THE ROLE OF ABSORPTIVE CAPACITY BETWEEN EXTERNAL KNOWLEDGE SEARCH AND FIRM'S PRODUCT INNOVATION PERFORMANCE

Faudziah Hanim Hj. Fadzil
Othman Yeop Abdullah Graduate School of Business
Universiti Utara Malaysia
fhanim@uum.edu.my

Chong Say Lee*
Othman Yeop Abdullah Graduate School of Business
Universiti Utara Malaysia
chongsaylee@gmail.com

*corresponding author: chongsaylee@gmail.com

ABSTRACT

Nowadays, it is commonly accepted that external knowledge search is important for firm's product innovation performance (PIP). However, it is still not clear, what dimensions of firms' external knowledge search strategy are crucial in determining their product innovation success, and how firms are exploiting the external knowledge from their external knowledge search activities. This study intends to open the "black box" between different dimensions of external knowledge search strategies, and PIP by proposing absorptive capacity as the mediating variable. Employing path analysis through partial-least squares structural equation modeling (PLS-SEM) in a sample of 137 Malaysian manufacturing firms, this study found that absorptive capacity is partially mediated between collaboration depth and PIP. In this way, it provides insight that collaboration depth contributes to developing firms' absorptive capacity, and yet, this strategy could also contribute directly to PIP. This study advances extant literature by explaining the way of a firm in attaining superior PIP from external search strategies and absorptive capacity and this provides insights for managers in developing suitable strategies to gain and sustain competitive advantages. As firms improve in its PIP, it could move up the value chain of a country, and encourage the better economic development of the nation.

Keywords: manufacturing sector, managers, product innovation performance, external knowledge search, absorptive capacity

1.0   INTRODUCTION

After independence in the year 1957, Malaysia reliance on agriculture and commodity sector development, such as rubber, timber, palm oil, and cocoa. Although agriculture and commodity sector promote growth in Malaysia economy, however, the government realised that investment in agro-based activities does not bring higher value for the country economic performance, typically for export earnings and trade profit compare to industrialise products that have greater value added and higher selling profit. Hence, Malaysia transit from an economy dependent on primary commodities to an industrialised economy that focuses in the manufacturing sector.

The first transition step took by Malaysian government was introducing the First Industrial Master Plan (IMP 1) during 1986 to 1995 to encourage the inflow of Foreign Direct Investment (FDI) in accelerating the growth in the manufacturing sector (Asid, 2010). During this period, export growth, the share of manufacturing in GDP growth, and the growth of value-added in manufacturing had reported obtained superior result and Malaysia has become one of the leading economy growths in Southeast Asia (OECD, 2013). Followed with the success of IMP 1, IMP 2 continued to attract FDI and encourage export in the manufacturing sector.

Today, Malaysia no longer serves as the best place for FDI due to the rises of labour wages and competition from the emerging countries, such as China, India, and Vietnam. As a result, export in Malaysian manufacturing sector is declining. Reliance on FDI without creating competing entities through the transfer of foreign skills and knowledge to local industries cause Malaysia loses its competitive advantages following the outward migration of some key products manufacturing. Malaysia is at an economic crossroad at this moment. The country's competitiveness will be threatened if Malaysia continues to depend on its low-cost production strategy.

As an upper middle-income country, rising wages led to the increase of investment cost for foreign investors and caused the outflow of foreign businesses to other lower wages countries. Malaysia Government realises the issue, and hence directed a new direction for the manufacturing sector to shift from low-cost production strategy to quality and performance-based production strategy. However, the transition progress of manufacturing sector to performance-based production has been extremely slow due to low productivity, lack of competitiveness and pervasiveness of low value-added labour-intensive industries based on reports from Economic Planning Unit (EPU, 2015).

Foreign dominated supply chain in Malaysia rarely geared up towards supporting the local technological and business process innovation in the manufacturing sector (OECD, 2013). Malaysia's challenge is to develop home-grown products and improve domestic manufacturing innovation capabilities (The World Bank, 2010). That is to say, manufacturing sector in Malaysia should focus on original brand manufacturing (OBM) and original design manufacturing (ODM) rather than focus on original equipment manufacturing (OEM). Product innovation is the key here for Malaysia manufacturing sector to advance to OBM and ODM by improving the productivity and creating more sophisticated products that can sell under its brand or create their patents.

Product innovation required supportive infrastructure and financial support. However, both supports do not guarantee the success of product innovation or the success of the new product in the market. Product innovation required a more complex combination of resources and firm's strategies rather than merely tangible material supports. This shifts from the paradigm of resource-based on knowledge-based, whereby, the key resource for the firm to involve in product innovation is knowledge, rather than another type of resources (Grant, 1996a).

The knowledge sources can be divided into internal and external sources (Svetina & Prodan, 2008). Traditional closed innovation paradigm which strongly internal focused can be hardly implemented in Malaysia manufacturing sector. In the current volatile environment, firms face the challenge of coping with rapid technological change, higher complexity of the business system, and shorter product life cycles (Md. Zahidul Islam, Doshi, Hanif Mahtab, & Zainal Ariffin Ahmad, 2009). Consequently, reliance on internal innovation or close innovation may increase the time to introduce a new product to the market, as well as causing the firm to miss the right time to enter the market. In addition, reliance on internal innovation could be costly and risky for the firm in introducing a new product to the market, and this may hamper firm to invest in innovation.

In recent years, practitioners and academician gradually agreed that open search for new knowledge could improve firm's product innovation. The interest for open innovation has grown substantively as witnessed by various scholarly research. The firm is committed to search external sources of knowledge as to compensate for the lack of existing market and technology knowledge to overcome the problem of "Not Invented Here" syndrome. This perspective is somehow different from conventional innovation management thoughts that "fear of losing their competitive advantages when they made their internal innovation activities accessible to the external environment" (Herzog, 2011, p. 22).

The knowledge-based view (KBV) suggested that firm engages in external knowledge search lead to the accumulation of knowledge (Eisenhardt & Santos, 2000) and generate more entrepreneurial opportunities that lead to greater firm's product innovation that could generate competitive advantages for the firm (Foss, Lyngsie, & Zahra, 2013). In this regard, it means that the outcome of external knowledge search does not end at new product introduction. Indeed, the purpose of a firm to introduce new products is to achieve competitive advantages. In more details, the new products that are successfully introduced to the market that generates values, regarding financial and non-financial values, for firms are the major concern for both policy-makers and practitioners. Hence, the research on external knowledge search should link directly with the outcomes of the external knowledge search, rather than linking with the ability of the firm to introduce new products (Patel & Van der Have, 2010).

External knowledge search is the systematic scanning of the external environment using mechanisms ranging from formal collaboration with external actors (Chen, Chen, & Vanhaverbeke, 2011), informal network with external actors, conferences, trade fairs, and more (Maskell, Bathelt, & Malmberg, 2006). Typically, external knowledge search for innovation performance literature emphasis in two parts, first, where to search, and second, how to search. The former entails the choice of firm concerning on the practices of search, which is relating to the way of firms' access to external knowledge, whereas, the latter, explore into the practices

used to search, the use of relevant external knowledge and the way to internalise this knowledge in firms for the firms' used for innovation (Martini, Neirotti, & Appio, 2015).

As prior literature found that different search strategies, by focusing on where to search, contribute differently on PIP (Patel & Van der Have, 2010; Wang, 2015), this study takes a step further to open the "black box". That is, not only investigating the effect of different external search strategies on PIP, but also digging in-depth of how the firms benefit from external knowledge search through their internal mechanisms-absorptive capacity, and thus, improve their PIP.

2.0   THEORETICAL BACKGROUND

Knowledge is the key resources for product innovation. Typically, knowledge can be sourced both from internally (through internal R&D generation) or source from external sources (such as collaboration with external actors for innovation, or knowledge spillover from informal linkages with external actors). Internal R & D is recognised as a source of new knowledge creation. However, in a dynamic industrial environment, knowledge in the industry is highly distributed across the firm and the new knowledge is constantly emerging (Barrutia et al., 2014). Consequently, new knowledge often emerges outside the boundary of the firm is thus an imperative for firms to sources the new knowledge from external sources to gain and sustain the competitive advantages.

Based on KBV, knowledge and capabilities are firm's key resources that contribute to firms' PIP. New product development requires knowledge searching and knowledge combination that can be organised in different ways (Kohlbacher, 2008). In this respect, knowledge assets are tradable across the firms and thus firms can acquire useful knowledge sources from its external environment (Grant, 1996b). Firms serve as a semi-permeable membrane that allows the knowledge pass at different rates and to a different degree. Fey and Birkinshaw (2005) argued that in reality, the market for knowledge assets is not perfect. In this sense, the firm is often difficult to realise or identify potential knowledge sources for value creation, as well as free to acquire the knowledge needed from others due to the knowledge protection mechanisms set by some market players. Thus, firm's ability to appropriate value from external knowledge sources required firm's ability to leverage external knowledge and resources through inter-organisational cooperation or external information searching (Kirsimarja & Aino, 2006).

Knowledge is subjected to economic of scale. Therefore, the increase of the use or deployment of knowledge, the greater of the knowledge expand. Indeed, the search for the knowledge should be widely and deeply across a variety of search channels (Laursen & Salter, 2006; Wang, 2015). The knowledge provides the firm with new ideas, information, and knowledge that could help them to gain and exploit innovative opportunities (Foss, Lyngsie, & Zahra, 2013). Although access to the variety of knowledge can expand, use or deploy the knowledge, however, knowledge has quasi-public character (partially non-excludable and non-rivalry), that indicates the knowledge is not freely available for the firm, but necessitates (costly) efforts is required to gain access and make use of it (Buchmann & Pyka, 2015). Implicitly, this argument rooted in the logic of bounded rationality (Simon, 1991). The firm has limited information and knowledge, thus, the excessive external search can be ineffective and even detrimental to firm's innovation

performance (Laursen & Salter, 2006), and because the search can be costly and simply inconclusive in increasing firm's actual knowledge stock (Martini, Neirotti, & Appio, 2015).

The exposed to the same amount of external knowledge does not necessary derive equal benefits to the firms' PIP (Martín-de Castro, 2015). Indeed, the key that differentiates them depends on firm's ability to capitalise and apply the externally acquired knowledge in the innovation process that can produce the desired product performance (Martini et al., 2015). This ability is always associated with firm's absorptive capacity that allows knowledge articulation of newly acquired knowledge, and then translates and shares it with the experiential knowledge in a firm which developed from passing through external search routines (Zollo & Winter, 2002). Absorptive capacity is the key for gaining increased competitive returns from external knowledge, therefore, determining the PIP of a firm.

2.1   External knowledge search strategies, absorptive capacity, and PIP

Product innovation requires a broad knowledge base because the development of new product involves multi-discipline of knowledge (Annique et al., 2010). In this respect, firm's open access to external sources exposes greater opportunities for firms to access to knowledge that is needed in product innovation process (Chesbrough, 2003; West & Bogers, 2014). Collaboration with external partners enables the firm to fill up the knowledge gap and enable them successfully commercialising new knowledge to the market (Chesbrough, 2003; Nieto & Santamaria, 2007).

Collaboration breadth is one of the open search strategies that enables firm sources important knowledge for their product innovation. Collaboration breadth refers to the extent of the firm has a relationship with different types of external partners (Laursen & Salter, 2006). Typically, collaboration with diverse partners enables firm to access to different types of knowledge that are important for innovation to take place (Nieto & Santamaria, 2007). The findings of empirical research in investigating linkages between collaboration breadth and product innovation are mixed. There are some prior research indicated direct positive linkages of collaboration breadth with PIP (Ebersberger & Herstad, 2011; Katila & Ahuja, 2002; Love, Roper & Vahter, 2014; Nieto & Santamaria, 2007), some indicated inverted U relationship with PIP (Chen et al., 2011; Kang & Kang, 2009), and others indicated insignificant relationship with PIP (Ferreras-Mendez et al., 2015).

The possible explanation for this incongruent result is because of the different geographical area will produce different findings. For example, Chen et al. (2011) conducted their research in the context of Taiwanese manufacturing companies from different industries found significant and positive relationship between collaboration breadth and PIP, whereas, Ferreras-Mendez et al. (2015) conducted their research in the context of biotechnology industry in Spanish recorded insignificant relationship between collaboration breadth and PIP.

In Malaysia context, National Survey of Innovation (2010) suggested the need for private companies engaging in external knowledge searching. Intensively, this survey indicated that tapping of the vast wealth of knowledge provide a quick route for firms to achieve greater innovation. In this regard, Chandran, Rasiah & Wad (2014) argued that local firms' interaction with multiple external linkages can lead to accumulation of knowledge and provides greater opportunities for firms in upgrading their technology, production, and innovation. On the other

hand, Ng and Thiruchelvam (2012) indicated that Malaysia's wooden furniture industries are characterised as collective innovation, whereby, the linkages with various actors, such as customers, suppliers, competitors are importance for firms' PIP.

Collaboration with various external partners contributes to firms' PIP. Prior studies indicated that collaboration with external partners exerted positive impact on PIP related to the rate of new product introduction (Laursen & Salter, 2006; Kang & Kang, 2009), novelty of new products (Nieto & Santamaria, 2007; Ebersberger & Herstad, 2011; Bengtsson, Lakemond, Lazzarotti, Manzini, Pellegrini & Tell, 2015; Monteiro et al., 2016), financial performance from new products sales, compatibility of new products (Ferreras-Mendez et al., 2015), speed of new product introduction and relative better market value and quality (Brettel & Cleven, 2011). Hence, in this research, researcher considers the effect of external collaboration breadth on PIP through the following hypothesis:

H1: Collaboration breadth is positively related to PIP.

Collaboration depth refers to the extent to which firm draws intensively from different collaborating partners (Laursen & Salter, 2006). In this regard, deeper relationship between the collaborating partners enable firm to understand more of the knowledge has been acquired (Hsieh & Tidd, 2012), facilitate the transfer of knowledge, and greater access to tacit knowledge, such as partner's experience and skill. There is some prior research found positive linkages between collaboration depth and PIP (Chen et al., 2011; Katila & Ahuja, 2002), while other found inverted U relationship between collaboration depth and PIP (Ferreras-Mendez et al., 2015).

Typically, collaboration depth allows the firm to maintain a stronger relationship with external partners and resulted in a deeper level of trust and communication among partners (Laursen & Salter, 2006; Terjesen & Patel, 2015). Consequently, this will lead to a greater understanding of firm with external sources. In this regard, it allows firms to develop common knowledge with external sources, which support the new product development process in the firms, hence, lead to greater PIP (Zhang et al., 2015). Several prior researchers indicate that collaboration depth has positive impact on the rate of the introduction of new products, sales and speed of new products (Chen et al., 2015), novelty and sales of new products (Monteiro, Mol & Birkinshaw, 2016), and efficiency of new products (Bengtsson et al., 2015).

In Malaysia context, Chin, Abu Bakar Abdul Hamid, Amran Rasli, and Tat (2014) suggested that the SMEs that have a close relationship with suppliers and customers lead to better performance in achieved the stated financial goals, customer satisfaction, and customer responsiveness. Likewise, Chandran et al. (2014) argued that close relationship with industrial associates and skills development organisations play important roles in supporting the manufacturing innovation through contributing to skills formation as well as work closely with the firm in designing the suitable training or course for the employee as to upgrading their skills and knowledge. Therefore, in this research, researcher considers the effect of external collaboration depth on PIP through the following hypothesis:

H2: Collaboration depth is positively related to PIP.

2.2 External knowledge search and firm's absorptive capacity

Studies of external sourcing always link with absorptive capacity in explaining the impact on firm's innovation performance. Indeed, the relationship between absorptive capacity and external knowledge sourcing is twofold. Typically, a firm that engages in external knowledge sourcing contributes in developing firm's absorptive capacity, while, the firm also need the absorptive capacity in absorbing external knowledge or information from its external knowledge sourcing strategy (Clausen, 2013).

Absorptive capacity is a broad concept, which allows for different operationalise meanings (Murovec & Prodan, 2009). For the current study, researcher operationalised absorptive capacity as a set of dynamic capabilities that acquire, assimilate, transform, and exploit external knowledge sources for firm's innovation process. Unlike other research that operationalised absorptive capacity as firm's internal R&D (Bougrain & Haudeville, 2002), defining absorptive capacity in multidimensional context enable researcher to collect more information on firm's internal mechanism in absorbing external knowledge sources (Lewin et al., 2011), and therefore suitable apply for broad context include the non-research intensive firms (Oliver, Garrigos, & Gil-Pechuan, 2011).

Collaboration with diverse partners enables firm to access to different types of knowledge sources. In this respect, Fosfuri and Tribo (2008) argued that greater interaction with different types of external partners lead to the greater absorptive capacity of the firm. Likewise, Enkel and Heil (2014) found that interaction with a diverse partner has widened firm's awareness of new knowledge value. In the same manner, Morovec and Prodan (2009) supported that the broader collaborative network contributes to firm's absorptive capacity. In essence, in this research, researcher considers the effect of collaboration breadth on absorptive capacity through the following hypothesis:

H3: Collaboration breadth is positively related to firm's absorptive capacity.

On the other hand, a firm that develops a deep connection with external partners tends to increase the potential information and tacit knowledge transfer from its focal firms (Vinding, 2006). Likewise, Rowley, Behrens, and Krackhardt (2000) contended that strong relationship between the collaborating partners produce thick information exchange that allows firms to gain better assimilate, transform and exploit the knowledge. Intensively, Murphy et al. (2012) argued that deep connection with external partners bridge the knowledge gaps between the firms. Indeed, this can make firm better in identifying the valuable external knowledge, enhancing firm's understanding of the knowledge, and improving firm's transformation and exploitation on the valuable external knowledge sources. In this respect, Ferreras-Mendez et al. (2015) found a positive relationship between collaboration depth and firm's absorptive capacity. In essence, in this research, researcher considers the effect of collaboration depth on absorptive capacity through the following hypothesis:

H4: Collaboration depth is positively related to firm's absorptive capacity.

2.3   Firm's absorptive capacity and PIP

Following the proposed model by several prominent past researchers, absorptive capacity is linked to innovation performance (Cohen & Levinthal, 1990; Lichtenthaler, 2009; Van Den Bosch et al., 1999; Zahra & George, 2002). In this regard, absorptive capacity has an equally important role for PIP because absorptive capacity allows firms to utilise new knowledge to increase its PIP (Stock et al., 2001), as well as to help guiding the uncertain search for innovations (Fabrizio, 2009).

There is a great deal of research have done on investigating the relationship between absorptive capacity and PIP, however, prior researchers are not consensus in conceptualising the concept of absorptive capacity. In this respect, past research conceptualised absorptive capacity in two respective means, which are, absorptive capacity as external knowledge search and absorptive capacity as firm's ability in acquire, assimilate, transform, and exploit the external knowledge.

For the first conceptualised mean of absorptive capacity, the researcher argued that it is possible to jeopardise the original means of absorptive capacity. In this regard, absorptive capacity is indeed comprised of complex meaning and it is reflecting firm's ability in absorbing external knowledge for firm's innovation process rather than firm's external search strategies whereby search for external knowledge does no necessary internalised the knowledge or exploit the knowledge in new product development (Cohen & Levinthal, 1990; Zahra & George, 2002).

For the second conceptualised mean of absorptive capacity, there are two types of operationalised measurements. First is proxies' type of measurements and the second is the direct measurements. Proxies' type of measurements may have potential to underestimate the absorptive capacity in the firm (Schmidt, 2010). Direct measurements overcome the limitation of proxies because it allows researchers to capture richer structure nature of absorptive capacity.

In general, majority findings from prior research found a positive and significant relationship between absorptive capacity and PIP. However, the application of the concept of absorptive capacity varies across the literature. Indeed, the differences of the operationalised concept of absorptive capacity could lead to a different understanding of the mechanism of firm's access to surrounding technology opportunity and the mechanism of firms in extracting the valuable external knowledge as well as using it in the innovation process.

In this research, researcher attempt to open the black box (inside the firm) regarding firm's internal mechanism in utilising external knowledge sources, thus, defined absorptive capacity as firm's ability to acquire, assimilate, transform and exploit external knowledge sources for product innovation. Moreover, researcher proposed to use direct measures in capturing firm's absorptive capacity. Since, majority findings indicated the positive linkage between absorptive capacity and PIP, researcher considers the effect of absorptive capacity on PIP through the following hypothesis:

H5: Absorptive capacity is positively related to PIP.

2.4   Firm's absorptive capacity as mediator between external knowledge   sourcing and PIP

The presence of valuable external sources of knowledge does not imply that firm are automatically or directly utilise the external knowledge sources in its innovation process. Principally, KBV suggested that knowledge assets can be traded, but it does not indicate that firms can recognise the potential value of the external knowledge as well as utilise it into the production factor (Aranda & Molina-Fernandez, 2002; Grant, 1996b).

KBV suggested that firm is a knowledge processing entity (Almedia, Song, & Grant, 2002). This link with the absorptive capacity concept, whereby, absorptive capacity processed the acquired external knowledge sources and applied this knowledge to the commercial end (Cohen & Levinthal, 1990; Zahra & George, 2002).   In this respect, absorptive capacity is the key to explaining how the firms process the externally acquired knowledge as to enable it to be applying to commercialisation process. In essence, absorptive capacity plays an intermediate role in explaining by what means of the external knowledge sourcing that drives the innovation benefit. For instance, Kostopoulos et al. (2011) argued that absorptive capacity may contribute to firm's innovation performance in two folds, which is first, undertaking the role as a tool for processing new external knowledge that can contribute to innovation performance, and second, as a pathway to transfer the knowledge for cross-organisation activities. Likewise, Moilanen et al. (2014) also argued that without absorptive capacity, external knowledge has no value for the firm's innovation performance.

To date, there is only limited empirical research that has investigated the mediating role of absorptive capacity between the external knowledge sourcing and PIP. Although Kostopoulos et al. (2011) and Moilanen et al. (2014) have conducted the empirical research in investigating the mediating role of absorptive capacity, however, they tends to used proxies rather than direct measure in capture firm's absorptive capacity, and this might encounter potential in underestimating the absorptive capacity of the firms (Schmidt, 2010). In this regard, both of the studies proposed the future research should use qualities measures for capturing different dimensions of absorptive capacity in studying the role of absorptive capacity plays between external knowledge sourcing and PIP.

In this research, due to the limitation of using proxies to measure the absorptive capacity, researcher proposed direct measures that include four dimensions of absorptive capacity in studying the role of absorptive capacity plays between external knowledge sourcing and PIP. There are four types of external knowledge sourcing involved in this research for investigation, this includes, collaboration breadth, collaboration depth, external information search breadth and external information search depth. Researcher attempts to investigate how a firm can benefit (regarding product innovation) from engaging in these four types of external knowledge sourcing through absorptive capacity. Based on the discussion in previous sections, it has indicated that the positive link between these four types of external knowledge sourcing and absorptive capacity, and the positive link between absorptive capacity and PIP. Thus, this leads to the development of following hypotheses:

H6: Absorptive capacity is a mediator between collaboration breadth and PIP,
H7: Absorptive capacity is a mediator between collaboration depth and PIP.

In conclusion, theoretical framework is shown in Appendix 1.

3.0   METHODOLOGY

3.1   Sample and data collection
Prior to mailing the questionnaires to the informants, the pre-test of the questionnaire items was carried out by interviewed two industry experts and one academic expert in order to ensure that the questionnaire items were fully understandable in the context of the industry analyze. These interviews suggest several modifications have to be made as to suit to the local context. Therefore, researchers modify the questionnaire as to make clear the questionnaire items before sending out the questionnaire. Subsequently, second pre-test was conducted using 30 samples selected randomly from the Federation of Malaysian Manufacturers Directory 2015 and these samples will not be included in the actual field study later. Reliability test- Cronbach's Alpha showed that the questionnaire items over 0.70 in this study suggested the survey instruments has internal consistency (Sekaran, 2003).

The current study employed sample survey research method. The unit of analysis for this study is emphasised on Malaysian manufacturing firms whereby the "process of converting raw materials into products" (Kalpakjian & Schmid, 2006, p. 1) is being observed as it involved in product innovation activities. The firms selected for this study were chosen based on the FMM Directory 2015 because the Directory provides a comprehensive information of Malaysia Manufacturers' (typically cover all manufacturing industries in Malaysia). Based on the list, there are total 700 manufacturing firms are selected as the sample of this study which is covered the textile industry, food industry, electrical and electronic component industry, chemicals and chemical products industry, metallic product industry, furniture industry, rubber and plastic products, etc.

The respondents of the questionnaires were the managers who had conducted product innovation projects or involved in product innovation process or the person who were highly knowledgeable regarding the firm's product innovation, this includes, Product or R&D Managers Managing Director, R&D Manager, New Product Development Manager, Product and Design Manager Chief Executive Officer, Marketing Manager, Manufacturing Manager, etc. To improve the valid survey response rate, researchers has called or emailed the firms in the sample list to explained the objectives of the study and invite them to participate in the survey. At the same time, via call or email, researcher confirmed the names and job title of the respondents, and this allows the questionnaire sent using registered postal service to the named respondents instead of the department name to reduce the chances of bureaucracy in mail handling.

The questionnaires were sent out in September 2015 and the collection process ended in December 2015. The process of data collection ran for four months. Out of total 700 questionnaires sent, there are 148 return questionnaires. There is a total of 11 unusable responses with seven questionnaires were returned blank, or answered with less than half of the total questions, and four questionnaires stated that they have less than three years experience in the firm that they have worked. This left with 137 usable responses giving the final percentage of 19.6% response rate over n=700. Based on the return questionnaires, Appendix 2 shows the demographic profile of respondents.

3.2 Definition and measurement of the constructs

The questionnaire comprised four parts. The first part consisted of respondent's background; second part was the measurements of PIP; third part was the measurements of external knowledge search strategies; fourth part was the measurements of absorptive capacity. The definitions and measurements of the study were further elaborate as follows.

- This study has operationalised PIP in four components, which are financial performance, product innovativeness, product performance and product development speed and cost performance. The measurement components for PIP are more comprehensive in this study because based on KBV, the firm innovates to gain greater economic rent and sustainable competitive advantage. In this regard, product innovation is essential for the firm not only of its economic or financial prospect but also include market success, ability to provide valuable and unique product in term of greater functionality value and greater novelty product value for the firm to achieve sustainable competitive advantage. Therefore, the measurement of financial performance consists of the items regarding sales, profit, market growth and sales growth of innovate product in the market, while product development speed and cost performance consist of the items regarding the costs and time to develop innovate product to the market. On the other hand, there are five items constructed to measure innovate product performance regarding its' market and quality performance, and four items were developed to measure the level of product innovativeness at firm and industry level.

- Absorptive capacity is defined as a set of dynamic capabilities, namely, acquisition capabilities, assimilation capabilities, transformation capabilities, and exploitation capabilities (Zahra & George, 2002). Each of the dimensions plays a different role in explaining the absorptive capacity concept, and four of these dimensions are complementary (Camison & Fores, 2010; Flatten et al., 2011; Jimenez-Barrionuevo et al., 2011). Acquisition capability refers to the firm's capability to localise and acquire critical external knowledge for its activity (Exposito-Langa et al., 2011; Gebauer, Worch & Truffer, 2012). Assimilation capability refers to the firm's capability in resolving the inconsistency between newly acquired knowledge and firm's existing knowledge bases through creating a collective understanding throughout firm's members on the newly acquired knowledge as to enable the integration of newly acquired knowledge with firm's existing knowledge base. Transformation capability refer to firm's ability to maintain and reactivate the knowledge (Lichtenthaler, 2009), interpreting and combining the knowledge, and integrates the new knowledge with the existing knowledge base (Camison & Fores, 2010; Flatten et al., 2011; Gebauer et al. 2012; Todorova & Durisin, 2007; Zahra & George, 2002). Finally, exploitation capability refers to the capability of the firm to use and implement the acquired knowledge into commercial applications.

- Collaboration breadth is defined as the relationship of the firm with different types of external partners that are formally bound by the formal agreements. Following previous study, current study measures collaboration links of the firm by looking at whether a firm is involved in formal innovation collaboration links with the eight different external partners, including: (1) suppliers, (2) clients or customers, (3) competitors, (4) consultants, (5) commercial laboratories/R&D enterprises, (6) universities or other higher

education institutes, (7) government research organisations, or (8) private research institutes. There are eight types of external partner are coded in binary scale, which is the answer with zero, if the firm has no collaboration link with that stated external partner, and the answer of one, if the firm has collaboration link with that stated external partner. Collaboration breadth of the firm is measured by summing up the eight dummies. In order to measure the extent of collaboration breadth, it is indicated by Laursen and Salter (2006), when the firm has no collaboration link with the stated partners, the firm gets a score of zero, while the firm gets a value of eight when the firm has collaborated with all stated external partners.

- Collaboration depth is defined as the extent to which the firm draws intensively from a different collaborating partner. In order to measure collaboration depth, respondents are asked to indicate whether the firm has collaboration with the eight different external partners, then, they are asked to rate based on an eight-point Likert scale for each type of collaboration link regarded to its level of importance in contributing to firm's innovation. In this regard, the score with one represent low importance and the score of eight is highly importance. In order to measure the depth of collaboration, the score of the level of importance for each type of collaboration link is calculated. Then, the sum of the score is dividing with the total collaboration links stated by a firm. In other words, collaboration depth is measured with the average of the eight scores represented the depth of collaboration link with the external partners. For the firm that gets an average score of zero, this indicates that the firm has no deep relationship with collaborated partners while the firm that obtained a value of eight indicates that the firm has a deep relationship with collaborated partner.

- Control Variables. This study included two control variables to reduce the possibility of alternative explanations. The first control variable is firm size and second control variable is firm age. Past studies indicated that firm size has an effect on PIP (Wakasugi & Koyata, 1997; Damanpour, 2010). Large firms are expected to have more financial and technical capabilities, economies of scope to absorb the cost and spread the risk of failure than a small firm, thus, large firm is viewed to be more innovative than small firms (Wakasugi & Koyata, 1997; Damanpour, 2010). In this study context, controlling firm size is particularly important, because the firms' size may affect not only PIP but also the level of absorptive capacity (Fabrizio, 2009; Moilanen et al., 2014). The firm size is measured by using logarithm on the number of employees of a firm because it is more stable across time and less sensible to macroeconomic shocks (Tsai et al., 2012). On the other hand, firm age needs to be controlled because younger firms tend to be more flexible, whereas older firms may develop a more rigid bureaucratic structure and encounter the competency trap, hence affected PIP (Gopalakrishnan & Bierly, 2006). Moreover, studies have suggested that a firm's age can affect the extent to which a firm is receptive to new ideas and thus, may affect firm's absorptive capacity (Hurley & Hult, 1998). Firm age was measured by the number of years since foundation in logs (Sok & Cass, 2015).

4.0 DATA ANALYSIS AND RESEARCH FINDINGS

This study employed Smart PLS 3 to verify the research framework and hypotheses. There are four antecedents of the research framework, namely collaboration breadth, collaboration depth, external information search breadth, external information search depth, and the consequent is PIP, while, absorptive capacity is the mediator for this study. The analysis consists two parts, that is, structural model-inner model and measurement models- outer models.

4.1 Evaluation of measurement variables

All the measurement variables in this study used reflective measurement model, except the independent variables (collaboration depth, collaboration breadth, information search depth, information search breadth). Collaboration breadth and information search breadth are measured by the sum of the knowledge sources used, whereas collaboration depth and information depth are measured by averaging the sum of the level of importance for each knowledge sources used (Likert scale 1-8). All these variables produced a single metric scale. Hence, these variables are not the reflective or formative type of construct. Indeed, the used of single metric scale for all the independent variables are relevant, since, the measurement of all the independent variables are adapted from past research. In practice, "the single metric measurement scale can be used when an attribute is judged to be concrete" (Rossiter, 2002, p. 313).

Since the measurement model in this study is reflective in nature, it should assess using internal consistency reliability, convergent validity (factor loading, Cronbach's Alpha, composite reliability, average variance extracted) and discriminant validity (Fornell-Larcker criterion). As depicted in Appendix 3, all the outer loadings of the constructs are significant at the level of .001, and the value is above the suggested threshold value of .708. This indicated that the items used to represent the latent variable had satisfactory internal consistency reliability. Moreover, the value of composite reliability for each latent variables range from .874 to .971, and Cronbach's Alpha exceed 0.70 also indicates that the variables have satisfactory internal consistency reliability. Other than the assessment of the outer loading, average variance extracted value is the common method used to assess the convergent validity by measure the degree to which a latent variable explains the variance of the indicators (Zait & Bertea, 2011). The AVE display values ranging from .695 to .892, which exceeded the recommended threshold value .500. This indicates that the measurement model of this study demonstrated adequate convergent validity (refer Appendix 3).

To assess discriminant validity, Fornell-Larcker criterion and cross-loading criterion were used to assess the discriminant validity. The Appendix 4 shows the value of square roots of AVE (diagonal values) exceeded the intercorrelation value (off-diagonal values) between the variables, while, Appendix 5 shows that in all cases, an indicator' s loadings on its own constructs are higher than all of its cross-loadings with other constructs. These results indicate there is discriminant validity between all constructs.

4.2 Evaluation of structural model

After the measurement model has been confirmed as reliable and valid, the next step is to assess the structural model results. Before interpretation the structural model results, the first step was to assess the collinearity among the variables. Refer to Appendix 6, VIF values for all exogenous

variables shows within the range 1.246 to 1.373, which is below 5.0, and this indicates that the structural model is not affected by collinearity problem.

Subsequently, the examination of the coefficient of determination (R²) of endogenous variables shows that the collaboration breadth, collaboration depth, information breadth and information depth (with two controls firm size and firm age) can explain 20.3% (R²= .203) of the variance in absorptive capacity. The collaboration breadth, collaboration depth, information breadth, information depth and absorptive capacity (with two controls firm size and firm age) explain 51.3% (R²= .513) variance on PIP, which can be considered as moderate follows by Chin (1998). This result suggests the predictive power R² of PIP has adequate predictive power of innovation since the R² value is higher than 0.1, whereby, explain at least 10% of the construct variability derives from the model (Falk & Miller, 1992).

The effect size f^2 is a "measure used to assess the relative predictive relevance of a predictor construct on endogenous constructs" (Hair et al., 2014, p. 201). Indeed, the measure of effect size serves as a practical guide for interpreting the magnitude of a particular relationship, and the effect size f^2 *is* to explain the magnitude of a predictor construct on endogenous constructs (Preacher & Kelley, 2011). The effect size f^2 can be calculated directly from Smart PLS Version 3, and the results are shown below in Appendix 7. According to Cohen's (1988) rule of thumb, absorptive capacity has a medium effect on PIP amounting to 28.1%. On the other hand, collaboration depth has a small effect on absorptive capacity amounting 9.3%. These results suggest that the exogenous variables in the hypothesised model have predictive relevance of endogenous variables.

In addition to evaluation of the magnitude of the coefficient of determination (R²), the predictive relevance of the structural model can be assessed by calculating the Stone-Geisser's Q^2 value (Stone, 1974; Geisser, 1975). The Q² value can be obtained by "using the blindfolding procedure for a ceratin omission distance D.=." (Hair et al., 2014, p. 178). In this study, omission distance used is seven, followed the default setting in Smart PLS 3. In accord with the rule of thumb suggested by them, Q^2 value for absorptive capacity and PIP (greater than zero) indicates that the exogenous variables have predictive relevance on absorptive capacity and PIP (refer Appendix 8). In other words, these results suggest that the structural model in this study has predictive relevance.

4.3   Test of mediation effect

This study used the bootstrapping method to test the mediation effect. Following Preacher and Hayes (2004, 2008), the bootstrap of sampling distribution for indirect effect is suitable to apply for simple and multiple mediator models. Indeed, bootstrapping makes no assumptions on sampling distribution, which indicates that this method is non-parametric based. Therefore, it can be concluded that this approach is perfectly suited to PLS-SEM method. Accordingly, this study applies bootstrapping procedure with 500 subsamples and no sign change, with the confidence interval Method-Bias-Corrected 95% bootstrap confidence interval for testing the indirect effect for Model 2. The confidence interval method-Bias-Corrected is selected because this method provides more accurate Type I error rates and have greater power for detecting indirect effect compare to other stated methods (Preacher & Hayes, 2008).

The structural model result presented that direct effect between collaboration depth shows significant relationship with PIP (β= .362, p<0.001), while, collaboration breadth shows insignificant relationship with PIP (refer to Appendix 9). This support hypothesis H2, while, rejected hypothesis H1. On the other hand, path analysis indicates that collaboration depth has positive and significant relationship with absorptive capacity with the path coefficient of (β= .304, p< .001), and collaboration breadth shows significant relationship with absorptive capacity with the path coefficient (β= .223, p< .001). These support both hypothesis H3 and H4. Absorptive capacity has positive and significant relationship with PIP (β= .415, p< .001), and this support hypothesis H5.

Following Preacher and Hayes (2004, 2008), mediation analysis involved the assessment to indirect effect. Study shows that collaboration depth has significant indirect relationship with PIP (β= .126, t= 3.324, p< .01) (refer Appendix 9). This suggests mediation effect of absorptive capacity exist in relationship between collaboration depth and PIP. As to examine the effect size of mediation effect, we follow hair, $et.$ $al.$ (2014) suggestion by calculating the size of indirect effect relative to the total effect-variance accounted for (VAF) in the model. The VAF value for collaboration depth-absorptive capacity-firm's PIP is .488, which indicates only 25.8% of collaboration depth effect on firm's PIP is explained via the absorptive capacity. Indeed, this result suggests that the exits of partial mediation effect (20% <VAF < 80%) of the role of absorptive capacity in the relationship between collaboration breadth and PIP, hence, provide partial support for H7.

5.0   DISCUSSIONS

The findings of external knowledge search on absorptive capacity indicate that collaboration depth has positively contributed on all four dimensions of absorptive capacity. This result suggested that firms engage in collaboration and draws intensively from different collaborating partners contributing to the increase of firms' absorptive capacity. Absorptive capacity is firms' ability to realised the value from acquired external knowledge (Gebauer et al., 2012), integrate external knowledge to current knowledge bases (Flatten et al., 2011), storing and reactivate the external knowledge when needed (Lichtenthaler, 2009), and apply it in new product development (Flatten et al., 2011). Collaboration depth allows firms to deepen the knowledge of external partners, and this enables the firm to become more easily to understand the pieces of knowledge and information provided by its partners (Cruz-Gonzalez et al., 2015). As a result, this increases the firms' realised value from acquired external knowledge and consequently having the competitive advantage in improving the integration and application of this knowledge in commercial ends.

Moreover, collaboration depth with external partners create a deep connection, and this enhances communication (Patel & Van der Have, 2010) and allows firms to sustain a pattern of interaction with external agents over times (Ferreras-Mendez et.al., 2015). Firms interact with external agents to build up a shared understanding and common ways of working [assimilation] and this allow the transfer of fine-grained knowledge (Carnabuci & Operti, 2013) that will facilitate the transfer and combination of the knowledge [transformation] with the already existing knowledge base (Chen et al., 2011). Recombination of the existing knowledge and firm's knowledge base, lead to better exploitation of knowledge in new product development process (Knudsen, 2007).

Deep connection with external agents overtimes increases trust between firms and external agents (Ferreras-Mendez et al., 2015) by unlocking sticky knowledge, such as skills and processing ability. Moreover, this enhances the transfer of knowledge of external agents to the firms and support acquisition, assimilation, transformation and exploitation of knowledge to create innovation (Datta, 2011). Instead of that, deep connection allows firms to identify and evaluate the arbitrage opportunities, such as differences between firms' existing knowledge and newly acquire sticky knowledge, and hence, leads to alteration of firms' absorptive capacity level in capture these opportunities for future developments (Hughes & Wareham, 2010).

The current study indicated that firms engage in external knowledge search contribute indirectly to PIP. Typically, the result indicated that external knowledge search has a direct relationship with absorptive capacity, but no PIP. There are two reasons to justify the current findings. First, based on the knowledge-based view (KBV), knowledge is characterised as partial public goods. In this notion, knowledge can be transmitting between one with another party, or with multiple parties, but with time and investments and resources devoted to it (Galende, 2006). In fact, knowledge is not a "scale free reproduction property", because the replication of knowledge concerning processes, organisational arrangements that required significant efforts, costs, and degrees of uncertainty about the ultimate success (Dosi & Nelson, 2009). This provides a fundamental explain in why firms engage in external knowledge search practices (collaboration breadth and depth, information search breadth and depth) does not directly lead to improvement of the PIP.

Secondly, acquired knowledge from external search practices offers greater opportunities for firms to gain greater external knowledge and information (Foss, Lyngsie & Zahra, 2013). However, this knowledge and information does not directly generate valuable outcome if firms does not realise its value (filtering and selecting the suitable knowledge), assimilate it (transmit and share information as pre-requisite to integrate the knowledge in firms' existing knowledge base), transform (integrates the new knowledge with the existing knowledge base) and exploit the knowledge for commercialisation. In order to bring a new product to markets, it entails a complex process because the well-codified ex-ante knowledge does not sufficiently establish the detailed properties in the ways of the product production process or artefact to carry out in bringing a new product to the market (Pavitt, 1984).

Absorptive capacity helps to translate the external knowledge and information into a meaningful way for firms, eventually, apply it in new product development process. Typically, there are two reasons for the necessity to translate the external knowledge, before firms can use them in their new product development process (Dosi & Nelson, 2009). First, the efforts at inventing and solving technological problems may be reaching beyond the range of options that are perfectly understood. Ultimately, knowledge acquired from external sources need to be learned, through disseminating and integrating process. Secondly, firms in an industry tend to differ from one another in their product development routines. Hence, the external knowledge needs to integrate into firms' existing knowledge base, and this would result in a new routine for product development process that creates a new product to the market.

In essence, the results of this study suggest the role absorptive capacity play as the intermediate between external knowledge search and PIP. External knowledge search has an indirect effect on PIP rather than direct effect as proposed in past research. In addition, the prior research that found the direct effect of external knowledge search on PIP, although, some of them include absorptive capacity, but they operationalised absorptive capacity mainly based on R&D related factors (Esbersberger & Herstad, 2011; Laursen & Salter, 2006; Nieto & Santamaria, 2007). Indeed, they do not treat absorptive capacity as an internal mechanism to process the externally acquired knowledge from external search practices, hence, does not reveal how firms could turn the external knowledge to the outcome (PIP).

The current study takes into account of capabilities of firms in acquiring, assimilating, transforming and exploiting the external knowledge as to contribute to firms' PIP. In this respect, absorptive capacity is treated as an internal mechanism to process the externally acquired knowledge from external search practices. The approach of this study is also aligned with the prior's conceptualised models of absorptive capacity in innovation context that suggest the mediating role absorptive capacity in between the relationship of external knowledge search and innovation performance (Lewin, Massini & Peeters, 2011; Zahra & George, 2002). Therefore, the study found no direct effect between external knowledge search and PIP.

Past empirical research that investigates the relationship between firms' absorptive capacity and its effect on PIP is varied due to wide and distributed operationalized concept of absorptive capacity and PIP. In this regard, past research has linked different perspectives of absorptive capacity, such as R&D expenditures (Murovec & Prodan, 2009; Stock et al., 2001), employees' education level in their research (Escribano et al., 2009), workers' knowledge, managers' knowledge, communications networks, communication climates (Tavani et al., 2013) with multiple perspectives of PIP, such as number of new products introduced by the firms in the past three years period (Escribano et al., 2009; Fosfuri & Tribo, 2008; Franco et al., 2014; Kostopoulos et al., 2011; Moilanen et al., 2014; Murovec & Prodan, 2009; Sun, Xu, & Wan, 2015), product innovativeness (Kotabe, Jiang, & Murray, 2017) and product quality (Stock et al., 2001). These suggest the heterogeneous explanation on the effect of absorptive capacity on firms' PIP.

The current study provides new insights in linking multidimensional absorptive capacity with multidimensional PIP. Typically, absorptive capacity is reflected as a set of dynamic capabilities, namely, acquisition capabilities, assimilation capabilities, transformation capabilities, and exploitation, whereas, PIP is reflected as financial performance, product performance, product innovativeness and product development speed and costs. The results indicated that firm's absorptive capacity is positively contributing to firm's PIP.

Product innovation required a large amount of knowledge that includes the simple codified knowledge, and complex and highly tacitness knowledge (Kotabe et al., 2017). Absorptive capacity help firm to evaluate, interpret, assimilate, and integrate external knowledge with the internal knowledge base that enables the firm to exploit it in their product innovation process. Indeed, absorptive capacity facilitates organisational learning (Lane & Lubatkin, 1998), and perceived as valuable firms' capabilities that integrate, build, and reconfigure available

knowledge that enables firms to sustain superior performance (Cohen & Levinthal, 1990; Zahra & George, 2002).

In a more comprehensive manner, absorptive capacity adds value to firms' internal knowledge base through the continuous integration of new knowledge from the external environment, apply in the new product development, and this allows the firm to attain greater PIP (Exposito-Langa et al., 2011). Typically, firm that equipped with absorptive capacity able to obtain key information and business opportunities (acquisition), create a shared understanding regarding the new insights (assimilation) as to overcome some of the competency trap, internalised the external knowledge as generate new ideas and opportunities, and applied these transform knowledge to product development and market launch (Sun et al., 2015).

Intensively, firms with better absorptive capacity are effectively access to new knowledge and create an appropriate knowledge base for firms and this facilitates decision-making relevant new product development activities (Tavani et al., 2013). The appropriate knowledge base enables firms to utilise appropriate knowledge and new technology at a right time in NPD projects, and this allows firms to enter into the new market and earn economic rents, such as profit, market share, sales growth (Kotabe et al., 2017). In addition, absorptive capacity is important for firms to keep updating with external environment (Tavani et al., 2013), stipulate useful external knowledge that could provide new insights regarding facts, specifications and technical details that needed in new product development process (Kotabe et al., 2017). With applying proper knowledge, this eventually leads to the better new product quality, reduce its development time and costs (Kostopoulos, Papalexandris, Papachroni & Ioannou, 2011), and with that, the firms would be able to exceed customer's satisfaction by producing good quality at the right time (Tavani et al., 2013).

The current study found that absorptive capacity play as mediating role between the relationship of collaboration depth and PIP. This result suggested that firms that engage in greater external knowledge search and high absorptive capacity is associated with better chances to successfully applied new external knowledge in new product development, and producing greater PIP. In a comprehensive view, external knowledge is not readily applied in developing new products without interpreting and process it, reconfigured the acquired knowledge, store and reactivated it when needed, as well as integrating the knowledge in daily operations as well (Moos, Beimborn, Wagner, & Weitzel, 2013).

The connection between external knowledge search and PIP is not direct, but it goes through an intermediate-absorptive capacity (Anatoliivna, 2013). Absorptive capacity is a cumulative process (Cohen & Levinthal, 1990). Typically, absorptive capacity is evolving over time as the external knowledge search triggers it to continuously refined the acquired knowledge, integrate and apply it when needed (Lewin et al., 2011). As a result, absorptive capacity serves as sources of competitive advantages of firms in elucidating why some firms are performing better than others are-explain PIP.

This study found that absorptive capacity is partially mediate between collaboration depth and PIP. Typically, collaboration could be involving joint decision making or engage in co-marketing, co-production, shared resources or joint development in new product development (Bonte &

Keilbach, 2005). In this regard, a firm that engages in collaboration depth implies that firm builds a deep relationship with its collaboration partners, and this allows firms to take advantage in acquiring proximate knowledge that is related to the specific field that it needed (Patel & Van der Have, 2010). This explains that firms that engage in collaboration depth has more or less contributed directly to the outcome (PIP) and absorptive capacity only mediates partially between the relationship of collaboration depth and PIP. In other words, this means some of the new information sources from collaboration depth require the firm to allocate effort-absorptive capacity to absorb it, while some of the new knowledge are co-developed by the firm and its partners, hence, is directly contribute to PIP.

6.0   IMPLICATIONS AND CONCLUSIONS

The outcome of this empirical research provides fruitful extensions of refining the concept of absorptive capacity in innovation studies. As various empirical research viewed absorptive capacity as facilitator in increase advantages in firm's external search activities (Ebersberger & Herstad, 2011; Escribano et al., 2009; Laursen & Salter, 2006), few have link the external knowledge search as antecedent for absorptive capacity and the outcome of absorptive capacity (Kostopoulos et al., 2011). In this regard, as proposed by Volberda, Foss & Lyles (2010), integration of external search with firm internal ability in absorbing the external knowledge are necessary to explain whether the firm can tap into external knowledge sources. Indeed, firm engages in external search may contribute to enhance firm's absorptive capacity cumulatively over time by accumulating a relevant knowledge base that can be further used to generate new products.

The findings of this study provide empirical support for absorptive capacity model established in past research (Torodova & Durisin, 2007; Zahra & George, 2002), which indicates that absorptive capacity could explain a substantial part of cross-firm heterogeneity in profiting from external knowledge search (Kostopoulos et al., 2011). In this regard, firms engage in external search activity is not directly derived to the outcome, but, it tends to contribute in developing absorptive capacity over time. Eventually, with greater firm's absorptive capacity, the more likely is the firm will be proactive in exploiting opportunities present in the environment, thus contributes to better outcomes.

On the other hand, the findings of this study provide insights for managers to improve PIP. Typically, the results indicate that collaboration depth contribute in explaining variance in firm's PIP through absorptive capacity. This suggests that the collaboration depth contribute in enhance firm's internal learning base (absorptive capacity) that later could translate into better PIP. Thus, it gives implication for managers and suggests that building and maintaining different search practices contributes to firm's interactive learning from external agents and learning from the external environment.

Moreover, absorptive capacity is the key to facilitating a greater learning of firm because the high level of absorptive capacity helps to understand the nature of new knowledge and become a decisive competitive factor (Anatoliivna, 2013). Developing and maintaining AC is critical for firms' long-term success and survival because it reinforces complements and changes the focus of their knowledge base (Zahra & George, 2002). High absorptive capacity is associated with the

better chances to produce success product innovation and showing better performance, and also overcoming the "Not-Invented-Here" syndrome. Indeed, investing in external knowledge search is only a first step for firms for product innovation. Managers should also devote more effort to develop their absorptive capacity as to capture the valuable knowledge from external search and translate this knowledge into tangible and intangible outcome for firms in return. In this regard, absorptive capacity is a source of competitive advantages for the firm, which is valuable, rare, inimitable and non-transferable during their process of catching up with their counterparts.

This study offers some policy implications. First, this study suggests that investment in external knowledge search and develop absorptive capacity is the key that contributes to firms' success product innovation. Absorptive capacity enlarges knowledge base of the firm through cumulatively integration of reconfigure external knowledge and internal knowledge that resulted in them deploying knowledge to create technology and new products (Gebauer et al., 2012). As Malaysia wish to move to high value added manufacturing, it is important for policymakers to acknowledge the role of absorptive capacity in catching up the opportunities for product innovation and improve the greater success of product innovation. As this research found that external knowledge search enhances firm's absorptive capacity, it gives implication for policymakers to promote a better business environment that could facilitate greater firms' external knowledge search.

Intensively, firm building and maintaining different search practices are essential for firms to foster its absorptive capacity and trigger success product innovation. Typically, it is suggested that formulating policies that aim at generating industrial cluster or geographically agglomerated industries encourage firms to maintain a better relationship with its external agents (enable the firm to acquire quality information) could foster greater firm's learning. Moreover, policies also need to target at supporting intermediate institutions (universities, public research centers, local and professional associations), encourage participation in exhibitions and trade fairs, as well as, promoting greater speed of internet accessibility because information from these external sources also play an important role in foster greater learning of local manufacturing firms.

Second, this study suggests four dimensions capabilities base model of absorptive capacity in explaining the way of firm extract valuable knowledge from external knowledge search practices. This suggested that development of absorptive capacity is not a straightforward process as prior research suggested, merely through conducting R&D activities (Murovec & Prodan, 2009), hiring qualified employees (defined as greater education qualification) and training (Mancusi, 2008), but it is embedded in organisational routines, which means that employees should be able to learn and turn the new knowledge into organisational knowledge. This indicates that it is an organisational learning process, through facilitating motivation of employees to acquire and filter the knowledge (acquisition capability), trigger mutual/ collective understanding in firm (assimilation capability), store and maintain, transform and reconfigure the knowledge (transformation capability) and exploit the knowledge in their commercialise end (exploitation).

Consequently, a policy that design to improve absorptive capacity needs to focus on motivating firm's capability to acquire the knowledge, facilitate knowledge sharing in the organisation, trigger cognitive thinking to transform and reconfigure the knowledge, as well as motivate them to apply the new knowledge in commercialisation end. Typically, a policy that designed to

provide an incentive for the firm is essential to trigger firm's motivation to innovate that will lead to the improvement of the firm's absorptive capacity. Indirectly, this will benefit the firm in terms of their future product innovation. Moreover, since absorptive capacity is collectively based on a firm, therefore human capital is still the key to sustain the absorptive capacity of a firm. Thus, a policy that designed to provide a quality education system that matching with industrialised requirement tends to improve firm absorptive capacity.

7.0   LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The present study has some inherent limitations that may also suggest future research lines. First, the model introduced in the study does not allow for the analysis of external search strategies within each search channel, and the way of it that contributes to improving firm's PIP through absorptive capacity. Future research may assess this aspect by developing several fine-grained items for each of the external search channels.

Secondly, the current study found that external knowledge search (collaboration depth, information search breadth and depth) explain only 28.4% variance on firm's absorptive capacity, and therefore, suggested the further explore for possible antecedent for firm's absorptive capacity needed to improve the explanation power on firm's PIP. According to Volberda et al. (2010), intra-organizational factors, such as organisational form, incentives structures, as well as managerial antecedents, such as, individual knowledge development and sharing and managerial cognitions are important factors that also contribute to firm's absorptive capacity. Hence, future studies could include the stated factors as to explain current framework.

Thirdly, it is suggested by some of the prior research about learning of firm from external knowledge search strategies may different under different environment conditions (Laursen & Salter, 2014; Cruz-Gonzalez et al., 2015). In this vein, as to comprehend to knowledge, it is suggested that future research should develop a model incorporate environment conditions as moderator as to explain the linkages of external knowledge search, absorptive capacity and PIP as to explain firms learning process under different environment conditions.

Finally, the data for the current study were gathered at one point in a time and this present as the limitation of this study. Indeed, development absorptive capacity is a path-dependent process, thus, cross-sectional data analysis may not capture the dynamics of firm's learning from external knowledge search activities. Therefore, future research could further apply longitudinal designs as to provide insights in how firm generate competitive advantages from knowledge coming from external sources and how these learning mechanisms affect firm's PIP across the time.

8.0   REFERENCES

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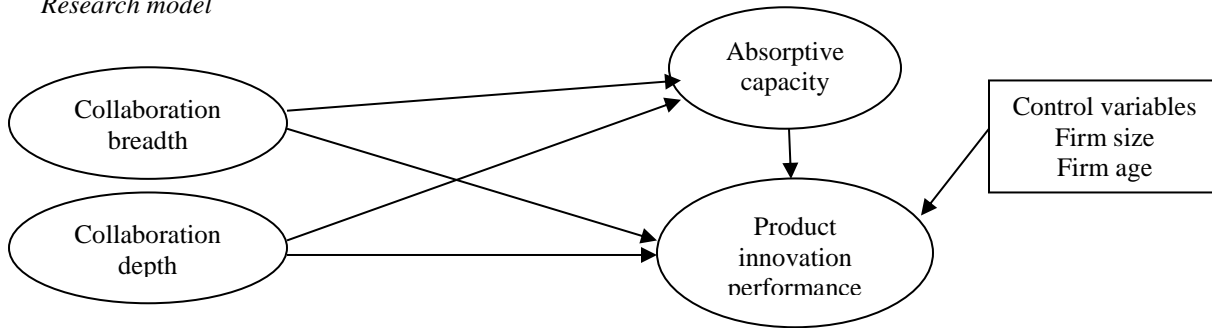
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APPENDIXES

Appendix 1
Research model

Appendix 2
Respondents' profile

Job Position	Frequency	Percentage (%)
Product Manager or R&D Manager	84	61.3
Equivalent To Product Manager or R&D Manager	52	38.0
Missing	1	0.7
Length of Service		
<5 years	15	10.9
>5 to 10 years	29	21.2
>10 to 15 years	27	19.7
>15 to 20 years	25	18.2
>20 to 25 years	20	14.6
>25 years	21	15.3
Firm's Age		
< 10 years	17	12.4
>10 to 20 years	40	29.2
>20 to 30 years	44	32.1
>30 to 40 years	19	13.9
> 40 years	17	12.4
Firm's Size		
< 75 employees	45	32.8
75 - 200 employees	44	32.1
> 200 employees	48	35.1
Types of Industry		
Basic Metal	1	0.7
Chemicals including Petroleum	10	7.3
Electrical and Electronics	20	14.6
Fabricated Metal	8	5.8
Food, Beverage and Tobacco	21	15.3
Machinery	7	5.1
Manufacturing of Furniture	12	8.8
Medical, Precision and Optical Instruments	5	3.6
Non-Metallic Mineral	5	3.6
Paper, Printing, and Publishing	7	5.1
Plastic	9	6.6
Rubber	3	2.2

		3	2.2
Textile, Wearing Apparel and Leather		3	2.2
Transportation		1	0.7
Wood and Wood Products, including Furniture		6	4.4
Others		19	13.9
Total		**137**	**100.0**

Appendix 3

Convergent validity of measurement model

Factor	Factor Loading	Standard Error	t	α	CR	AVE
Absorptive capacity				**0.947**	**0.953**	
Acquisition				0.922	0.942	0.764
da1	0.796***	0.053	14.955			
da2	0.884***	0.030	29.028			
da3	0.925***	0.013	70.878			
da4	0.919***	0.014	65.560			
da5	0.841***	0.028	29.766			
Assimilation				0.916	0.934	0.670
db1	0.701***	0.050	13.957			
db2	0.713***	0.051	13.853			
db3	0.840***	0.025	33.363			
db4	0.894***	0.019	47.241			
db5	0.787***	0.043	18.445			
db6	0.886***	0.020	44.087			
db7	0.885***	0.019	47.075			
Transformation				0.947	0.958	0.793
dc1	0.874***	0.020	43.337			
dc2	0.845***	0.027	31.420			
dc3	0.888***	0.021	41.912			
dc4	0.936***	0.011	82.996			
dc5	0.926***	0.011	83.012			
dc6	0.870***	0.021	40.724			
Exploitation				0.909	0.943	0.846
dd1	0.895***	0.025	35.378			
dd2	0.943***	0.011	88.129			
dd3	0.921***	0.017	52.983			
PIP				**0.914**	**0.923**	
Financial performance				0.959	0.971	0.892
Aa1	0.939***	0.014	68.149			
Aa2	0.926***	0.019	48.172			
Aa3	0.960***	0.007	131.399			
Aa4	0.953***	0.010	94.443			
Product Performance				0.890	0.919	0.695
ab6	0.803***	0.029	27.602			
Ab7	0.803***	0.039	20.542			
Ab11	0.851***	0.031	27.282			
ab12	0.862***	0.028	31.119			
Ab13	0.848***	0.029	29.370			

Product Innovativeness				0.923	0.945	0.813
ab14	0.860***	0.031	27.718			
ab15	0.893***	0.023	39.631			
ab16	0.922***	0.018	50.161			
ab17	0.929***	0.016	57.614			
Product Development Speed and Cost				0.783	0.874	0.697
Ab8	0.838***	0.022	37.433			
ab9	0.835***	0.035	23.938			
Ab10	0.832***	0.038	21.919			
Collaboration breadth	1.000	0.000	0.000		1.000	1.000
Collaboration depth	1.000	0.000	0.000		1.000	1.000
Information search breadth	1.000	0.000	0.000		1.000	1.000
Information search depth	1.000	0.000	0.000		1.000	1.000
Firm Size	1.000	0.000	0.000		1.000	1.000
Firm Age	1.000	0.000	0.000		1.000	1.000

Note: Significant level (*** p<.001), t - t value, CR- Composite Reliability, α-Alpha value, AVE-Average Variance Extracted value

Appendix 4
Discriminant Validity Based on Fornell-Larcker Criterion Assessment

	Ac	As	Tr	Ex	FP	PP	PI	PDCS	CB	CD	Size	Age
Ac	(0.874)											
As	0.524	(0.819)										
Tr	0.448	0.670	(0.890)									
Ex	0.405	0.447	0.567	(0.920)								
FP	0.279	0.388	0.265	0.220	(0.945)							
PP	0.450	0.477	0.490	0.393	0.454	(0.834)						
PI	0.402	0.334	0.312	0.298	0.287	0.502	(0.902)					
PDSC	0.219	0.353	0.342	0.315	0.307	0.575	0.372	(0.835)				
CB	0.432	0.254	0.226	0.288	0.234	0.351	0.334	0.128	1			
CD	0.387	0.387	0.288	0.189	0.352	0.487	0.498	0.323	0.444	1		
Size	0.029	0.085	0.169	0.035	0.227	0.215	0.158	0.190	0.085	0.115	1	
Age	0.001	-0.034	-0.026	0.033	0.049	0.085	0.057	0.196	0.033	-0.023	0.328	1

Note: FP-Financial Performance, PDSC-Product Development Speed and Cost, PP-Product Performance, PI-Product Innovativeness, Ac-Acquisition, Ac-Assimilation, Tr-Transformation, Ex-Exploitation, CB-Collaboration Breadth, CD-Collaboration Depth, Size- Firm Size, Age-Firm Age. Diagonal elements are square root of the AVE; Off-diagonal elements are the correlations among the constructs.

Appendix 5
Discriminant Validity Based on Loadings and Cross-Loadings of Items

	EX	PDCS	AS	TS	AC	FP	PP	PI	CD	CB	AGE	SIZE
dd1	0.895	0.231	0.344	0.441	0.412	0.122	0.348	0.319	0.180	0.328	0.005	-0.067
dd3	0.921	0.246	0.427	0.549	0.358	0.210	0.348	0.250	0.121	0.263	-0.033	0.064
dd2	0.943	0.384	0.457	0.567	0.352	0.264	0.387	0.258	0.221	0.213	0.113	0.087
ab10	0.181	0.832	0.240	0.213	0.185	0.177	0.452	0.275	0.266	0.082	0.199	0.071
ab9	0.290	0.835	0.207	0.174	0.091	0.222	0.406	0.314	0.183	0.010	0.185	0.188
ab8	0.307	0.838	0.410	0.435	0.255	0.349	0.564	0.337	0.344	0.205	0.119	0.205
db2	0.279	0.152	0.713	0.403	0.428	0.184	0.187	0.258	0.200	0.262	-0.001	-0.078
db1	0.452	0.238	0.701	0.457	0.488	0.183	0.319	0.219	0.207	0.171	-0.004	-0.035
db5	0.371	0.297	0.787	0.527	0.372	0.367	0.421	0.332	0.381	0.234	-0.064	0.195
db3	0.295	0.295	0.840	0.559	0.464	0.370	0.367	0.259	0.339	0.176	-0.059	0.020
db6	0.393	0.350	0.886	0.661	0.382	0.336	0.456	0.258	0.339	0.184	0.002	0.166
db7	0.470	0.353	0.885	0.641	0.461	0.355	0.515	0.294	0.345	0.251	-0.028	0.107
db4	0.291	0.303	0.894	0.550	0.420	0.399	0.418	0.297	0.379	0.185	-0.039	0.077
dc2	0.540	0.326	0.587	0.845	0.431	0.235	0.512	0.294	0.291	0.262	-0.026	0.182
dc6	0.442	0.302	0.581	0.870	0.348	0.234	0.407	0.265	0.227	0.155	0.059	0.163
dc1	0.516	0.304	0.622	0.874	0.407	0.179	0.416	0.213	0.225	0.202	-0.087	0.097
dc3	0.452	0.288	0.598	0.888	0.431	0.228	0.399	0.304	0.251	0.217	-0.022	0.152
dc5	0.552	0.269	0.579	0.926	0.356	0.248	0.409	0.277	0.253	0.166	-0.038	0.146
dc4	0.524	0.335	0.610	0.936	0.420	0.290	0.471	0.313	0.286	0.205	-0.021	0.163
da1	0.308	0.157	0.318	0.260	0.796	0.199	0.314	0.304	0.309	0.293	0.031	-0.007
da5	0.420	0.246	0.513	0.468	0.841	0.283	0.440	0.375	0.349	0.419	-0.082	0.069
da2	0.332	0.201	0.379	0.347	0.884	0.229	0.362	0.344	0.307	0.295	0.040	-0.017
da4	0.367	0.189	0.526	0.421	0.919	0.263	0.437	0.337	0.368	0.455	0.027	0.054
da3	0.329	0.158	0.514	0.428	0.925	0.235	0.392	0.387	0.352	0.398	0.004	0.013
aa1	0.195	0.266	0.348	0.245	0.233	0.939	0.362	0.208	0.292	0.215	0.002	0.207
aa2	0.114	0.277	0.315	0.171	0.298	0.926	0.417	0.298	0.334	0.244	0.019	0.222
aa4	0.301	0.339	0.411	0.314	0.267	0.953	0.469	0.291	0.356	0.224	0.062	0.216
aa3	0.213	0.275	0.388	0.265	0.255	0.960	0.461	0.281	0.341	0.200	0.096	0.214
ab6	0.238	0.425	0.387	0.397	0.405	0.442	0.803	0.513	0.452	0.325	0.115	0.255
ab7	0.204	0.365	0.275	0.299	0.319	0.277	0.803	0.421	0.411	0.263	0.076	0.269
ab13	0.410	0.527	0.454	0.443	0.409	0.448	0.848	0.365	0.367	0.244	0.062	0.116
ab12	0.412	0.551	0.423	0.447	0.405	0.316	0.862	0.387	0.375	0.342	0.092	0.107
ab11	0.362	0.520	0.434	0.443	0.331	0.397	0.851	0.405	0.423	0.286	0.010	0.155
ab15	0.291	0.455	0.362	0.352	0.373	0.215	0.473	0.893	0.474	0.343	0.060	0.070
ab14	0.245	0.329	0.254	0.198	0.392	0.304	0.428	0.860	0.445	0.307	0.092	0.132
ab16	0.243	0.237	0.249	0.237	0.364	0.267	0.422	0.922	0.382	0.259	0.007	0.181
ab17	0.291	0.313	0.336	0.331	0.321	0.250	0.484	0.929	0.489	0.294	0.045	0.187
CD	0.189	0.323	0.387	0.288	0.387	0.352	0.487	0.498	1.000	0.444	-0.023	0.115
CB	0.288	0.128	0.254	0.226	0.432	0.234	0.351	0.334	0.444	1.000	0.033	0.085

AGE	0.033	0.196	-0.034	-0.026	0.001	0.049	0.085	0.057	-0.023	0.033	1.000	0.328
SIZE	0.035	0.190	0.085	0.169	0.029	0.227	0.215	0.158	0.115	0.085	0.328	1.000

Note: FP-Financial Performance, PDSC-Product Development Speed and Cost, PP-Product Performance, PI-Product Innovativeness, Ac-Acquisition, As-Assimilation, Tr-Transformation, Ex-Exploitation, CB-Collaboration Breadth, CD-Collaboration Depth, Size- Firm Size, Age-Firm Age

Appendix 6
Collinearity Assessment

Endogenous	Exogenous	VIF
PIP	Absorptive Capacity	1.262
	Collaboration Depth	1.373
	Collaboration Breadth	1.312
Absorptive Capacity	Collaboration Depth	1.246
	Collaboration Breadth	1.246

Note: VIF-Variance Inflation Factor

Appendix 7
Effect Size Result

	f²	Effect
Absorptive capacity -PIP	0.281	Medium
Collaboration depth-Absorptive Capacity	0.093	Small

Appendix 8
The Result of Predictive Relevance Q²

Variables	Q² Redundancy	Effect
Absorptive capacity	0.098	Small
PIP	0.221	Medium

Appendix 9
Summary of Mediation Analysis

	Total Effect	Direct Effect		Indirect Effect					
	a.b+c´	(a/b/c´)	(a·b)	Std. error	t value	p value	Percentile (CI)		
							Lower 2.5%	Upper 97.5%	
Hypothesized Effect									
Collaboration breadth -> PIP		0.045							
Collaboration depth -> PIP		0.362***							
Collaboration breadth -> AC		0.223**							
Collaboration depth -> AC		0.304***							
Collaboration breadth -> AC -> PIP	0.138		0.093	0.037	2.476	0.014	0.026	0.169	
Collaboration depth -> AC -> PIP	0.488		0.126**	0.038	3.324	0.001	0.048	0.191	
AC -> PIP		0.415***							
Size -> PIP		0.143*							
Age -> PIP		0.081							

Note: Significant level (* p< .05), (**p< .01), (*** p< .001)