiguity. Second, the high local party diversity will reduce the loss during the translation but increase the possibility of finding the connections between external knowledge and internal knowledge. Thus, the substitution effect is mitigated. Therefore, we predict that:

**Hypothesis 2:** The local partner diversity weakens the substitution effect between external R&D and internal R&D.

**Foreign partners from Hong Kong, Macau, Taiwan**

Due to the unique historical and social linkages between these regions and mainland China, multinational firms from these Greater China areas (Hong Kong, Macau, and Taiwan) share many Chinese characteristics and differ substantially from the non-Chinese multinationals. Because of their cultural origin, HMT firms have advantages to access the local knowledge and locally embedded resources, and have a better understanding of the local market than non-HMT firms (Chang & Xu, 2008). In our context, the HMT should have high combinative capabilities to combine the external R&D and internal R&D. First, the HMT has high capability to scrutinize the market due to their
cultural bases and reduce the risks of entering into “traps”. Second, the shared cultural bases facilitate both the external R&D cooperation with local agents, reduces the translation loss of the external knowledge into the IJVs and improves the synergy of the external and internal knowledge.

Therefore, we predict that:

**Hypothesis 3:** For IJVs with home countries of Hong Kong, Macau and Taiwan, the substitution effect between external R&D and internal R&D is weakened.

**Local market uncertainty**

Since the external knowledge is socially embedded, the market uncertainty also plays a role the relationship between external R&D and internal R&D. When the market uncertainty is high, it constrains the firm’s combinative capability, making both the generation and transfer of the knowledge more difficult (Simonin, 1999). In such a situation, the market ambiguity is amplified; as a result, it is highly possible for the IJVs to fail in the external R&D. In addition, when the local market uncertainty is high, the knowledge from the external R&D turns to be more difficult to interpret and transfer, thus reducing the synergy possibility of internal and external knowledge. Therefore, we predict that:

**Hypothesis 4:** The local market uncertainty strengthens the substitute effect between external R&D and internal R&D

**Methods**

**Data and sample**

Our main data source is from National Bureau of Statistics of China (NSBC), which is the most comprehensive information provider about foreign firms in China and has been frequently used by previous studies (e.g., Xu, Lu, & Gu, 2014; Li & Li, 2014). NSBC provided firm-level financial information from its Industrial Department and R&D information from the National Science and Technology Department. The two sources of data were merged based on the unique firm code. The merged dataset covers seven years between 2002 and 2006, a period during which the China joined the WTO and the R&D activities of foreign firms were highly welcome in China. Our definition of IJVs follows the previous studies that the equity ownership of the local partners is larger than 5% (Chang, Chung & Moon, 2013). The detailed information of IJVs such as the home country origin and the local partner equity information, are also reported by NSBC. The industry-level information is also obtained from NSBC. With the missing variables excluded, we constructed a longitudinal sample of 343 IJVs in China from 2002 to 2006 with at least one external R&D investment taken during the time window.

**Model specification**

As the empirical analysis of this paper focuses on IJVs who have taken the external R&D, there is potential for sample selection bias. To address this, we employed a Heckman two-stage model (Heckman, 1979). As Equation 1 showed, at the first stage, a Probit model predicting the likelihood of an IJV’s external R&D was employed with the larger sample of firms. An adjustment term called “inverse Mills ratio” is calculated then.

Equation 1: Likelihood of External R&D_t = α_0 + β_1 * Industrial External R&D_{t-1} + β_2 * Regional External R&D_{t-1} + β_3 * Controls + ε_1

In equation 1, likelihood of external R&D is measured as a dummy variable which equals to one if a firm takes external R&D at t and zero otherwise. We included two instrumental variables to predict the probability of doing external R&D, industrial external R&D, which was the natural logarithm of the numbers of foreign firms that in the same industry with the focal firm and took external R&D in the same industry at t-1 and regional external R&D, which was the natural logarithm of the numbers of foreign firms that in the same region with the focal firm and that took external R&D at t-1. Other control variables including local partner diversity, HTM, local market uncertainty, firm age, firm size, debt ratio, intangible asset, export ration, industry competition, which all take the same measurement
as in the second stage analysis. In the second stage predicting product innovation, the “Inverse Mills Ratio” was included as a control variable (Heckman, 1979).

Equation 2: Product Innovation\(_{t+1}\) = \(\gamma_1 \text{External R&D}_t \times \text{Internal R&D}_t + \gamma_2 \text{inverse Mills ratios} + \varepsilon_3 \times \text{Controls} + \varepsilon_0\)

**Dependent variable**

Following the previous literature, the product innovation is measured by the new product sales scaled by the total sales that year (Laursen & Salter, 2006; Zhou, Gao, & Zhao, 2016; Zhou & Li, 2008). According to the regulations of NSBC, the new product is those new to market and contains the new knowledge component involved, such as new technology, structure and design. Thus, such a measure is consistent with our knowledge-combination story.

**Independent variables**

The external R&D in investment is measured by the ratio of external R&D spending to total sales and the internal R&D investment is measured by the ratio of internal R&D spending to total sales identically (Grimpe & Kaiser, 2010).

**Moderating variables**

The local partner diversity is the count number of how many kinds of equity it has, which is equal to 2 when the local partners involve both the state and private capital, otherwise it is 1; The Hong Kong, Macau and Taiwan firm (HMT) is measured as dummy variable that equal to 1 if its foreign partners are from the three regions. The laws normally require the foreign or HMT partner to hold at least a 25% share of the registered capital; the local market uncertainty was measured as the instability of industry sales over the prior five years (Keats & Hitt, 1988). Industry sales were regressed against time, and the standard errors of the regression slope coefficients were divided by the mean sales. Larger values indicated greater environmental uncertainty (Keats & Hitt, 1988).

**Control variables.**

First, firm characteristics were included as controls: firm age, debt ratio intangible asset. Second, the industry variables, industry competition, measured by the Herfindahl measure by utilizing the firm-level local market sales information contained in the data following Zhou and Li (2008), is also controlled. Finally, we included year and industry dummies in all our regression models to control for any potential unobserved heterogeneity introduced by yearly economic conditions and by different industry sectors.

**Results**

Table 1 presents the correlation matrix, the means, and the standard deviations of the variables of both the first-stage and second-stage variables. All of values of variance inflation factors (VIF) are lower than 5, thus multi-collinearity does not seem to be a serious issue (O’Brien, 2007).

<table>
<thead>
<tr>
<th>Panel 1: The summary of first-stage variables</th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 External R&amp;D Dummy</td>
<td>0.130</td>
<td>0.337</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Industrial external R&amp;D</td>
<td>2.769</td>
<td>1.054</td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Regional external R&amp;D</td>
<td>3.473</td>
<td>1.120</td>
<td>0.00</td>
<td>0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Local partner diversity</td>
<td>1.054</td>
<td>0.225</td>
<td>0.09</td>
<td>-0.02</td>
<td>-0.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 HMT</td>
<td>0.410</td>
<td>0.492</td>
<td>0.00</td>
<td>-0.09</td>
<td>0.12</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Local market uncertainty</td>
<td>1.017</td>
<td>0.013</td>
<td>-0.01</td>
<td>0.03</td>
<td>0.09</td>
<td>-0.02</td>
<td>-0.01</td>
<td></td>
</tr>
</tbody>
</table>

N=8855, Correlations with absolute value equal to or above 0.02 are significant at the \(p \leq 0.05\) level of confidence.

<table>
<thead>
<tr>
<th>Panel 2: The summary of Second-stage variables</th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Product innovation</td>
<td>0.324</td>
<td>0.325</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2 presents the result of regression. Model 2 adds the interaction effects. Model 3 and Model 4 add the moderating effect of HMT and local partner diversity, respectively. Models 5 include the moderating term of local market uncertainty.

Hypothesis 1 suggests a negative interaction between external R&D and internal R&D on the product innovation. This hypothesis is supported as the coefficient of the interaction term of is negative and significant (b=−38.49, p<0.05), as shown in Model 2. Following the procedures suggested by Aiken and West (1991), we plotted the interaction in Figure 1 and defined “high” and “low” as one standard deviation above the mean and below the mean of external R&D, respectively. Figure 1 shows that when the external R&D is high, the internal R&D has a negative effect on the product innovation, which supports the substitution effect we argue.

Table 2. The tobit model of firm and industry factors on product innovation.

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>External R&amp;D</td>
<td>0.044</td>
<td>1.737</td>
<td>3.043</td>
<td>0.731</td>
<td>0.908</td>
</tr>
<tr>
<td></td>
<td>(0.819)</td>
<td>(0.961)</td>
<td>(1.893)</td>
<td>(1.188)</td>
<td>(1.056)</td>
</tr>
<tr>
<td>Internal R&amp;D</td>
<td>0.941</td>
<td>1.512</td>
<td>2.636</td>
<td>1.269</td>
<td>1.116</td>
</tr>
<tr>
<td></td>
<td>(0.270)</td>
<td>(0.321)</td>
<td>(0.856)</td>
<td>(0.363)</td>
<td>(0.355)</td>
</tr>
<tr>
<td>HMT</td>
<td>-0.062</td>
<td>-0.067</td>
<td>-0.065</td>
<td>-0.069</td>
<td>-0.068</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.031)</td>
<td>(0.030)</td>
<td>(0.039)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>Local partner diversity</td>
<td>-0.005</td>
<td>-0.008</td>
<td>0.038</td>
<td>-0.008</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.045)</td>
<td>(0.059)</td>
<td>(0.045)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>Local market uncertainty</td>
<td>-2.119</td>
<td>-2.166</td>
<td>-2.214</td>
<td>-2.100</td>
<td>-3.181†</td>
</tr>
<tr>
<td></td>
<td>(1.444)</td>
<td>(1.434)</td>
<td>(1.431)</td>
<td>(1.429)</td>
<td>(1.638)</td>
</tr>
<tr>
<td>Firm size</td>
<td>0.058†</td>
<td>0.056**</td>
<td>0.055**</td>
<td>0.057**</td>
<td>0.056**</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Firm age</td>
<td>-0.014</td>
<td>-0.010</td>
<td>-0.010</td>
<td>-0.007</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.027)</td>
<td>(0.027)</td>
<td>(0.027)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>Debt ratio</td>
<td>-0.001†</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Intangible asset</td>
<td>0.078</td>
<td>0.048</td>
<td>0.045</td>
<td>0.080</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>(0.317)</td>
<td>(0.315)</td>
<td>(0.314)</td>
<td>(0.315)</td>
<td>(0.314)</td>
</tr>
<tr>
<td>Export ratio</td>
<td>0.073</td>
<td>0.061</td>
<td>0.060</td>
<td>0.056</td>
<td>0.070</td>
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<tr>
<td></td>
<td>(0.065)</td>
<td>(0.065)</td>
<td>(0.065)</td>
<td>(0.065)</td>
<td>(0.065)</td>
</tr>
<tr>
<td></td>
<td>(8.868)</td>
<td>(8.817)</td>
<td>(8.809)</td>
<td>(8.788)</td>
<td>(8.909)</td>
</tr>
<tr>
<td>Inverse Mills Ratio</td>
<td>-0.092</td>
<td>-0.087</td>
<td>-0.083</td>
<td>-0.082</td>
<td>-0.095</td>
</tr>
<tr>
<td></td>
<td>(0.090)</td>
<td>(0.089)</td>
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<td>(0.090)</td>
<td>(0.089)</td>
</tr>
<tr>
<td>ER*IR</td>
<td>-38.494</td>
<td>-118.062</td>
<td>13.047</td>
<td>-15.099</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(12.513)</td>
<td>(38.062)</td>
<td>(26.303)</td>
<td>(17.987)</td>
<td></td>
</tr>
</tbody>
</table>

N=933, Correlations with absolute value equal to or above 0.06 are significant at the p≤0.05 level of confidence.
Hypothesis 2 predicts that the negative interaction effect of external R&D and internal R&D is weakened by the local partner diversity. Model 3 shows that this hypothesis is supported as the coefficient of the three-way interaction is positive and significant (b=132.26, p<0.05). Hypothesis 3 proposes that the negative interaction effect of external R&D and internal R&D is weakened by the HMT. Model 4 indicates that this hypothesis is supported as the coefficient of the three-way interaction is positive and significant (b= 127.14, p<0.05). Hypothesis 4 posits that the negative interaction effect of external R&D and interaction R&D is strengthened by the local market uncertainty. Model 5 shows that this hypothesis is supported as the coefficient is negative and significant (b=−3000, p<0.1).

Robustness Check
Since our main analysis applied the random-effect Tobit model following the recent studies, we also did the fixed-effect to check the robustness of the result. It could also address the possibility that the result might be driven potential unobserved factors. For the fixed-effect, we centered the product innovation by the industry mean as the dependent variable (Zhou & Li, 2009). Except for the local market partner diversity, the result is similar to our main analysis. The interpretation goes the same as our main analysis.

Discussions
In this study, we did a comprehensive study to examine the interactive relationship of external R&D and internal R&D in a particular context, IJVs in China. Our finding confirms our hypotheses that the external R&D substitutes the internal R&D investment for product innovation due to the market ambiguity and cultural barriers. However, the local partner diversity and the foreign firm origin from
Hong Kong, Macau and Taiwan could mitigate the substitute effect; but the local market uncertainty strengthens the substitution effect. Our study has the following contributions.

First, our study joins the literature on open innovation to evaluate the effectiveness of knowledge sourcing and its interactive relationship with internal R&Ds. The main relationship shows that both two types of R&D activity have a positive effect on the product innovation, internal R&D has a greater effect. Interactively, they have a negative effect on product innovation. Such a finding is not surprising. Laursen and Salter (2006) have proposed that the external R&D and internal R&D substitute for innovation performance by arguing that external knowledge can be internally obtained by its own R&D exploration. Although our substitute relationship found is not new, using the three-way interactions, we explicate the deep mechanisms behind and enrich the understanding of the inter-firm knowledge transfer and intra-firm knowledge integration, a complex knowledge-management process.

Second, our study enriches our understanding of the knowledge combinative capabilities, which directly affects the combination of internal knowledge and acquired external knowledge. Underneath the knowledge combinative capability, the design of the organization form and environmental factors determines the synergy or integration of different knowledge components. Our specific context highlights the role of local partner of IJVs, which serves as the translator of the external knowledge and influence the combination of internal and external knowledge. In a broader view, such a finding suggests the important role of scouting unit in the area of open innovation to scrutinize evaluate and assimilate the external knowledge into the firm (Monteiro & Birkimshaw, 2016). Our study also highlights the role of culture, starting from the perspective of national culture and pin down to the organizational level, verifying that the corporate culture is crucial for the knowledge transfer and integration as argued by the related literatures (Kogut & Zander, 1992).

Third, our study contributes to the literature on international joint venture in terms of its boundaries. According to the logic of transaction cost economics, due to high market uncertainty, it is more reasonable for firms to internalize the key activities such as R&D activities (Williamson, 1985). Our first-stage result confirms such a prediction that the high market uncertainty leads to low likelihood of contracting the R&D, but the possibility of doing external R&D increases follows an imitation logic as shown. That is, when the industry peers and regional peers would like to take external R&D, it is more likely for the IJVs to do as well. Another explanation is that due to the popularity of external R&D from foreign firms, the market for technology is improved, thus increasing the likelihood of external R&D for the focal IJVs. Despite the two explanations, since the IJVs are often regarded as a real option for the foreign firms to understand the local market by depending on the local partners temporarily, thus, further research might be taken to evaluate how the external R&D might affect the stability of the IJVs.

References


