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Study on the Impact of Corporate Knowledge Search and Absorption on Product Innovation Performance: A Theoretical Framework Construction

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Abstract: Open innovation theory is expurgated from many outstanding foreign corporates R and D practice. Not only does these corporates be in possession of intensive internal R and D, but also they search external technology sources, fully absorb and utilize them to fill their own lack of R and D. On the basis of the open innovation theoretical research at home and abroad, this study studied the influencing mechanism of corporate knowledge search on production innovation and put forward related theoretical framework.

Key words: Corporate knowledge search, absorptive capacity, product innovation performance, open innovation, status analysis of the open innovation-based knowledge search at abroad

INTRODUCTION

Since Harvard Business School Professor Henry Chesbrough raised the concept of open innovation in his book <Open innovation: The new imperative for creating and profiting from technology>, it has drawn attention from both practical and theoretical circles. Open innovation theory is also expurgated from many outstanding foreign corporates R and D practice. Not only does these corporates be in possession of intensive internal R and D, but also they search external technology sources, fully absorb and utilize them to fill their own lack of R and D. At the same time, through the integration of the internal and external technology, corporates can reduce the uncertainty of technology and thus, avoid going into innovation dilemma. Some global excellent corporates, such as Xerox, IBM, Intel, P and G, Apple and so on, have widely in the world adopted “open innovation” and used “knowledge network” to search and acquire knowledge. For example, Xerox is a closed-end R and D corporate and the PARC it built in Northern California in 1970 brought about many epoch-making innovations, but most of them can't be effectively applied. However, Apple, Microsoft, SUN Microsystem, etc., introduced these PARC results and lead the rapid development of the information industry in the future. In support of the Silicon Valley venture capital fund, the number of the corporates isolated from Xerox upped to 24, of which 10 companies listed, among which are 3 Com,

Adobe and other start-up companies. All these companies benefited from the Xerox technology. In 2001, the total market capitalization of these companies was far more than Xerox, but Xerox failed to spot this trend and continued to invest a lot of R and D resources and ultimately fell into bankruptcy crisis (Huang *et al.*, 2010).

Open innovation recognizes that “not all the world's brightest minds can work for us” and companies need keep global search for knowledge sources. In 2001, Procter and Gamble (P and G) established special “Contact and Development Department”, which is committed to searching solutions for external technology innovation and planned more than half of innovations in the future came from outside the enterprise. Since 2007 the department has collected over 3700 innovative solutions, bringing heterogeneous knowledge for corporate innovation and improving effectiveness of the innovation activities. Another case of open innovation is IBM, which smoothly converted from closed innovation to open innovation mode. Since the company went through a painful year of 1993, with a significant decline in operating results, it came to realize innovation is not only within company wide, but company also should search more innovative knowledge from outside and the creative number-one includes service innovation, business process innovation, business mode innovation, management and culture innovation. In 2005, IBM unboundedly developed 500 software patents to the

outside and helped more stakeholders to create an open innovation platform. These partners' external innovation was equal to promoting innovation value chain that IBM built and worked together to construct a positive business ecosystem. IBM invented "Innovation Jam" and this activity has started inviting internal staff, clients, consultants, family members of staff and other "outsiders" to discuss innovation from the beginning of 2001. Among them, only a big discussion in 2006 attracted 150,000 participants from 104 countries, publishing 46,000 thoughts, combining IBM's most advanced research and technology and their own application to solve real-world problems and emerging business opportunities.

Merger and technology transfer is also a way of knowledge search. Through technology transfer and mergers, enterprises can get available technology from the outside, thereby reduce the risk of independent R and D input. Weapon of Cisco's rapid development is obtaining technology from outside through mergers. From 1996 to 2001, Cisco had merged 69 companies and its operating income increased to \$18.9 billion. When purchasing a large number of technologies, P and G also sold technologies involved in pharmaceutical, food and other business technology to initiatively reduce and control risk. Nowadays, SUN is the leader in the workstation market, the main sources of its creativity are famous university laboratories, such as microprocessor was from Stanford University, the operating system was from UNIX system of California University at Berkeley and graphical interface was from X-Window developed by Massachusetts Institute of Technology. Through the open portfolio innovation strategy, SUN has lower R and D investment than IBM, HP and other companies in the same market, but its market competition advantage is more prominent (Wang *et al.*, 2008).

External R and D cooperation is also an important way of corporate knowledge search, because external R and D network embeddedness provides a potential opportunity for enterprises to search knowledge or information. Most of the corporates which adopt open innovation entrust their basic research to universities and research institutions. In this way, they can get university R and D patents, cooperate with universities and research institutions to develop the key technologies and share the results. For instance, P and G have broad co-op activities with global academic community (Bleekel and Ernst, 2005). Since entering China market, it has developed more than 200 cooperative projects with Tsinghua University and Chinese Academy of Sciences and the co-funding was more than 50 million. Every day, it's about 8,000 people come to work in Philips Research Center in Netherlands. However, the majorities come from universities, research

organizations, suppliers and even competitors and the reason for their joining a Philips team is that they want to contribute their wisdom into a project.

STATUS ANALYSIS OF THE OPEN INNOVATION-BASED KNOWLEDGE SEARCH AT HOME

For a long period of time in the future, enhancing autonomous innovation ability is still an important strategy for China to build an innovation-oriented country. However, independent innovation is not equal to closed innovation and ignoring the already existing technological achievements and acting blindly will be detrimental for our country to rapidly catch up with the developed countries. Due to the lack of core technology and independent intellectual property, China's enterprises still mainly rely on cheap labor, resource consumption, land occupation and preferential policies to obtain competitive advantage. They are still in the low-end position in international affiliation of the business division and can't break through developed countries and their multinational corporations' technological monopoly and blockade. Knowledge search under the condition of open condition is not completely copying the advanced technology of Western companies, but must be combined with original innovation and imitation innovation. We should search for technical support and resources with a variety of means, promote product innovation and technical innovation and improve the competitive position of Chinese enterprises in the international division of labor in the value chain (Jiang, 2008).

Although, internationalization is an important index to measure enterprises external cross-regional knowledge search, the majority of Chinese enterprises are limited to cooperation with foreign enterprises to establish R and D alliances, not really go out of the country to establish overseas R and D branches. The establishment of overseas R and D branches should be aimed at external technical search and monitoring activities and making technical study for the project (Zhu, 2007). There are some problems of Chinese domestic enterprises knowledge search and innovation: (1) Great attention to maintaining the existing technology and market competitive advantage, but little emphasis on exploratory learning. Song (2005) made an investigation and found that most enterprises were "to follow the leading enterprises as order to maintain technological superiority (27.12%)" and "to maintain the lead position as an innovator in the company's existing product areas (22.03%)", the number which selected "to explore new technologies and enter potential emerging markets" only accounted for 17.51%. (2) More emphasis on internal R and D study, but little

attention to external knowledge search and learning. Due to the limitations of the traditional closed-end innovation thinking, Chinese enterprises all agree that the internal R and D department is primarily responsible for new product development. Chinese enterprises' contact with users is limited to the marketing department and the relationship with suppliers is limited to procurement. Simultaneously, owing to the lack of trust, cultural conflict, worry about technology leakage and other reasons, the cooperation between competitive enterprises is almost impossible. The survey of Zhu (2007) indicated that in Chinese enterprise internal technical innovation accounted for 41.24% and external technical innovation mainly relied on cooperation with research institutions (30.51%), with lower participation of other customers and suppliers and being limited to technical knowledge. (3) Emphasis on external technical equipment introduction, increasing enterprise input in absorptive capacity and internal digestion. Most Chinese enterprises' introduction of technology, joint ventures and other activities only aim at increasing production capacity not commit to strengthening digestion and absorption of technology. Their absorptive capacity is limited and cannot fully absorb external advanced equipment and technology. Since the 1990s, Chinese enterprises' proportion of technology introduction and digestion-absorption input has been 1:0.04 to 1:0.09, far below the level of the developed countries, whose proportion is 1:10.

REVELATION OF THE KNOWLEDGE SEARCH PRACTICE AT HOME AND ABROAD TO THIS STUDY

By studying on domestic and foreign corporates knowledge search or open innovation practice, we can find that excellent world-class corporates have attached great importance to the external search of technical knowledge and many domestic corporates have just started to act as this. The phenomenon gives the study some following revelations:

- Firstly, under open innovation background, internal R and D can not only enhance corporate innovation capability, but also improve the ability of absorbing external technology. It is the basic condition for corporates to possess the ability of innovation. Some studies have found that the introduction of technology was not conducive to corporate development, but now the introduction of technology to make up for internal R and D has become the key to business success. Open innovation doesn't mean the introduction of

technology and internal R and D isn't important, but means that corporates need to search and import new ideas, which are complementary with the existing R and D projects and R and D capabilities and make digestion, absorption and re-innovation. Empirical research of Rammer *et al.* (2009) also showed that for small and medium-sized enterprises, even if the enterprises which are lack of in-house R and D capability have imported open innovation model, they still can't absorb external advanced technology, at the same time, though they can get short-term rapid growth, it is still detrimental to their long-term development

- Secondly, in spite that external technical knowledge search is the key content of knowledge search and open innovation, market knowledge are important for technical innovation. The large Fortune 500 companies in the world are concerned about the access to technical knowledge via mergers and acquisitions, technology transfer and external cooperation. However, the concern for external market knowledge being not in place will also makes it difficult to promote the process of commercialization of new products. External market knowledge is a necessary supplement to technical knowledge. Only when corporates fully understand customer needs and competitor dynamics in the market, can they launch suitable and necessary new products to the targeted customers and potential customers more timely

Finally, under open innovation model, corporate knowledge search requires comprehensive utilization of innovative sources coming from a multiplicity. With the increasingly dynamic changes of the external environment, corporates cannot grasp all the knowledge needed for innovation; more knowledge relies on search from other external companies or organizations. The knowledge may be embedded in the suppliers, customers, competitors or cooperative enterprises, investment banks, government departments, universities, research institutions, etc. Only through fully searching external knowledge and integrating external knowledge and building innovation network, can corporates acquire knowledge spillover, overcome technology innovation barriers and reduce the risk of innovation.

PROBLEM RESEARCH AND THEORETICAL DEFAULT

Under the background of open innovation, corporates face fierce market competition and dynamically

changing competition environment. At the same time, corporate internal knowledge base is increasingly being eroded and its marginal value is reduced gradually, therefore, more and more corporates search external knowledge across organizational boundaries. Corporate external knowledge search often can only get useful knowledge fragments and these fragments can't meet corporates' need for complete knowledge on the quantity and quality. Thus, corporates need make use of absorptive capacity to improve the capability of absorbing and transforming external knowledge (Winter, 1984). The existing studies about the relationship between corporate search strategies and methods and innovation performance mainly focus on the probable direct effect of different knowledge (such as technology, market knowledge), knowledge base features and search width and depth, but they haven't answered the question that whether or how knowledge search affects corporate to obtain, absorb, transform and use knowledge. To this point, from corporate external knowledge search and absorption perspective, exploring companies how to achieve organization quick learning and completing product innovation with the help of knowledge search and absorption is of important practical significance for enhancing Chinese corporates innovation capacity, promoting the success of China's manufacturing industry transformation and upgrading and even promoting the change of "made in China" to "created in China".

In the context of open innovation, corporates must make full use of external knowledge resource and use external knowledge resource search to transform external knowledge into internal knowledge base, thereby enhance the efficiency of corporate internal innovation (Laursen and Salter, 2006). The content of external knowledge search involves technical knowledge and market knowledge and the two types of knowledge have an synergistic role in corporate product innovation. The former refers to the knowledge that corporate explores, transforms and develops in the process of cultivating absorptive capacity; the latter refers to opportunity or market information that can help corporates apply and commercialize technical knowledge. These two kinds of knowledge are complementary and the combination of them can improve the correlation between innovation and performance through organization learning (Song *et al.*, 2005; Lane *et al.*, 2006). These search activities aimed at technical knowledge and market knowledge can be divided into exploitative search and exploratory search according to the search strategy. The former indicates that corporates focus on the use of the exiting knowledge to search, acquire, integrate and make full use of all knowledge and it is usually manifested as organization

searching and getting solutions in accordance with established technical track; the latter indicates that corporates pay attention to exploring new external knowledge beyond the original technical knowledge track and it usually shows as extensive use of external knowledge sources. About the effect of knowledge search on innovation performance, scholars found that a wider search activity can broaden the corporate knowledge base and increase the types of knowledge base. And these knowledge can help corporates benefit the number of the new products and provide alternative solutions to problems (March, 1991; Nelson and Winter, 1982). By repeated search and utilization of the same knowledge, we can enable corporates to decrease the errors made in the search process and increase the reliability of the search in a specific search path way (Levinthal and March, 1993). Repeated knowledge search activity will strengthen the corporate understanding of the existing knowledge, improve the ability to recognize the valuable knowledge and promote corporate to take advantage of knowledge restructuring and depth use to improve the enterprise innovation performance (Katila and Ahuja, 2002).

There are some studies indicating that absorptive capacity plays a fundamental role in the process of knowledge search (Jansen *et al.*, 2006). For example, through empirical research on the 83 bio-manufacturing enterprises, Fabrizio (2009) found that absorptive capacity is beneficial to searching new invention and it plays an important role in search time and knowledge quality. Absorptive capacity can be potential absorptive capacity and actual absorptive capacity and only the enterprises with better actual absorptive capacity can gain a competitive advantage through R and D and technological innovation; in contrast, the enterprises with better potential absorptive capacity need effective integration mechanism to converted it to actual absorptive capacity (Zahra and George, 2002). Chen *et al.* (2002) made qualitative analysis of the impact of absorptive capacity on product and service innovation and pointed out that absorptive capacity improvement not only can enable corporates to obtain valuable new external knowledge and increase corporate accumulation of knowledge, but also can make corporates enhance product and service innovation performance by the aid of knowledge sharing. Recent researches demonstrate that corporate knowledge search plays a driving role in corporate product innovation performance through the intermediary mechanism of absorptive capacity (Tsai, 2001; Wang, 2010). However, none of the above studies analyze the relationship between the two sub-dimensions of absorptive capacity and knowledge search and product innovation and the study of

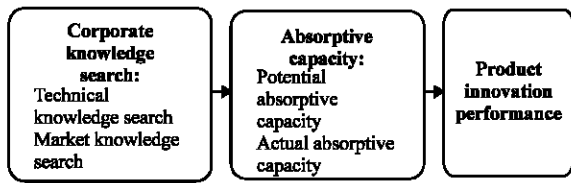


Fig. 1: Study on the impact of corporate knowledge search and absorption on product innovation performance

absorptive capacity and knowledge search is still rare. Although, some scholars preliminarily affirmed the basic role and function of situation of absorptive capacity in knowledge search and innovation performance, some relevant studies have not yet considered the matching problem of external knowledge search activity and corporate absorptive capacity and haven't taken over role of different types of absorptive capacity in innovation search, either.

In summary, this study suggests that, when carrying out a research, we should regard corporate knowledge search and absorption as study content, take open innovation as the point and focus on the core issue of "corporate how to realize product innovation via knowledge search and absorption" and the research need view absorptive capacity as mediating variables and introduce the mechanism of knowledge search on product innovation performance. Meanwhile, we must study whether knowledge search affects corporate innovation performance by acting on absorptive capacity or not and the corporate knowledge should include technical knowledge search and market knowledge search and the absorptive capacity should include potential absorptive capacity and actual absorptive capacity. Based on the above, we can get the subsequent theoretical research framework, which is shown in Fig. 1.

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