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Made in Vietnam: The Effects of Internal, Collaborative, and Regional Knowledge Sources of Product Innovation in Vietnamese Firms

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**Made in Vietnam: The Effects of Internal, Collaborative, and Regional Knowledge
Sources of Product Innovation in Vietnamese Firms**

Abstract

This paper analyses the impact of different knowledge sources of product innovation in Vietnam using firm-level data. We analyze the separate impacts of internal knowledge, collaborative knowledge, and regional knowledge. The analysis reveals that internal knowledge sources from internal R&D have a positive influence on product innovation. However, not all kinds of collaborative knowledge sources have significant effects on innovation. Only collaborative knowledge gained from inside the supply chain affects product innovation positively. Apparently, the capacity to benefit from working with knowledge institutes and absorbing knowledge from the environment do not materialize in new products.

1. Introduction

Innovation has been studied as an indicator for firm performance in various studies (Artz, Norman, Hatfield, & Cardinal, 2010; Calantone, Cavusgil, & Zhao, 2002; Darroch, 2005; Hitt, Hoskisson, & Kim, 1997; Kasseeah, 2013). Additionally, a firm's capacity to generate innovations constantly is considered a source of sustained competitive advantage (Barney, 1991). Innovation often originates from knowledge exchange and the recombination of knowledge. Therefore, firms need to acquire new knowledge from numerous sources to continuously generate innovations and maintain their competitive edge (Porter, 1990).

Firm-level resources allow firms to distinguish themselves from their competitors and develop a competitive advantage. According to the resource-based view (RBV) of the firm, this is only possible, however, when resources are valuable, rare, inimitable and non-substitutable (Barney, 1991). Even though knowledge is crucial for all type of firms, the exact type of knowledge that is most useful might differ between larger and smaller firms. Large companies engaged in internationalization pay particular attention to internal knowledge as a source of innovation (Scaringella, 2016). SMEs on the other hand are resource-constraint so they need to draw on knowledge networks that tie a broad set of partners, customers and suppliers together to take advantage of innovation resources.

The literature has shown different ways to categorize knowledge sources. Lundvall (1988) list two sources of knowledge: internal knowledge (knowledge created within a firm's boundaries) and external knowledge (new knowledge from external sources). Frenz and Ietto-Gillies (2009) classify knowledge into own-generation knowledge through R&D and knowledge transfers via bought-in resources for innovation purposes, external collaborations on R&D and internal networks of subsidiaries . Additionally, Boschma (2005) and Asheim and Isaksen (1997) argue that firms can learn and gain knowledge by just locating in a region

with other firms. Hence, knowledge comes from various sources, which could be internal sources, collaborative sources and regional sources.

Internal knowledge sources could be generated by firms through in-house R&D activities, employee training or managers' experience (Chen & Huang, 2009; Frenz & Ietto-Gillies, 2009; Martínez-Ros & Orfila-Sintes, 2012). Collaborative knowledge sources could come from collaborative activities between firms and their counterparts from inside the supply chain such as their competitors, suppliers and customers or outside the supply chain such as universities and research institutes (Lin, Hung, Wu, & Lin, 2002). Regional knowledge sources could come to firms from the information available in the regions where firms located because knowledge may spill over across firms especially when their distance between them is small (Boschma, 2005; Knoblen & Oerlemans, 2006). Boschma (2005) states that short distances could bring people together, favor information contacts and facilitate the exchange of tacit knowledge. Hence, within the same region, firms could access to externalities available such as specialized labor sources and gain knowledge from their expertise.

While there is a large volume of theoretical and empirical research on firms and the effect of internal and external knowledge on innovation separately, the literature deals less with the relative importance of specific sources of knowledge on firms' innovativeness. More recent attention has focused on the effect of internal firm dynamics, inter firm linkages and regions on innovation (Giuliani, 2006; Wang & Lin, 2012). This study therefore aims to simultaneously test the relationship between three different sources of knowledge (internal, collaborative and regional) with innovation. In doing so, we will use firm level data from Vietnam to analyze those relationships. A great deal of previous research on innovation is conducted in developed economies and those findings are not necessarily applicable to developing economies. The case of Vietnam is especially salient to analyze as this country

has changed from a central planning regime where the central government decided output targets and prices, domestic and international trade with bureaucratic controls to a more market-based economy since 1986. 30 years after the enactment of Vietnam's "doi moi" (renovation) policy in 1986, Vietnam has increased economic liberalization and achieved structural reforms needed to modernize the economy and to produce more competitive, export-driven industries. State-owned enterprises now account for roughly 40% of GDP. Vietnam has enjoyed rapid economic growth, which has been among the fastest in the world, with a mean of 6.4 percent a year since 2000. Remarkably, it has been transformed from one of the poorest to a lower middle-income country (The World Bank, 2016). With a population of almost 93 million people (GSO, 2017), Vietnam is a densely populated developing country with 34.6% of the population living in urban areas. Despite the fact that its poverty has declined significantly, the country is working to create jobs to meet the challenge of a labor force that is growing every year by more than one million people.

Although Vietnam does have firms and industries actively engaged in innovation, the overall innovation system is weak. Vietnam ranks eleventh out of twelve East Asian countries in terms of human resource capacity (3.79 out of 10) reported by OECD & The World Bank (2012). Firms in transition economies exhibit a number of striking differences with firms in developed countries, such as a lack of complete discretion to acquire and allocate resources and little knowledge and experience to compete in a competitive, market-based economy (Peng, 2000). By conducting this study with Vietnamese data, we can assess whether the relationship between different sources of knowledge and innovation shows systematic differences to those in advanced economies.

The following part of this article will first provide an overview of the theoretical background and the hypotheses. Next, the empirical data and research methodology are

showed. Afterwards, the analysis will be reported together with the results summary. Lastly, we provide a discussion on our results and conclusion.

2. Theoretical Background

At firm level, the ability to innovate leads to the wealth generation capacity. Innovation can reduce production cost and improve the quality of firms' goods and services. Numerous empirical studies suggest that innovation enhances firm performance (Artz et al., 2010; Hitt et al., 1997; Neely & Hii, 2012). In this study, we will focus on product innovation, which is defined as "a good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics" (OECD/Eurostat, 2005, p. 48). It is now well established from a variety of studies that the ability of firms to introduce product innovation is considered to be a key determinant of organizational performance and sustainable development (Danneels, 2002; Laursen, Masciarelli, & Prencipe, 2012). A number of authors have emphasized the vital role of knowledge in building and sustaining innovation (Leonard-Barton, 1995; Quintane, de Castro, Casselman, Reiche, & Nylund, 2011; Schulze & Hoegl, 2008). In addition, innovation is defined as a knowledge-based commodity. Hence, firms need to have knowledge to innovate and thus to profit from innovation (Lundvall, 1988, 1992) Therefore, this study will also focus on the impact of knowledge on innovation. In doing so, we will use three different sources of knowledge: internal knowledge sources, collaborative knowledge sources and regional knowledge sources.

First, internal knowledge sources for innovation have been researched extensively in developed and developing countries alike (Barasa, Knobens, Vermeulen, Kimuyu, & Kinyanjui, 2017; Baumann & Kritikos, 2016; De Oliveira Cabral, 2010; Roper, Love, & Bonner, 2017; Svetina & Prodan, 2008). Internal knowledge sources could be generated from

internal R&D which has become a classical explanation for innovation in the sense that firms with higher level of internal R&D are expected to be more innovative (Caloghirou, Kastelli, & Tsakanikas, 2004; Frenz & Ietto-Gillies, 2009). Another example of internal knowledge sources are managers' experience and skills. With their experience and skills, managers understand and response effectively with changes in their competitive environment. Additionally, managers could rely on their experience and skills accumulated over time to make decision in identifying innovation opportunities (Bantel & Jackson, 1989; Liu & Buck, 2007; McGee & Dowling, 1994).

Second, collaborative knowledge sources have been relevant to innovation generation and firms are aware of the necessity of establishing R&D collaboration to obtain expertise which cannot be generated in-house (Frenz & Ietto-Gillies, 2009). Collaboration with other firms and institutions in R&D is a crucial way to make external resources usable (Becker & Dietz, 2004; Bougrain & Haudeville, 2002). Several lines of evidence suggest that there is a positive influence between collaborative knowledge sources and innovation (Becker & Dietz, 2004; Frenz & Ietto-Gillies, 2009; Laursen & Salter, 2006). However, collaborative knowledge sources do not always bring benefits to firms. When collaborating with universities, firms' achieved benefits may be insignificant and the promised knowledge transfer may not happen, because universities might collaborate with competing companies or unintended flows of knowledge and confidentiality issues might occur (McAdam, O'Hare, & Moffett, 2008).

Third, data from several studies suggest that regional knowledge sources influence firms in improving their innovation (Boschma, 2005; Cantwell & Iammarino, 2000; Moulaert & Sekia, 2003). Regional knowledge refers to knowledge that firms can obtain even when they do not enter any proactive collaboration with others. When firms locate in close proximity or in the same region, they can gain benefits such as (a) opportunity to access to specialized labor, (b) opportunity to access to specialized inputs, (c) opportunity to access to technology

spillovers, and (d) opportunity to access to greater demand. The first three types of benefits bring firms unique or efficient access to the supply of necessary resources including knowledge resources (McCann & Folta, 2008).

3. Hypotheses

As explained above, different sources of knowledge can have a different effect on innovation at firm level. Following this line of thought, we hypothesize that in a transition country like Vietnam, with a weak innovation system, knowledge even plays a more vital role compared to advanced economies. Below, we develop our hypotheses that link the different knowledge sources to innovation.

3.1 Internal knowledge sources

The ability of firms to create knowledge internally could lead them to be more innovative and successful (Nonaka & Takeuchi, 1995). The resource-based view also emphasizes the important role of internal knowledge sources, which could be generated from human resources (employee training, manager experience and skills) and technology resources (internal R&D) (Barney, 1991; Wright, McMahan, & McWilliams, 1994). Moreover, Porter (1991) mentions the needs for firms to upgrade their internal advantages to sustain and extend competitive advantages. When firms are in a highly competitive environment, they are forced to innovate and by developing internal knowledge continuously, firms could create temporary knowledge monopolies. Besides, firms that invest in R&D extend their internal knowledge base, which also allows them to increase their innovation output (Barasa et al., 2017; Baumann & Kritikos, 2016; De Oliveira Cabral, 2010; Roper et al., 2017; Svetina & Prodan, 2008). Within the context of Vietnam, we also propose that internal knowledge sources will influence product innovation positively. In this study, we use two variables to measure internal knowledge sources: internal R&D and managerial experience. Many recent studies

have shown a positive relationship between internal knowledge sources from R&D, manager experience and innovation at firm level (Austin, 2002; Barasa et al., 2017; Frenz & Ietto-Gillies, 2009; Goedhuys, Janz, & Mohnen, 2008, 2013). When opening up their economies, most developing countries make their manufacturing firms face the fierce competitive conditions of globalization. Hence, firms in those economies need to have the ability to assimilate, master and improve technologies to provide the international market with high quality products. That ability is affected by several factors including internal R&D and quality of management board (Goedhuys et al., 2008). Goedhuys et al. (2008) state that firms conduct internal R&D as an alternative to imported technology or build up absorptive capacity to benefit from outside R&D, while good managers help firms in converting research results into marketable products and absorb external market information.

Moreover, managers play a vital position in analyzing the situation, understand and describe firms' economic performance. Managerial experience is generally considered to be an important input for successful innovation (Schilirò, 2010). It also reflects an important tacit skill required to select the most promising innovation projects (Custódio, Ferreira, & Matos, 2014). Hence, the managerial ability to manage the resource portfolio into bundles of unique capabilities that can be leveraged within a certain competitive environment is critical for developing new innovative products (Ireland et al., 2003: 977). As such, we argue that prior experience in innovative activities provides managers a basis to more fully understand the challenges of innovation, which makes these managers more tolerant of the uncertainty and ambiguity it brings (Birkinshaw, Hamel & Mol, 2008).

Hypothesis 1a: The stronger a firm's internal R&D, the higher the likelihood that that firm produces a product innovation.

Hypothesis 1b: The longer time the top manager of a firm working in this sector, the higher the likelihood that that firm produces a product innovation.

3.2 Collaborative knowledge sources

Various studies have emphasized that firms are likely to face difficulties when innovating in isolation and suggest that firms gain access to their most valuable knowledge through collaboration (Hamel & Prahalad, 1994; Shan, Walker, & Kogut, 1994; Teece, 1986; Tether, 2002). Firms can benefit from innovative activities of competing firms, academic institutions and supply chain partners (Isaksson et al., 2016). Furthermore, Laursen and Salter (2016) also mention that firms that access a broader range of collaborative knowledge sources (e.g. collaborating with universities, competitors, and customers) and use them more deeply, increase their innovation productivity. Hence, instead of creating new knowledge internally firms can also combine or recombine their existing knowledge with that of others to create new combinations of knowledge (Oerlemans & Knobens, 2010).

In this study, we expect the level of collaborative knowledge, whether from inside or outside the supply chain, will benefit a firm's innovative performance. However, the degree to which knowledge from inside or outside the supply chain affects innovation might be different. It has been demonstrated that joining alliance networks can enhance firm learning and innovation (Ahuja, 2000; Soh, 2003; Walker, Kogut, & Shan, 1997). Pittaway et al., (2004) emphasize that network relationships with suppliers, customers and intermediaries are vital factors affecting firms' innovation performance and productivity, as different partners control different sources of knowledge and information, which will influence firms differently. Furthermore, firms that do not collaborate nor exchange knowledge, limit their knowledge base in long term. Several lines of evidence suggest that collaborative knowledge sources are critical not only to create in-house innovations but also for learning about innovative work practices that other organizations have done or adopted (Biemans, 1991;

Erickson & Jacoby, 2003). Additionally, Oerlemans and Knoblen (2010) when conducting their research on South African firms, use different external sources, including (1) business organizations: buyers, suppliers, competitors, consultants and sectoral institutes; (2) technological knowledge sources: public research labs, universities, innovation centers; and (3) codified knowledge sources: patents, electronic databases. They reveal that using knowledge from competitors increase the number of innovations within a firm, while others sources such as universities and institutes have less effects on the innovative potential of firms. Hence, we formulate the following hypotheses:

Hypothesis 2a: The stronger a firms' collaborative knowledge gained from inside the supply chain, the higher the likelihood that that firm produces a product innovation.

Hypothesis 2b: The stronger a firms' collaborative knowledge gained from outside the supply chain, the higher the likelihood that that firm produces a product innovation.

3.3 Regional knowledge sources

Access to resources that are not internal to the firm can also stem from simply being located in a region where many other firms are located, a so-called agglomeration (Weterings & Knoblen, 2013). Within that region, firms could take advantage of available specialized labour, specialized inputs, technological spill-overs, and demand market thickening (McCann & Folta, 2008). A large body of research shows that tacit knowledge can be implanted in geographic regions, enabling firms within these regions to draw from this knowledge (Boschma, 2005; Sorenson & Baum, 2003; Tsuji & Miyahara, 2009). Additionally, Social scientists have long recognized the importance of geography for innovation (Funk, 2013; Laursen et al., 2012). Being in scientific communities and recruiting skilled employees provide knowledge that help firms innovate and generate competitive advantage. McCann

and Folta (2008) state that if firms are located in clusters, there is a pooled market for workers with specialized skills, which benefits both workers and firms.

Moreover, when firms require specialized inputs such as tools, suppliers, manufacturing facilities or services, being in the same region with other firms in the same or similar fields would help them to reduce transaction costs. Schumpeter (1934) mentioned that proximity is helpful as it enables access to diverse knowledge that firms can recombine in novel ways to make discoveries. Furthermore, the benefit of being in the same region with other firms can help a firm to stay informed of technological knowledge, which help them to be more innovative (Funk, 2013). Proximity is considered an important condition for knowledge sharing, transfer and technology acquisition(Gertler, 1995). Being close to firms from the same or similar industry could bring firms benefits in terms of labor market pooling and transport cost savings. At the same time, being with firms from outside its industry could provide firms with knowledge spillovers (Beaudry & Schiffauerova, 2009). For those reasons, we suppose that when firms are located in a region with more firms or a region with high level of R&D activities, it is more likely for them to innovate.

Hypothesis 3a: The stronger the knowledge base of the region a firm is located in the higher the likelihood that that firm produces a product innovation

Hypothesis 3b: The higher the population of the region a firm located in the higher the likelihood that that firm produces a product innovation

4. Data and Method

4.1 Data

The data used in this study is from two main sources: (1) The World Bank Enterprise Survey (ES) conducted between November 2014 and April 2016 and (2) the Innovation Capabilities Survey (ICS) conducted from October 2016 to February 2017. The ES is an ongoing project covering over 155,000 firms in 148 countries, collecting data based on firms'

experiences and enterprises' perception of the business environment and investment climate. This firm-level survey comprises non-agricultural formal, private-sector firms. The ICS in this study is a follow-up and complementary to the ES. It randomly selected respondents from the ES sample to make its sample a subset of the ES. However, it focuses on innovative activities and innovative capabilities of manufacturing firms. The standardized questionnaires have been translated into local languages and back-translated into English to check its accuracy.

The data for this study is merged from the most recent version of the ES and the ICS conducted in Vietnam. Unsurprisingly, the data contain missing observations, hence our analyses will use fewer observations than the full sample.

4.2 Variables

Dependent Variable: Innovation is measured by using the question “From fiscal year 2011/2012 thru 2013/2014, did this establishment introduce any new or significantly improved product or service?” in the ICS. We code a variable equal to one if firms respond affirmatively and a variable equal to zero if firms respond negatively to the question. Our measure of innovation is in line with previous studies

Internal knowledge sources: We measure internal knowledge sources using internal R&D and top manager experience. Internal R&D has been using as the explanatory variable for innovation output in many studies (Crépon, Duguet, & Mairessec, 1998; Frenz & Ietto-Gillies, 2009). Internal R&D is defined as creative work undertaken to increase knowledge for developing innovative products and processes. Moreover, we also use top manager experience as another explanatory variable for internal knowledge sources. It has been proved to have a relationship with innovation (Bantel & Jackson, 1989; Daellenbach, McCarthy, & Schoenecker, 1999; Li, Lin, & Huang, 2013). We use the question in the ICS to measure the variables, for internal R& D, the question used is “Between fiscal year 2011/2012 and fiscal

year 2013/2014, did this establishment conduct internal R&D?”. We code it equal to 1 if firms choose yes and zero otherwise. For manager experience we used: “how many years of experience working in this sector does the Top Manager have?”

Collaborative knowledge sources: Collaborative knowledge that generated inside the supply chain of a firm such as competitors, suppliers and customers was measured by the following questions respectively: Thinking about innovation, has this establishment used information or ideas from competitors for any innovation activity undertaken between fiscal year 2011/2012 and fiscal year 2013/2014?; Thinking about innovation, has this establishment used information or ideas from suppliers for any innovation activity undertaken between fiscal year 2011/2012 and fiscal year 2013/2014?; and Thinking about innovation, has this establishment used information or ideas from customers’ feedback for any innovation activity undertaken between fiscal year 2011/2012 and 2013/2014?”. We code the variable equal to one if any of the answer for the three above questions is yes.

Collaborative knowledge generated from outside a firm’s supply chain such as universities and research institutes is measured by the question “Thinking about innovation, has this establishment used information or ideas from universities and research institutes for any innovation activity undertaken between fiscal year 2011/2012 and fiscal year 2013/2014?”. We code the variable equal to 1 if the answer is yes.

Regional knowledge sources: Regional knowledge sources is measured with regional R&D and firm location. Regional R&D is measured using the mean of internal R&D over regions as firms could take advantage of being in the same region with other firms when they can enjoy technological diffusion, information and knowledge flows among them (Funk, 2013; Laursen et al., 2012). In addition, we use the question “size of the locality?” to measure firm location. It is emphasized that the city size where firms located could affect the level of

innovation (Feldman & Audretsch, 1999; Taylor, Derudder, Saey, & Witlox, 2006). We recode location equal to 1 if the answer is a city with population over 1 million.

Control Variables: We measure the control variables using information from the ES.

Firm size: Firm size is used as a control variable in various studies and support the finding that the larger the firm is the higher its level of innovation. Data from several studies suggest that because of having more employees, firms can take advantages of economy scale in creating innovation (Ayyagari, Demirgüç-Kunt, & Maksimovic, 2011; Barasa et al., 2017). Moreover, investment in R&D could be affected by firm size as large firms are more likely to secure the funding needed for large scale R&D (Shefer & Frenkel, 2005). Hence, in this study, we also use firm size as one of the control variables and check for consistency with previous studies. The question that we use is “how many permanent, full-time individuals worked in this establishment? “

Firm age: This study uses firm age as another control variable because there is evidence that firm age has a significant effect on innovation (Balasubramanian & Lee, 2008; Hansen, 1992). It is widely believed that a major proportion of industrial R&D is undertaken by larger and older firms, however it is also observed that in the high-tech industrial branch, a large number of startups that are young and relatively small engage intensely in innovative activities (Shefer & Frenkel, 2005). Furthermore, Huergo and Jaumandreu (2004) claim that entrant firms tend to present the highest probability of innovation while the oldest firms tend to show lower innovative probability. Thus, this study aims to investigate the relationship between firm age and innovation to figure out if any connection exists based on empirical data of firms in Vietnam .In this study, we calculate firm age by taking the difference between 2015 and the answer of this question “In what year did this establishment begin operations? ”

Insert Table 1 here

4.3 Method

To measure the dependent variable, we use a dummy variable that takes the value of “1” if a firm has introduced any new or significantly improved innovative product and “0” if otherwise. Hence, binary logistic regression model was chosen for analysing the data. This method has been used in previous studies using similar data structures (Ayyagari et al., 2011; Barasa et al., 2017).

5. Results

The descriptive statistics and correlation matrix for all variables are provided in Table 2. The data consists of 300 manufacturing firms in Vietnam with the average age of 13.73 years old and average number of employees is 148. 84 percent of the firms are located in a city with population over 1 million. Most of the firms do not conduct internal R&D (83.45%). 57% of the firms have collaboration inside their supply chain while only 16% of the firms have collaboration outside the supply chain. The World Bank conducted the survey in 4 Vietnamese regions which are Red River Delta, North Central area and Central coastal, South East and Mekong River Delta. The South East region has the largest number of firms with 105 firms, next is the Red River Delta with 89 firms. The explanation for that could be because the South East has Ho Chi Minh city, which is the biggest city in term of population (8.426 million people) and the Red River Delta has Hanoi – the capital of Vietnam and ranks second in term of population (7.588 million people). Regional knowledge creation has an average of 16.65.

On the dependent variable side, 37% of the firms reported that they have product innovation. The average rate of product innovation in Vietnam is markedly higher than the average rate of innovation observed in EU-28 (23.7%). Cirera and Muzi (2016) argue that such high levels

of self-reported innovation in developing countries partly arise from a rather subjective definition of an innovation in the surveys, especially since innovations are likely to be more incremental and less radical.

Insert Table 2 here

In the method session, we mentioned that a binary logistic regression model is used for our hypotheses. Model 1 is a baseline model, which we include only control variables to evaluate the independent variables explanatory value. We add two independent variables which are internal knowledge sources measured by internal R&D and the experience of top managers in Model 2. Model 3 tests the effect of collaborative knowledge resource with 2 independent variables, in which one measures knowledge created from inside the supply chain collaboration and the other measures from outside the supply chain collaboration. Model 4 includes 2 variables, namely: Firm location and regional R&D. Model 5 assess the effects of all independent variable simultaneously. Table 3 report all the results of the models.

Insert Table 3 here

Model 1 shows that the control variables (firm age and size) have no significant effect on firms' likelihood to innovate. Acs & Audretsch (1987) stated that even previous studies mentioned larger firms promoted more innovative activities, however, it is not true in every industry. They found that only larger firms in industries which are concentrated, capital and advertising intensive have the relative innovative advantage than their smaller counterparts. (Symeonidis, 1996) also mentioned there is little evidence support the hypothesis that larger firms stimulate innovation. On the other hand, firm age tend to have an inverse relationship with product innovation (Hansen, 1992). Even though, the result shows no significant, we

also have a negative result for firm age. The possible reason could be because most of the firms in our sample are SMEs so we could not observe the total range.

Model 2 demonstrates the direct effect of internal knowledge source on innovation. There is a positive and statistically significant effect of internal R&D on firm innovation. Hypothesis 1a is supported: a firm's likelihood to innovate increases when there is an increase in internal R&D. On the other hand, for hypothesis 1b the result is positive but not significant. Therefore we could not say if managerial experience of firms in Vietnam has any effect on innovation.

Model 3 explains the relationship between collaborative knowledge sources and innovation of firms. The result confirms previous studies in the literature that a firm's collaborative knowledge gained from inside the supply chain (customers, suppliers, competitors) has a positive significant relationship with product innovation of that firm. On the other hand, it shows no significant relationship between collaboration with universities or research institutes and innovation. Khanna and Palepu (2005) mention that in developed economies, firms can rely on a variety of similar outside institutions to minimize sources of market failure, while on the other hands firms in emerging markets have to face with the absence or underdevelopment of specialized intermediaries. Therefore, this result in Vietnam could be due to an institutional void, i.e. the weak linkages between firms and universities and/or research institutes in Vietnam. As such, hypothesis 2a is strongly supported, while there is no support for hypothesis 2b.

Model 4 includes 2 independent variables, which are regional R&D and firm location. There is no significant relationship between regional R&D and product innovation. Hence, we could not accept hypothesis 3a. Nonetheless, hypothesis 3b is supported as location of firms has a significant positive relationship with product innovation. Firms in a city with population of more than 1 million people are likely produce more product innovation than

their counterparts in less crowded cities. That might be explain by the fact that in big cities, more facilities and infrastructure are available for firms to utilize. Moreover, in big cities, firms could easier to find suitable personnel who could bring them new knowledge with their expertise (Glaeser & Mare, 2001).

Model 5 contains all the independent variables. It appears that internal knowledge sources and collaboration knowledge gained inside the supply chain are all significant positive with product innovation. This is consistent with the result when we test those two variables separately. However, when we assess the effect of firm location on product innovation together with all other independent variables simultaneously, it is no longer significant.

6. Discussion

The results of our study also reveal that the stronger a firms' collaborative knowledge gained from inside the supply chain, the higher the likelihood that that firm produces product innovation in Vietnam. This is in line with findings in the study of Knobens and Oerlemans (2010) which is done in South Africa. Hence, it might be specific to developing countries that firms need to create a network with customers, suppliers and competitors to enhance product innovation.

This study found no significant relationship between collaborative knowledge gained from outside the supply chain and product innovation. It is as reported in London (2011) that there is very little collaboration between firms and knowledge institutes in Vietnam. He also states that even if firms do want to have collaborative activities with universities and research institutes, there are numerous barriers among them; namely lack of capabilities for firms and universities to negotiate, learn and share information with each other. Furthermore, Bauer (2011) finds that the collaboration between firms and knowledge institutes in Vietnam is not always effective as nowadays many research institutes are established but they only operate

for making money not quality. In addition, it is reported by OECD & The World Bank (2014) that the physical infrastructure in universities and state research institutes in Vietnam remains undeveloped as various of R&D subsidies do not have scientific instruments required to implements the projects. Another issue is that Vietnamese training and education system is still unrelated to the market needs, what the knowledge institutes provide is not practical and does not meet the demand or with low quality. Hence, it is very difficult for collaboration activities happens or bring benefits. The possible reason might be because the systems in Vietnam still have a characteristic of a central planning economy. They only try to fulfil the training target of the government plan and have less enthusiastic in research and science.

One of the explanation why regional knowledge sources do not work in the case of Vietnam is that country knowledge-producing organizations and states agencies are slow and reluctant to exchange information and knowledge. Moreover, the information is scattered in different agencies, ministries and research institutes, while there is limited regional coordination, no data compilation or editing. Hence, those obstacles cause time and money consuming for firms to get access to knowledge (Bauer, 2011).

The results of this study exposes that both activities that benefits firms are closely related to what firm has been doing. Apparently, the absorptive capacity to benefit from working with knowledge institutes and absorbing knowledge from the environment do not materialize. The findings are in line with what Voeten, De Haan, De Groot, and Roome (2015) reported on small producers in Vietnam. Those producers innovated only by themselves with their own internal processes, interactions and knowledge gained within their cluster. That could be explained by the fact that Vietnam's innovation policies and institutions for the knowledge economy was positioned among the group of countries in the early stages of introducing innovation programs for technology adoption and technology upgrading and it is not easy for firms especially in private sector to get support from the government.

We could also explain this case of Vietnam by using institutional voids theory of Khanna and Palepu (2005, 2010). They state that there is an information asymmetry in emerging markets, which might be the reason why collaboration outside the supply chain and regional knowledge sources did not work. In addition, Vrgovic, Vidicki, Glassman, and Walton (2012) mention the vital role of institutions when firms deciding with whom they should collaborate, firms in developing countries often have limited information sources and lack of financial resources to gather relevant information so properly designed institutions would help. In order to be fully developed and have knowledge available for firms to utilize, an emerging market like Vietnam need to have three markets functioning well which are product markets (soft and hard infrastructure), capital markets (information and financial intermediaries) and labor markets (such as educational institution, placement agencies, employment regulations, unions) (Khanna & Palepu, 2010).

This study has some limitations that we would like to highlight. First, the data for the paper is mostly information in innovative activities of firms between 2013 and 2015. This made it difficult to analyze the sustainability of firms' innovativeness and evaluate the prior innovation history. Second, the observed firms are private firms and mostly are SMEs. Consequently, we might only saw part of the total range as state-owned enterprises in Vietnam accounted for just only 0.2 percent but they accounted for one third of the GDP (The World Bank, 2016). However, those limitations could lead to several issues for future research. One of the possible future topics is analyzing effects of knowledge sources over a longer period of time. Another topic could be analyzing the impact of knowledge sources on state owned enterprises.

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Table 1: Variable measurement

Variable	Measurement	Source	Question No
<i>Innovation</i>			
Product innovation	Firm introduced any new product or service: "1" Yes "0" No	ICS	H3a, h3b, h3c
<i>Internal Knowledge sources</i>			
Manager experience	Top manager's number of working experience year in this sector	ES	B7
Internal R&D	Dummy variable: "1" Yes "0" No	ICS	B01
<i>Collaborative knowledge sources</i>			
Inside the supply chain	Innovation developed with competitors, customers, or supplier: "1" Yes "0" No	ICS	
Competitors	Information or ideas from competitors: "1" Yes "0" No	ICS	B1b
Suppliers	Information or ideas from suppliers: "1" Yes "0" No	ICS	B1c
Customers	Information or ideas from customers' feedback: "1" Yes "0" No	ICS	B1j
Outside the supply chain	Information or ideas from universities and research institutes: "1" Yes "0" No	ICS	B1e
<i>Regional Knowledge sources</i>			
Regional R&D (log)	% of firms conducting internal R&D within a region using mean of the internal R&D over the 4 regions in Vietnam	ICS	B1
Firm location	City with population over 1 million: "1" Urban "0" Rural	ES	A3
<i>Control variables</i>			
Age	Number of year since establishment	ES	B5
Size	Number of permanent, full time employees	ES	L1

Table 2: Descriptive statistics and correlations

		Mean	Std.Dev	Min	Max	1	2	3	4	5	6	7	8	9
1	Product innovation	0.37	0.48	0.00	1.00	-								
2	Age (log)	2.41	0.62	0.10	4.22	0.00	-							
3	Size (log)	3.76	1.40	0.69	8.85	-0.02	0.37	-						
4	Manager experience	18.41	9.40	2.00	56.00	0.03	0.38	0.18	-					
5	Internal R&D	0.17	0.37	0.00	1.00	0.34	0.05	0.12	-0.04	-				
6	Inside the supply chain knowledge	0.57	0.50	0.00	1.00	0.63	0.03	0.07	-0.02	0.33	-			
7	Outside the supply chain knowledge	0.16	0.37	0.00	1.00	0.30	0.09	0.11	0.01	0.32	0.38	-		
8	Regional R&D	16.65	8.25	6.67	27.45	0.02	0.05	0.03	-0.11	0.21	0.19	0.14	-	
9	Firm Location	0.84	0.37	0.00	1.00	0.06	-0.11	-0.18	0.09	-0.05	-0.07	-0.09	-0.26	-

Table 3: Model results

	Model 1 DV= Product Innovation == 1		Model 2 DV= Product Innovation == 1		Model 3 DV= Product Innovation == 1		Model 4 DV= Product Innovation == 1		Model 5 DV= Product Innovation == 1	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Age (log)	0.00	0.24	-0.06	0.22	-0.00	0.28	0.00	0.23	-0.09	0.23
Size (log)	0.02	0.14	-0.10	0.16	-0.12	0.16	0.04	0.14	-0.17	0.17
Manager experience			0.01	0.02					0.02	0.02
Internal R&D			2.13***	0.22					1.38***	0.05
Inside supply chain knowledge					3.88***	1.1			4.06***	1.22
Outside supply chain knowledge					0.41	0.38			0.41	0.55
Regional R&D							0.01	0.02	-0.05	0.04
Firm Location							0.44*	0.26	0.6	0.36
Constant	-0.61	0.59	-0.63	0.76	-3.01***	0.49	-1.20	1.06	-3.00***	0.59
Model information										
Type of Model	Logistic regression		Logistic regression		Logistic regression		Logistic regression		Logistic regression	
Observations	297		287		294		297		284	
Prob> Chi2	0.98		0.00		0.00		0.80		0.00	
Pseudo R-Square	0.00		0.09		0.35		0.00		0.42	

All reported standard errors are robust clustered standard errors at the regional level

* p<0.10

** p<0.05

*** p<0.01