Open Innovation in Service Sector

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Abstract

Open innovation is a paradigm suggesting that firms should seek external pathways, knowledge and capabilities in their product development process. Several companies have benefited from open innovation giving the concept high attention from the academia and businesses. However, despite service sector's high economic contributions, open innovation in the sector is still under-researched. This study focuses on how service companies implement open innovation for new product development. The study is in terms of the process types, networks, steps, outcomes and barriers involved in the open innovation process. Because open innovation process is affected by the industrial characteristics, only selected industries, which include financial institutions, telecommunications and knowledge-intensive industries, were studied. The study closes the gap in the academic area as well as provides managerial insights for firms in service sector. To answer the research questions, interviews were conducted with service companies in Thailand and responses were analyzed resulting in new findings about open innovation.

Keyword
Innovation, open, service, knowledge

1. Introduction

Open innovation refers to a paradigm suggesting that firms should go beyond their boundaries and that ideas do not have to be originated or further developed only within the firms' boundaries. In other words, companies should open their innovation management by integrating external knowledge or by bringing the ideas developed internally outside. Open innovation involves utilizing the business models that integrate the external and internal knowledge to create value while define the mechanism to capture that value. (Chesbrough, 2003)

Studies on open innovation are mostly done within the context of manufacturing sector. However, no study has been done particularly on how open innovation is practiced in service sector, which in today's industrialized world, exhibits the highest contribution towards the economy. Whilst there are evidences that companies in the sector have practiced open innovation, the implementation process has not been sufficiently studied and documented.(Mention, 2011; Mention & Asikainen, 2012; Patrick Schueffel1, 2015) Therefore, because of the rising significance of service sector, it is worthwhile to investigate how service firms practice open innovation.

This study answers the question: how has open innovation been implemented in service sector –particularly companies in financial institutions, telecommunications and knowledge-intensive industries? The selected industries generated rapid growth in gross domestic product (GDP) shares in the last two decades. (Eichengreen & Gupta, 2013) The question covers five areas of interest including 1) type of processes used, 2) roles and types of partners, 3) steps companies took, 4) short and long-term outcomes and 5) internal and external barriers. This study begins with the literature review and research question. Next is the methodology, followed by interview results. The study ends with the conclusion which includes managerial implications, limitations and future work.

2. Literature Review and Research Question

2.1 Closed Innovation to Open Innovation

Closed innovation surrounds the idea that firms should have control over their own innovation and generate and utilize ideas within the companies. Several factors had led to the decline of closed innovation in the last years of twentieth century. First factor is the increased mobility in skilled individuals who took the knowledge and knowhow of their former employers as they moved to new ones. Second factor is the increase in the number of individuals with higher education allowing in-depth knowledge to move from research centres to small organizations. Third factor is the increase in private venture capital who specialize in creating new firms. Other factors include the more informed customers, more dynamic, fast time to market for many products and services and shorter shelf life of technology. (Chesbrough, 2003)

Some characteristics of industries indicate that the companies in those industries should practice open innovation. The first characteristics is globalization which is driven by ICT and mobility of capital, lower logistics costs. Secondly, the industries have to be technology-intensive as companies in these industries are greatly influenced by new technology and financial support. Moreover, the industries have to support and allow technology fusion or the merging of ideas into new fields and cross-border researches. Another characteristic is the use of new business models and flexibility in changing them. Lastly, knowledge is the focus of the industries and mobility of knowledge is high and encouraged. (Gassmann, 2006)

2.2 Categorization of Service Industries

Eichengreen and Gupta (Eichengreen & Gupta, 2013) grouped service industries based on the changes in their shares of GDP shown in the table below. The first category (Traditional) includes those with fallen GDP while the second category (Hybrid) includes those with slowly risen GDP. The third category (Modern) includes those with rapidly increasing GDP. This category produces tradable services and uses high degree of ICT and skilled labor.(Buera & Kaboski, 2012)

Table 1. Service sector categorization

Category 1: Traditional	Category 2: Hybrid	Category 3: Modern
Public administration, defence	Hotels and restaurants	Financial institutions
Retail trade	Other community and personal services	Telecommunications
Transport and storage	Education	Knowledge-intensive service: computer, legal, technical and advertising services
Wholesale trade	Health and social work	

This categorization in service sector suggests that companies in different industries exhibit distinct characteristics and manage their businesses differently. Moreover, the work by Storey, Cankurtaran et al. suggests that the differences between innovation in various types of services are as great as those between products and services. (Storey, Cankurtaran, Papastathopoulou, & Hultink, 2016) Therefore, it is reasonable that the industries within the service sectors are categorized and studied separately in this study.

2.3 Research Question

As open innovation is a contingent concept, only the modern category of Eichengreen and Gupta (Eichengreen & Gupta, 2013) is focused. The category was selected because of the rapid growth in GDP shares which represents its increasing importance to the economy. This study aims to answer the question: how has open innovation been implemented in service sector – particularly companies in financial intermediation, telecommunications and knowledge-intensive industries? In terms of implementation, this question covers five sub-questions explained below.

1. **What are the process types?**
   This question covers which of the three process archetypes of open innovation is used. The three process types are outside-in, inside-out and coupled processes as categorized by Gassmann & Enkel. (Gassmann & Enkel, 2004) Outside-in process involves bringing ideas from outside into the company to enrich its internal knowledge. Inside-out process is when internal ideas are brought outside the firm to leverage its own knowledge and to benefit from opening ideas to others. Coupled process combines outside-in and inside-out processes to create two-way benefit. (Gassmann & Enkel, 2004)

2. What are the forms of network?
This question covers two aspects of network: 1) who the partner is and 2) the role that the partner play in the open innovation process. The partner is classified into 7 types according to Community Innovation Survey (CIS). These types include customers, suppliers, science-based firms, higher education institutions, competitors, government and other businesses. Customers are those who receive the service. Suppliers are those along the value chain. Competitors are companies in the same industry. Government includes public sectors. Other businesses are those in different industries.

3. What are the steps that companies took?
This question covers the activities that the companies implemented for open innovation process. As King and Lakhani presented in the designing of open innovation strategy, open innovation is not just one strategy but comprises of three components including what to open, how to open and how to solve problems arisen from the openness. (A. King & Lakhani, 2013) Therefore, this question covers these three mentioned components. (Wallin & Krogh, 2010)

4. What are the outcomes?
This question covers both short and long-term outcomes. Short-term outcome refers to the immediate commercial success which is the market response to the new service. Secondly, long-term outcome addresses the strategic competitive advantage which represents how well the open innovation result helps the firms gain competitive advantage and withstand the competitors. (Storey et al., 2016)

5. What are the barriers and challenges?
This question covers the obstacles firms may face when implementing open innovation. As open innovation requires some success factors, lacking these success factors can obstruct open innovation implementation. (Durst & Stahle, 2013) These barriers can be internal and external factors. Internal barriers are those that companies can control while external barriers are those that companies cannot control.

3. Methodology

This study was conducted using qualitative method. Interview provides the perspectives of the interviewees on the research questions and information that does not exist in the literature and therefore, more insights to the topic. Whilst there is no restricted guideline for the sample size of interviews, many researchers have proposed that the sample size should be above 10 and below 50 as too high number of participants can alter the results. (Ritchie, Lewis, & Elam, 2003) (Mason, 2010) Data was collected from interviews with 13 service companies in Thailand. The companies were selected based on the industries they are in. The companies interviewed include 5 financial institutions, 3 telecommunications and 5 knowledge-intensive firms.

The type of interview used is the structured open-response interview. The questions were open-ended and questions within a set were in specific order while the order of the question sets are flexible. (N. King, Cassel, & Symon, 1994) An interviewing process consists of three stages. The first stage is the start of the interview which mainly consisted of general questions, such as company background. The second stage is where the more detailed questions were asked. Thirdly, the interview ended with an opportunity for the interviewee to make comments on topics not covered in the interview. (N. King et al., 1994) The interviews were conducted either face-to-face or via phone call. Notes were taken down during the interview.

4. Results

4.1 Types of Processes

The outside-in process for the three industries are usually practiced for new product development incentive. The outside-in process is implemented to gain additional knowledge and skills as necessary for firms to compete in competitive environment. Additionally, in some occasions, the outside-in process is practiced for marketing and human resource purpose. The inside-out process for the three industries are usually practiced for branding purpose and human resource purpose. However, only the knowledge intensive firms where the inside-out process is practiced for new product development.

The coupled process reported are often through merger and acquisitions. Companies practice coupled process for new product development or to gain competitive advantage. Also, in some circumstances, the outside-in process gradually becomes coupled process. This is because as the knowledge transfer gets more concentrated, it

is impossible for knowledge to be transfer in only one direction. Therefore, it becomes compulsory for companies to involve in both-way knowledge transfer.

From the study, it could be seen that companies in each industry exhibit difference frequency in practice each type of process. This observation is concluded in the figure below.

Industries	Process Types: Outside-in Process	Inside-out Process	Coupled Process
Financial Service Industry	//	/	/
Telecommunications Industry	///	/	/
Knowledge-intensive Industry	/	///	/

Symbol Descriptions
/ = low-observable rate and tendency to practice
// = moderate rate and tendency to practice
/// = high rate and tendency to practice

Figure 1. Process type rate and tendency to practice

The trend observed above can be explained by the characteristics and nature of the firms in the industries. The knowledge-intensive firms generally have more abundant knowledge sources compared to the other two industries. Part of the service of the knowledge-intensive firms is to provide the specialized, technical skills and innovative capabilities for others. Therefore, this characteristic of the industry makes knowledge-intensive industries be the partner that provides knowledge to others. In other words, knowledge-intensive firms have higher rate in and tendency to practice inside-out process compared to the other two industries.

Both telecommunications and financial service industries are industries which intensively use technology. Both industries reported that it is necessary for them to keep on track with the technological advancement in order to compete in the market. As tracing the advancement in technology is not their core service, companies may lack the capability and skills to compete in terms of technology by themselves. They are less innovative in terms of bringing ideas into reality and developing actual product. Therefore, they have higher frequency and tendency to practice outside-in process to acquire external knowledge.

The frequency of the coupled process varies depending on the economic situation and the strategic direction firms want to take. No significant trend among the three industries can be observed. In other words, the tendency in practicing coupled process is not industry-specific and cannot be explained through the nature of the industries.

4.2 Network

4.2.1 Types of Network

The following figure shows the summary of relationship of the network types and the three industries. The rate of occurrence and whether the partnership generates positive outcome towards new product development (NPD) are depicted. NPD was chosen because it relates to the success and novelty of the knowledge transfer.

Industries	Network Types: Customers	Suppliers	Science-based firms	Higher-education institutions	Competitors	Government	Other Businesses
Financial Service Industry	//	///	/	/	///		
Telecommunications Industry	//	///	/	//	///		/
Knowledge-intensive Industry	///		/	/	//		

Symbol Descriptions
Empty = zero occurrence
/= rare occurrence with positive outcome on NPD
//= moderate occurrence with positive outcome on NPD
///=high occurrence with positive outcome on NPD
/= rare occurrence with no outcome on NPD
//= moderate occurrence with no outcome on NPD
///=high occurrence with no outcome on NPD

Figure 2. Network type occurrence

4.2.2 Roles and Contributions

Customers: Customers are the learning tool for companies to learn and gain better understandings of their needs and wants. The ideas created by customers are more relevant and closed to the customers' needs. In both telecommunications and financial service firms, customer involvement is practiced to some degree but resulted in non-positive outcomes. The drawback in this idea creation by customer is that the idea generated may only suit a specific group of customers. Also, the customer may find trouble in translating their ideas and needs into words or with technical terms. For knowledge-intensive companies, the companies participate in the product development and successfully supply the knowledge and skills that their customers are lacking.
Suppliers: Suppliers appear as open innovation partner only in telecommunications and financial service industries. Suppliers act as technology supplier. This is because of two main reasons. Firstly, the relationship between the suppliers and the firms is already established. The established relationship facilitates the activities involved including the knowledge transfer and the employee participation. Secondly, the suppliers already have some understandings of the firms and are familiar with the firms' products. Consequently, the firms also establish some understandings of the knowledge or skills provided by the suppliers.
Science-based Firms: Science-based firms act as a knowledge provider in supplying additional knowledge to the firms' existing knowledge pool. For financial service and knowledge-intensive firms, partnership with science-based firms does not lead to new service development. This contrasts with the rarely-occurred partnership between telecommunications and science-based firms which can lead to creation of new product.
Higher-education Institutions: The partnership with this type of partner is mainly implemented for human resource purposes for all three industries. Higher-education institutions act as the knowledge receiver in the inside-out process. In most occasions, companies do not expect inward knowledge transfer from this kind of partnership. However, only telecommunications companies have partnered with higher-education and resulted in new product development but the partnership does not generate considerable success.
Competitors: Competitors are the knowledge provider for the development process and generally are not idea creator. Competitors have understandings of the corresponding industry and the market firms is serving. The shared understanding facilitates the open innovation process. This popularity of partnership with competitors applies to all three industries especially telecommunications and financial service industries.
Government: No companies report to have partnered with government in open innovation process.
Other Businesses: Among the three industries, only telecommunications that report to have partnered with firms in other industries. These partners are usually start-ups and act as both idea generator and knowledge supplier in the development process. The partnership rarely occurs because of the difficulty in selecting the appropriate partner.

Some findings can be concluded from the study of network. Firstly, the nature of the industry largely influences the rate of occurrence. Knowledge intensive firms rarely practice open innovation apart from the cocreation with customers. This is because of the high degree of confidential information of the industry. Moreover, from the high occurrence and effectiveness of partnership with suppliers and competitors, some prior understandings of the firms, customers and market conditions are crucial for open innovation. Shared characteristics between partnering firms are also required for successful open innovation partnership as indicated by the rare occurrence of partnership with other businesses or firms in other industries.

4.3 Implementation

The implementation process in terms of how to open, what to open and how to solve issues due to openness were concluded from the results of the three service industries. The three industries follow similar patterns on the implementation process as described below.

4.3.1 How to open

The firms realize the needs to practice open innovation by studying the markets. Appropriate partner is selected according to the business requirements. A team, which comprises of representatives from various specialized departments, is formed. The team needs to know how to learn from partners, distribute the knowledge and integrate it into the new products. Hence, firms may need to employ technical tools to handle the knowledge transfer and integration.

The planning stage is the stage that determines the performance of later stages including development and product launch. In the planning process, staffs need to find the balance between short and long-term goals. The goals need be known by all parties involved. The roles of working team and partners need to be clearly assigned. Here, firms decide what to do with the knowledge.

In the development stage, the knowledge is prepared to be transferred. The knowledge preparation process depends on the type of knowledge. The employees need to understand the firm and partner's capabilities and the purpose of the partnership. They are also encouraged to get involved in the knowledge transfer as much as possible as well as make the most of the infrastructure and new technical tools.

Some firms suggest that testing the idea with groups of customers and interacting with them are necessary for the product launch as customers can beware of the products and correctly understand the values that the product provides. For financial service industry, the firms emphasize the interaction and involvement with customers during the development stage.

Implementation stage is where the transfer of knowledge occurs. During the implementation process, firms need to work closely with their partners. Firms need to ensure that they have all the information required by clearly defining the roles of partner and accessibility to the tools involved. Progress is measured through evaluation methods and individuals are rewarded for their success.

In the last stage, firms maintain the relationship by making good use of meetings and documents transfer. The knowledge transferred needs to benefit both parties and complement one another's knowledge pool. The internal staff needs to be able to absorb the results of knowledge transfer by understanding the purpose of the partnership. Throughout the process, the project team needs to keep their goals in mind.

4.3.2 What to open

Companies need to keep three factors open for open innovation implementation. Firstly, the organizational culture needs to encourage the openness. Organizational climate describes the trust, enthusiasm and attitude of employee towards partners and the strategy. The organization needs to consider the new product not only as financial benefit but also as improvement of company performance and competitive advantage.

Secondly, the staff needs to keep their mind open to open innovation strategy and the activities involved along the process. The management needs to be open to new approaches. The manager and staff needs to keep in mind the purpose of open innovation strategies and be willing to share knowledge and cooperate with partnering team. The willingness to learn lowers the possible critics about others' knowledge.

Moreover, the companies need to be open in terms of infrastructure and the accessibility to tools and resources. Partners need to get access to the tools and knowledge sources to some extent in order for them to work with the information or transfer the knowledge effectively. This allows the transparency in the process and progress to be tracked. The accessibility to infrastructure also generates trust and permits members to perform their tasks effectively. The openness in infrastructure ensures the utilization of the knowledge transfer and idea integration.

4.3.3 How to solve issues due to the openness

First is the issue of negative feeling towards partner team which is likely to occur in the early stage. The effectiveness of openness depends on both external and internal communication. Internal information transfer within in the project team increase the readiness of the team to cooperate with partner. The external communication improves the cooperation climate and reduces the negative feeling towards partner team.

Secondly, the knowledge transfer process itself can be problematic. The team may be unwilling to share their knowledge to the partner. This can be solved by having a manager that motivates the team and the team climate that facilitates openness. Moreover, the team member needs to know the value of knowledge transfer and the overall purpose of the cooperation to motivate them to transfer the knowledge.

One of the issues due to the openness is the increase in the risks involved. The companies are more open and they risk in exposing sensitive information to the partner. To mitigate the risk, the role of the partner and team members needs to be clearly defined. Also, some sort of risk-related agreement or risk management scheme needs to be created and agreed among partners. The amount of information flow needs to be defined.

Another problem is the unequipped infrastructure to facilitate the communication and openness. Therefore, the management needs to support the open innovation strategy by investing in infrastructure required to implement the strategy effectively. The infrastructure needs to be ready in a way that allows some degree of accessibility to the partners and that allows transparency in the process.

4.4 Outcomes

4.4.1 Short-term Outcomes

Outcomes of open innovation strategies lead to successful new product development and product launch. Ideas and development of new service improve because of the extensive knowledge integration from various sources. Product better meets the customers' needs due to the wide-ranging input incorporated into the product and more accurate interpretation of customers' needs. The new product has higher innovativeness which is a crucial success factor in these industries. Moreover, the development of the products can be accomplished through a variety of effective and efficient approaches as the development process no longer needs to be within the firms' boundaries. The commercialization process improves through better planning and equipped teams involved to shorten time-to-market. Companies reported to experience increase in sales volume of both existing and new products ultimately improving their performance. Other short-term outcomes include increase in capitalization, internal process improvement and firm market value.

4.4.2 Long-term Outcomes

Long-term outcomes come in terms of competitive advantage. Firstly, firms gain competitive advantage in the resources of knowledge and capabilities. For these high-technological industries, the knowledge and skill are crucial asset for the firms to compete in the market. External partnership allows firms to stay current with the technology and catch up with the markets and changing customers' needs. Through cooperating with partners, firms rapidly gain capabilities that they are lacking and that they cannot build on their own. The increased capabilities widen the service offerings.

Secondly, firms build on competitive advantage in gaining more connections and access to wider customer groups. These relationships facilitate business activities to run more smoothly and encourage knowledge transfer process. Companies gain higher flexibility in conducting their business activities due to the various methods and options available due to the partnership. Building external relationship, firms build connections with not only the partnering firms but also their customers. Firms also gain access to the customers of the partnering firms providing them chance to increase the market share.

Thirdly, firms enhance the performance and assurance in long-term success through building on their brand image. Brand image is built through the improvement in performance and the business activities. More engagement to external parties promote the existence of the firms. Consequently, the success in new product development reflects the skills and capabilities of the firms.

4.5 Barriers

4.5.1 Internal Barriers

Internal barriers are barriers that can be controlled by the firms and are due to the internal factors. There are two groups of internal barriers, human-related and implementation-related barriers. Firstly, internal human-related barrier is unequipped human capital. Firms may lack the managerial skills and experience to handle the change. To cooperate with external partner effectively, firms need to invest in human capital in terms of developing skills and mindset for the cooperation. However, this process tends to be costly and require time to develop. This factor is more severe in knowledge-intensive industry where there is high turnover rate. Investing in human capital may not worth the benefit yield.

Another human-related barrier is the resistance to knowledge transfer. Employees can be reluctant to share knowledge with external partners and accept new knowledge. Employees may have negative feelings towards the partnership. This resistance in knowledge transfer lowers the effectiveness of open innovation strategies.

Another barrier is organizational barrier. Firms fear and are reluctant to have organizational change. Firms are reluctant to change the ways they are doing things for the following reasons. Firms do not want to rely on external partner. Firms have trouble finding the balance between open innovation activities and daily functions. Also, some firms may prefer to seek knowledge or capabilities within corporate group. The notion of change creates stressful environment due to the fear of changes in work norms.

In terms of implementation-related barrier, firms face challenge in the knowledge-transfer process itself. Companies do not know how to transfer knowledge because no written procedure on how to transfer the

knowledge exists. This effect intensifies when knowledge is in uncodified form or tacit knowledge which has to be interpreted into understandable manner. Tacit knowledge is often embedded in people meaning that the knowledge transfer having to immensely rely on people. The knowledge transfer process is less problematic when the knowledge is put into written documents which are easily to be transferred.

Second implementation-related barrier is to choose the partner and idea to use in open innovation process. Because there is no clear written instruction on how to select partner, firms find it difficult to select partner with matching requirements and desirable knowledge. Hence, business requirements need to be carefully written to address the needs and goals of the to-be-acquired knowledge.

The intensity of these barriers mentioned varies from industry to industry. The figure below shows the severity of the barriers in each industry.

Industries	Internal Barriers				
	Human-related Barriers			Implementation-related Barriers	
	Unequipped Human Capital	Resistance to Transfer Knowledge	Fear towards Change	Idea and Partner Selection	Knowledge-transfer Process
Financial Service Industry	O	O	OO	O	O
Telecommunications Industry	o			OO	OO
Knowledge-intensive Industry	OO	OO	O	O	OO

Figure 3.1 Internal barriers

Symbol Descriptions
Empty= zero degree of barrier severity
o= low degree of barrier severity
O = moderate degree of barrier severity
OO = high degree of barrier severity

4.5.2 External Barriers

External barriers are barriers that cannot be controlled and are due to the external environment of the firms. Whilst telecommunications firms reported no external barrier, knowledge-intensive firms and financial institutions faced some uncontrollable obstacles in their open innovation implementation. There are two reported external barriers. First is the size of the firm. Second is the nature of the industry. Similar to the internal barriers, the severity of external barriers varies in each industry as summarized in figure below.

Industries	External Barrier		
	Sizes	Nature of Industry	Symbol Descriptions
Financial Service Industry	o	O	Empty= zero degree of barrier severity o= low degree of barrier severity O = high degree of barrier severity
Telecommunications Industry			
Knowledge-intensive Industry	O	O	

Figure 4. External barrier

Sizes of the firms obstruct them from practicing open innovation. Unlike large companies, small-to-medium ones find it difficult to find an appropriate partner because of the lack of connections. Small firms may lack the capabilities and human resource to handle the partnership. Also, they may find the complications and paper works that come with the strategy are out of their hand and do not worth the effort they have to put in concerning their sizes.

Another barrier is the nature of the industry. For knowledge-intensive industry, the work highly involves confidential information. Practicing open innovation, firms risk in exposure of sensitive information to partnering companies which will negatively affect the firms. The high risk involved and the extra caution needed in the process discourage and make it difficult for knowledge-intensive firms to practice open innovation.

For financial service industry, the nature of the industry involves high degree of bureaucracy and rigidity. These two factors slow down the knowledge transferring process and activities in open innovation implementation. Financial institutions industry is regulated industry where companies' actions need to follow a set of regulations which limit and slow down open innovation process. Also, having to deal with confidential information on a daily basis, financial service firms have high risk in practicing open innovation. Moreover, financial institution industry is sensitive to economic situation. Hostile economic condition can make firms reluctant to practice open innovation.

5. Conclusion

5.1 Conclusion

As open innovation is contingent to different industries, open innovation in service sector cannot be treated similarly to those in other sectors. Therefore, studying on how open innovation has been implemented in service firms can provide insights to the research area and useful managerial implications. The selected industries of the service sector include financial institutions, telecommunications, knowledge-intensive services.

This study provides information about the implementation of open innovation in terms of 1) types of processes, 2) types of networks, 3) steps in implementation, 4) outcomes and 5) barriers. This information can be used as guidelines for firms to analyse and further adopt open innovation.

The first question concerns with the three process archetypes which are outside-in, inside-out and coupled processes. The outside-in process is practiced to fulfill the insufficient knowledge and skill pool to compete in the industry. The inside-out process is done for branding and human resource purposes. Companies practice coupled process with the aim for new product development and gaining competitive advantage. (Gassmann & Enkel, 2004) Also, in some cases, outside-in process gradually turn into coupled process as transferring knowledge one-way does not lead to effective open innovation implementation.

From the study, it was concluded that the likelihood of companies to practice each type of processes depends on the industries. Telecommunications and financial service firms are usually outside-in process practitioners while knowledge intensive firms frequently practice the inside-out process. For the coupled process, the frequency is equally distributed among the industries.

Second question is the network type. Some trend can be observed from the network type selection. For financial service and telecommunications companies, suppliers and competitors are the two most popular and effective network types while partnership with customers are less frequent and only bring about non-positive outcome. On the contrary, for knowledge-intensive firms, customers are the most popular and effective partner type. Also, competitors are the next popular and effective partner for knowledge-intensive firms.

Customers contributed as an idea generator and as learning tool. Customers can create ideas that are most relevant and closed to their needs. (Magnusson, 2003) Suppliers have a role of either technology supplier or market distributor. Competitors are the knowledge supplier during the product development process and are not the source of product ideas. Science-based firms are knowledge provider to firms' knowledge pool which does not usually lead to innovation. Partnering with higher-education institutions is effective for human resource purpose but is not successful for new product development purpose. Other businesses act as idea generator and knowledge provider.

Moreover, it is necessary for partners to have some prior understandings of the firms. The availability of these understandings affects the partner selection and the result of open innovation process. Also, some shared characteristics between partners need to exist for the partnership to work out. This requirement on shared understandings has never been mentioned in any other study.

The third question is implementation process. Firms go through five stages in the implementation process. The first stage is initial stage. This is where the firms realize the needs to practice open innovation, select partner and assign working team. The second stage is planning stage. Here, firms determine the short and long-term goals and decide what to do with the knowledge. The third stage is the development stage which is where the firms prepare the knowledge to be transfer. The fourth stage is the implementation stage which is where the knowledge transfer happens. Last is the final stage. Here, team has to maintain the relationship and the firms need to ensure that the internal staff are prepared to take on the result of open innovation process.

In the open innovation process, there are three things that the companies need to keep open. Firstly, the organizational climate, which impacts the attitude of employees, needs to facilitate the acceptance of partnership and open innovation activities. (Durst & Stahle, 2013) Second is the staff's mindset that needs to be open. Staff need to be willing to learn, share and accept knowledge. Third is the infrastructure. The team and partner have to get access to the tools and knowledge sources in order for them to work with the knowledge effectively. The accessibility to infrastructure also allows the transparency and progress to be tracked.

Four main issues arise during the open innovation implementation. First issue is the negative feelings towards the partner team. This can be solved by utilizing internal and external communication to enhance the collaboration climate. Second issue is the unwillingness to transfer knowledge. (Empson, 2001) (Drew, 1995) This problem can be relieved by assigning a motivating manager to the team and carefully selecting open-minded team members. Another issue is the increase in risks in exposing sensitive information to partner. Therefore, companies need to implement some risk management scheme to control the risks. Fourth issue is the unequipped infrastructure. Firms need to be willing to invest in and prepare the infrastructure.

The fourth question is associated with the outcomes. For short-term outcomes, innovative produce idea and effective development, along with the successful product launch and shorter time-to-market, ultimately bring about commercial success and increase in sales volume. For long-term outcomes, open innovation results in the increase in competitive advantage. Firms gain competitive advantage in terms of the abundant knowledge and capabilities pool. Second competitive advantage is the accessibility to wider customer groups. Moreover, because of open innovation, firms' brand image improves. Through the connections built, firms also gain support in the business activities and assurance for long-term success.

The fifth question is barrier. Barriers are classified into two types, internal and external barriers. Internal barriers are human-related and implementation-related. Human related barriers include unequipped staff, their resistance in knowledge transfer and organizational fear towards change. Implementation-related barriers are the knowledge-transfer process and partner and idea selection process. The knowledge-transfer process is problematic because knowledge can exist in a non-transferrable form.

Two external barriers are sizes and nature of the industry. Small companies have limited human resources and skills to handle additional open innovation strategies. They also lack the connections to seek appropriate external partners. Nature of the industry such as the rigidity and bureaucracy involved slowed down open innovation process and limited the flexibility of the firms. Interestingly, external barriers intensify only in financial service and knowledge-intensive industries.

5.2 Managerial Implications

The true determining factor of successful open innovation strategy is, not the type of process or partner but instead, how well the resulting product meets customers' needs. This indicates that open innovation is a contingency concept and that there is no clear specific guideline on what criteria should be used in determining the open innovation partner or process types. These criteria are to be determined by the companies at their corresponding specific situation. However, some findings from the study can provide ideas for managers to consider in forming open innovation strategies.

For process selection, the industry affects the likelihood of adopting open innovation process. Financial institutions and telecommunications companies often practice outside-in process because their industries use high degree of knowledge and technology but might be low on researching or gathering new knowledge on their own compared to knowledge-intensive firms. On the other hand, knowledge-intensive firms usually practice inside-out process because they are knowledge and capability provider in profession and have high researching capabilities compared to the other two industries.

For partner selection, it is likely that open innovation partner is the one that has some understandings of the industry and the firms such as firm's customers and products. Established relationship prior the implementation facilitates open innovation activities. Financial institutions and telecommunications firms often benefit from partnering with suppliers and competitors. Knowledge-intensive firms often partner with customers effectively.

The corresponding industry of the firms affects their open innovation strategies. Hence, managers need to consider the impact of their corresponding industries and industrial barriers. Despite these findings about process and partner selection, managers are encouraged to be innovative, willing to invest and openminded in open innovation strategy formation to differentiate themselves from competitors.

Moreover, from the study, some factors that influences the effectiveness of open innovation strategy were determined and managers are recommended to follow during the preparation, measures formulation and implementation of the strategy.

In preparation for open innovation, managers need to ensure that the following requirements are met. Firstly, the organizational culture is open and facilitates acceptance of partnership and supports creativity and positive changes. Secondly, the staff needs to be openminded to new knowledge, change and knowledge sharing. Thirdly, the infrastructure is ready to take on knowledge integration and other results of open innovation process. The infrastructure is kept open to the extent that the internal staff is able to make the most use of and the external team can integrate or share knowledge effectively and efficiently.

To determine measures for open innovation and project goals, managers should expect the following results from open innovation. For short-term measures, open innovation product is more relevant to customers' needs as shown through the increase in sales volume. The development of the product is faster and efficient and results in shorter time-to-market. For longer-term measures, managers can observe performance of the firm in long-run as supported by enhanced brand image, wider connections and competitive advantage due to up-to-date and abundant capability pool.

In terms of implementation, managers need to hold certain characteristics. Firstly, managers need to be up-to-date with the technological advancement and consistently monitor the changing customers' needs. This is crucial for managers to prepare their resources, including the staff, in time and to notice the possible way for the firms to benefit from open innovation cooperation.

Secondly, the managers need to understand the importance and impact of the customers' needs. In the implementation, some criteria and business requirements need to be created according to the corresponding situation. This step is significant to the success of the strategy and depends on how well the managers can interpret the market situations and the needs of the company. Managers are encouraged to be innovative and openminded to the use of both internal and external resources to gather information about customers' needs as much as possible in setting up these criteria.

Thirdly, managers need to ensure that teams value the open innovation process and develop clear understanding. Both the staff and partnering team need to fully understand the project goals, their responsibility and the expected contribution to the open innovation projects. Teams have to acknowledge the value-added process of open innovation. The clear understanding of these aspects can be generated by having sufficient communication within and between teams. By doing so, managers can ensure that the negative feelings towards partnering team are reduced and willingness to transfer knowledge is created.

Lastly, managers should try to minimize the barriers. While it is difficult or impossible to control the external barriers, internal barriers can somewhat be controlled and minimized. Companies need to ensure that they have a dynamic environment that supports flexibility. The management style has to support open innovation by encouraging staff to be innovative and have an appropriate mindset. The staff are allowed to make mistake and learn from them. They can present ideas and successful achievers are rewarded. Workshops or activities need to be regularly held to encourage staff to be openminded and have the appropriate skills. However, achieving appropriate company culture and environment is a long-term process which requires time to be met. These processes reduce barriers including the unprepared staff and resistance to knowledge transfer. Additionally, as mentioned, management needs to be up-to-date to technological advancement in order to equip their staff in time.

5.3 Limitations

There are some limitations to this study. Firstly, the interviews were only conducted in Thailand. Therefore, the findings might be characterized by some national factors and might be different for other countries. Secondly, the choice of companies selected might limit the results. Third factor is the interview itself. The interviewees might not answer the interview question completely or the they just gave partial answer.

5.4 Future work

Firstly, because this study is limited to findings from Thailand, a study can be done by conducting interviews with service companies in other countries. Secondly, as part of the internal barriers found are implementation-related barriers which consist of the difficulty in knowledge transfer and idea and partner selection, it is

beneficial to conduct studies in this area. More studies can be created to develop further understanding of how these processes are done for example, how criteria were set in the idea and partner selection and how knowledge is transferred. Moreover, this study focuses on three industries of the service sector which are grouped in the modern category. (Buera & Kaboski, 2012) Similar studies can be done on the other two categories of service sector.

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