

SPECIALIZED KNOWLEDGE SEARCH IN PROCESS OF INNOVATIONS’ MANAGEMENT ADOPTION

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Under the strategic paradigm of open innovations, the function of external knowledge search in innovative enterprises innovation has been concerned. Research mainly discusses the effect on technical innovation from the aspects of local/crossover search or knowledge search. With questionnaire survey, 482 valid copies of questionnaire are collected in this study, and Hierarchical Regression is applied to test the hypotheses. The research findings reveal the remarkably positive effects of supplier-driven search and science-driven search on management innovation adoption, insignificant effects of compete-driven search on management innovation adoption, and moderation effects of knowledge integration capacity on the relationship between supplier-driven search and management innovation adoption. It provides theoretical reference for enterprises to confirm the knowledge search strategies.

Key Words: supplier-driven search, compete-driven search, science-driven search, management innovation adoption, knowledge integration capacity

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Introduction

During 70-80s in the XX century, a lot of US enterprises presented the advantage of notable leading technologies but the dilemma of enterprise transformation or unenhanced product quality still encountered. Japanese enterprises, at the time, rapidly emerged by passing brand-new management practice of Just In Time System and Totally Quality Management to develop new thinking and directions for enterprise innovation (Stata, 1989). Accordingly, a lot of researchers started to pay attention to other types of innovation, such as process innovation, service innovation, and strategy innovation, aiming to further comprehend the innovation management and the contribution to company long-term performance (Lin, Zhang, Li & Wu, 2015).

Management innovations were therefore emphasized. Management innovation is an important path for organizations pursuing excellence and maintaining competitive advantage (Hecker & Ganter, 2013; Wu, Tsai & Tai, 2016). Most past research on innovation practices explained organizational innovation practice from the viewpoint of rational efficiency choice (Amit & Zott, 2012). Organizations precede management innovation as a way to enhance technical efficiency and business performance; contrarily, an organization might reduce management innovation when it can not enhance the efficiency. Strategy researchers indicated that, under uncertain environments, social factors revealed more significant effects on organizational strategic behaviors than rational efficiency factors (Lin et al., 2015). It was difficult to pre-evaluate the results of organizations engaging in management innovation, with priority of social impact. Birkinshaw et al. (2008) considered management innovation as a new management with new practice, process, structure, or technology for the contemporary corporative situation.

The purpose of management innovation is not to directly satisfy consumer demands, but to enhance the operation efficiency of an organization. Besides, management innovation does not show high requirements on differentiation and is not protected by patents that can be easily introduced and imitated by relevant enterprises. It therefore becomes common for enterprises, according to the resources, introducing, adjusting, and practicing existing management innovation practice; it is covered in “adoptive management innovation” (Lin & Su, 2014; Lin et al., 2016). In this case, the function of external knowledge acquisition, an important path for enterprises acquiring management innovation practice plans, becomes critical.

There was research discussing an effect of external knowledge acquisition on management innovation, from the “network” aspect (Mol & Birkinshaw, 2009). The basic logic of such research thinking was that knowledge presented liquidity, could flow among different knowledge agents, and showed public property; besides, the geographical closeness between an enterprise and different knowledge agents could enhance such fluidity (Phelps et al., 2012). Consequently, enterprises embedded in various types of relationship networks or social networks, with advantageous network positions, could reach richer and more diverse

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knowledge and information to promote the innovation. Network research paradigm ignored the effects of knowledge and information offered by external knowledge agents with distinct attributes on enterprises. Besides, effective utilization of external knowledge depended on the knowledge integration capacity of an organization (Singh, 2008). Such research focused on specific management innovation, like the communication of quality control, ISO 9000, and poison pill among organizations (Mol & Birkinshaw, 2014), factors in different innovation management effects on performance (Peeters et al., 2014), and the antecedents and outcome variables of management innovation (Vaccaro et al., 2012; Camisón & Villar-López, 2014). In general, management innovation, compared to technical innovation, still lacked sufficient research. In the systematic literature review, Crossan and Apaydin (2010) revealed that merely 3% research on innovation stressed on management innovation, and there were still large theory blanks in management innovation. In this case, this study intends to discuss the differentiation function of specialized search on management innovation adoption and the moderation effect of knowledge integration capacity in such a process, from the aspect of knowledge source attribute and following the research thinking of Sofka & Grimpe (2010).

Literature Review and Hypothesis

Knowledge and resources, the bases to support the enterprise constant innovation, have rapidly spread in the practice with the concept of open innovation (Chesbrough, 2013). Moreover, the specific effect of knowledge search could be divided into analysis thinking of 1. research concerning the effects of local search (Stuart & Podolny, 1996) and crossover search (Rosenkopf & Nerkar, 2001) on enterprise innovation and 2. research focusing on knowledge search breadth (diversity of search) and depth (intensity of search) (Katila & Ahuja, 2002; Laursen & Salter, 2006). Based on the idea of knowledge source division in past studies (Belderbos et al., 2004; Laursen & Salter, 2006; Sofka & Grimpe, 2010; Xu, Wu & Yu, 2015), specialized search is divided into supplier-driven search, compete-driven search, and science-driven search in this study. Supplier-driven search contains knowledge from suppliers, customers, and distributors; compete-driven search includes knowledge from competitors of the same industry or relevant industries; and, science-driven search covers knowledge from knowledge production or service institutes, such as colleges and universities, scientific research institutes, intermediaries, industry associations, and advisory bodies.

Peng & Luo (2000) pointed out the correlations among enterprises, suppliers, and customers in enterprises acquiring high-quality materials, good services, and timely delivery as well as the promotion of customer loyalty, consumption, and reliable payment. Knowledge exchange with suppliers could help enterprises find out the internal management problems, such as poor information exchange among departments, low production and operation efficiency, and customer dissatisfaction with services. It allows managers searching relevant external innovation knowledge to improve the conditions, such as new coordination

mechanisms, new operation processes, and new services, and to enhance management innovation adoption. In comparison with supplier knowledge, competitor knowledge presents direct reference for enterprises. Because of the high overlapping of knowledge, competitor alliance can better benefit the utilization of information than upstream/downstream alliance (Rindfleisch & Moorman, 2001). Moreover, an enterprise would show stronger motivation to “imitate and exceed” competitors when the competitors present high resource similarity and large overlapping businesses. In addition to innovative products or services, an enterprise would expect to win the dynamic competition with more effective structure, processes, and sounder systems. Such a behavior also enhances management innovation adoption.

Birkinshaw et al. (2008) regarded scholars and consultants as the group mostly interested in new management practice who could prove the legitimacy of plans at the initial stage of management innovation formation and remain it in an enterprise. In the management innovation formation process, they could provide distinct reliable professional knowledge, scientifically guide original thoughts, enhance experiments and exploration in enterprises, and eventually promote the theorization and labeling of plans to develop the functions. For managers, acquiring theoretical knowledge related to management innovation through reading theoretical articles, listening to lectures or reports, and face-to-face dialogue could benefit the comprehension of the roots of internal management problems and the introduction of management innovation practice matched with the situations in an enterprise. Furthermore, when an organization encounters multiple management dilemmas and could not propose effective plans, an enterprise often invite external consulting teams to comprehensively diagnose the problems and propose improvement suggestions and measures for promoting management innovation adoption. Accordingly, the following hypotheses are proposed in this study.

H1: Supplier-driven search presents positive effects on management innovation adoption.

H2: Compete-driven search shows positive effects on management innovation adoption.

H3: Science-driven search reveals positive effects on management innovation adoption.

Whether external knowledge search could effectively enhance enterprise innovation relies on the knowledge integration capacity of an enterprise (Singh, 2008). First, knowledge from different knowledge sources present distinct characteristics. Consequently, merely enterprises with strong knowledge integration capacity could find out knowledge sources suitable for themselves so as to make decisions on innovation adoption. Secondly, external knowledge often appears deficiency, redundancy, or conflict so that enterprises could hardly form management innovation options related to production and operation, organizational structure, and management strategy directly from such knowledge. Therefore, enterprises have to match external knowledge with the existing resources and conditions in order to make decisions on effective management innovation adoption. According above, enterprises with stronger knowledge integration capacity could effectively complete knowledge selection and match to reduce the cost for using external knowledge (Pisano, 1994) and enhance the

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innovation adoption standard. For this reason, the following hypotheses are proposed in this study.

H4: Knowledge integration capacity appears positive moderation effects on the relationship between supplier-driven search and management innovation adoption.

H5: Knowledge integration capacity presents positive moderation effects on the relationship between compete-driven search and management innovation adoption.

H6: Knowledge integration capacity shows positive moderation effects on the relationship between science-driven search and management innovation adoption.

Method

Sample

Applying questionnaire survey to collect data, manufacturing enterprises in Pearl River Delta Economic Zone in China are researched in this study. Senior managers or core technicians in enterprises are distributed the questionnaire, as they reveal more comprehensive understanding of specialized search, management innovation adoption, and knowledge integration capacity of the enterprises to give more accurate question answers. The questionnaires are distributed on-site and through emails to science and technology departments in Guangzhou and Foshan. Total 797 copies of questionnaires are retrieved, including 482 valid copies.

Methodology

The measurement of management innovation adoption is referred to the scale proposed by Vaccaro et al. (2012). 6 questions are established from new practice, process, and structure to reflect the management innovation performance and standard. The Cronbach' α appears 0.805. The measurement of specialized search is referred to the scale proposed by Sofka & Grimpe (2010). The acquisition of knowledge sources is divided into three types, including supplier-driven search, containing 6 questions, shows the Cronbach' α 0.851, compete-driven search, including 3 questions, reveals the Cronbach' α 0.827, and science-driven search, covering 5 questions, presents the Cronbach' α 0.842. Finally, the measurement of knowledge integration capacity is referred to the scale proposed by Zander & Kogut (1995). 4 questions are contained, and the Cronbach' α appears 0.780. All above questions are measured with Likert 7-point scale.

Furthermore, type of industry, enterprise scale, nature of property, age, and position in the industry chain are selected as the control variables in this study to clearly identify the relationship between explanatory variables and explained variables so as to ensure the conclusion not being affected by such factors. Type of industry is classified with dummy variable D1, where D1=1 stands for strategic emerging industry and D1=0 represents conventional industry. Enterprise scale is denoted with dummy variable D2, where D2=1

stands for large enterprises and $D2=0$ represents small and medium enterprises. Nature of property is presented with dummy variables $D3$ and $D4$, where $D3=1$ stands for state-owned enterprises, $D4=1$ represents private enterprises, and enterprises are of other nature of property (e.g. joint venture, institutions) when both $D3$ and $D4$ are 0. Enterprise age is measured from the establishment of an enterprise to the survey period. It is classified into 4 categories of below 5 years, 5-10 years, 10-15 years, and above 15 years. Based on the age, the minimum is 1 and the maximum is 4. Finally, position in the industry chain is denoted with dummy variables $D5$ and $D6$, where $D5=1$ stands for enterprises being in the upstream industry chain, $D6=1$ represents enterprises being in the midstream industry chain, and enterprises are in the downstream industry chain when both $D5$ and $D6$ appear 0.

Result

The correlation coefficients of variables are listed in Tab. 1, where supplier-driven search, compete-driven search, science-driven search, management innovation adoption, and knowledge integration capacity reveal significant paired relationship ($P<0.01$), that it is suitable for regression test. Hierarchical Regression Analysis is utilized in this study for testing the hypotheses. First, type of industry, enterprise scale, nature of property, age, and position in the industry chain are listed as control variables, supplier-driven search, compete-driven search, and science-driven search are regarded as independent variables, and management innovation adoption is considered as the dependent variable for Regression Analysis to test hypotheses H1, H2, and H3. Under control variables, Tab. 2, enterprises with higher supplier-driven search show higher management innovation adoption ($\beta= 0.566$, $P<0.001$) that H1 is supported. The coefficient of the test between compete-driven search and management innovation adoption does not reach the significance ($\beta= 0.054$, $P>0.05$) that H2 is not supported. Enterprises with higher science-driven search present higher management innovation adoption ($\beta= 0.151$, $P<0.001$) that H3 is supported.

In regard to the test of moderation effects, Tab. 2, knowledge integration capacity appears remarkably positive effects on management innovation adoption ($\beta=0.101$, $P<0.05$) and the non-standardized regression coefficient of the interaction “supplier-driven search×knowledge integration capacity” is notable ($\beta=0.064$, $P<0.05$), showing that knowledge integration capacity could positively moderate the relationship between supplier-driven search and management innovation adoption. H4 is therefore supported. The non-standardized regression coefficients of the interaction “compete-driven search×knowledge integration capacity” and “science-driven search×knowledge integration capacity” are not significant, revealing that knowledge integration capacity does not develop the moderation effect on the influence of compete-driven search and science-driven search on management innovation adoption that H5 and H6 are not supported.

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Table 1 - Correlation Coefficient Table
(made by co-authors)

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |
|--|-------|--------|-------|--------|-------|--------|-------|-------|-------|-------|-------|---|
| 1.corporate type(D ₁) | 1 | | | | | | | | | | | |
| 2.corporate scale(D ₂) | .013 | 1 | | | | | | | | | | |
| 3.state-owned enterprise (D ₃) | -.05 | .14** | 1 | | | | | | | | | |
| 4.private enterprise (D ₄) | -.1* | -.29** | -.4** | 1 | | | | | | | | |
| 5.corporate age | -.1* | .43** | .23** | -.27** | 1 | | | | | | | |
| 6.upstream of industrial chain (D ₅) | .1* | .019 | .12** | -.12** | .056 | 1 | | | | | | |
| 7.middle of industrial chain (D ₆) | -.049 | .012 | -.061 | .066 | -.046 | -.82** | 1 | | | | | |
| 8. supplier-driven search | .085 | .16** | .00 | -.018 | .15** | .057 | -.050 | 1 | | | | |
| 9.compete-driven search | .15** | .17** | -.01 | -.062 | .048 | .111* | -.082 | .35** | 1 | | | |
| 10.science-driven search | .15** | .21** | .13** | -.14** | .062 | .103* | -.004 | .35** | .39** | 1 | | |
| 11.knowledge integration capacity | .078 | .18** | -.049 | -.052 | .22** | .044 | -.049 | .46** | .29** | .25** | 1 | |
| 12.management innovation adoption | .15** | .21** | .055 | .12** | .13** | .121** | -.08 | .59** | .32** | .39** | .37** | 1 |

Note. n=482; *P< .05, **P< .01

Discussion

This study aims to:

1. discuss the effect of specialized search on management innovation adoption and
2. test the moderation effect of knowledge integration capacity on the influence of specialized search on management innovation adoption.

Total 482 valid samples are collected with questionnaire survey for the statistical analysis. The results show that suppliers with the strongest correlations and complementarity to the enterprise's business could be easily accepted, comprehended, and adopted by enterprises, no matter innovative knowledge or collaborative knowledge is offered. For this reason, supplier-driven search appears the strongest function on management innovation adoption of an enterprise. Such a conclusion expands the viewpoints of Peng & Luo (2000) and Volberda et al. (2013). That is, cooperating with suppliers and customers to broadly acquire the knowledge could remarkably enhance both technical innovation and management innovation adoption of an enterprise. Particularly, many manufacturing enterprises depend on the cooperation with suppliers for the development and growth. A lot of large enterprises

would support enterprises with technologies and management in order to ensure the provided parts conforming to the quality requirement. For example, Gree Electric Appliances, as the largest professional air-conditioning manufacturer in the world, practice parts standard forward to ensure the air-conditioning product quality. In addition to guide the supporting enterprises to enhance technologies, it has experts stay in the supporting enterprises, regulate the production and operation processes of the supporting enterprises, and insert the culture and management of Gree into the supporting enterprises to enhance the management efficiency and promote the stability and reliability of parts production. Such a method directly promotes the management innovation of the supporting enterprises.

Table 2 - Regression Analysis Results
(made by co-authors)

| Variables | Dependent variables | | |
|--|--------------------------------|-------------------|-------------------|
| | Management innovation adoption | | |
| | Model 1 | Model 2 | Model 3 |
| Constant | 4.271*** | .765** | .341 |
| Control variables | | | |
| corporate type(D ₁) | .292** | .139 ⁺ | .130 ⁺ |
| corporate scale(D ₂) | .366** | .143 ⁺ | .135 |
| state-owned enterprise (D ₃) | -.018 | -.026 | -.009 |
| private enterprise (D ₄) | -.065 | -.115 | -.100 |
| corporate age | .069 | .009 | -.006 |
| upstream of industrial chain (D ₅) | .236 | .112 | .146 |
| middle of industrial chain (D ₆) | .034 | -.008 | .030 |
| Independent variables | | | |
| supplier-driven search | | .566*** | .565*** |
| compete-driven search | | .054 | .040 |
| science-driven search | | .151*** | .139*** |
| Moderator variables | | | |
| knowledge integration capacity(KIC) | | | .101* |
| Interaction terms | | | |
| supplier-driven search×KIC | | | .064* |
| compete-driven search×KIC | | | -.034 |
| science-driven search×KIC | | | .031 |
| Model statistics | | | |
| R ² | .085 | .420 | .434 |
| Adj R ² | .072 | .408 | .417 |
| F values | 6.306*** | 34.120*** | 25.578*** |
| ΔR ² | .085 | .335 | .014 |
| ΔF | 6.306*** | 90.667*** | 2.869* |

Note. n=482; ⁺P< .1, *P< .05, **P< .01, ***P< .001

Scholars, consultants, and experts in knowledge-intensive service institutes, like colleges and universities, scientific research institutes, and advisory bodies, generally offer knowledge based on the experiences, which present the characteristics of professionalism and theorization. Being external experts, the professional analyses reinforce the perceived strictness and the legitimacy of management innovation to cope with such challenge. As a result, management innovation adoption also presents notably positive effects. Such a

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conclusion supports the viewpoints of Mol & Birkinshaw (2009) and Volberda et al. (2013). That is, science-driven search could remarkably affect management innovation of an enterprise while technical innovation enhancing.

Competitors are an important source for enterprises acquiring knowledge; the cooperation with competitors is called “Co-opetition”. Research has revealed the significantly positive effects of Co-opetition on enterprise innovation (Bengtsson & Kock, 2000). Nonetheless, the research results show that compete-driven search does not notably and positively enhance management innovation adoption, possibly because enterprises of the same industry present the competition and cooperation on technologies, while the management shows vivid individual characteristics. For instance, the organizational structure and management systems among Gree, Haier, and Midea, who are famous appliance manufacturers in China, are distinct. Gree presents strictly hierarchical management, Haier promotes decentralized platform structure, and Midea shows division systems. Moreover, the management of enterprises deeply reveals the characteristics of entrepreneurs. The improvement of management is seldom cooperated with competitors, because the acquisition of technical knowledge to promote product and service capabilities is the main objective. It presents that compete-driven search would not affect management innovation adoption of an enterprise.

Regarding the moderation effect of knowledge integration capacity, it merely appears on management innovation adoption in supplier-driven search, possibly because knowledge from suppliers presents the characteristics of diversity, complexity, and non-normative which need to be selected, extracted, and matched for enterprises, and the requirement for knowledge integration capacity is higher. Knowledge from knowledge-intensive service institutes, such as colleges, universities, and scientific research institutes, reveals the characteristics of theorization, normative, and professionalism (Makri & Lane, 2007). It relatively presents problem analysis steps and standardized problem-solving plans and paths for enterprises, which merely need to complete plans and match organizational situations. The requirement for knowledge integration capacity is not so high that the moderation effect is not remarkable.

For management practice, enterprises should pay attention to different knowledge sources for searching relevant knowledge when developing management innovation. Costs are also required for knowledge search. For management innovation, the principle of knowing oneself and the competitors might not be suitable for enterprises. When encountering management problems, focusing on the tight cooperation with suppliers can better ensure the effectiveness of knowledge acquisition than searching for the tactic of competitors. Meanwhile, enterprises should also stress on the promotion of knowledge integration capacity, when developing knowledge search, to integrate and organize scattered knowledge stored in different devices in an enterprise, including original knowledge, internal new knowledge, and external knowledge absorbed, so as to constantly inspire innovation, hasten innovation, and reinforce sustainable competitive advantage.

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