

The Impact of Knowledge Complexity on Subsidiary Innovation: Considering Moderating effects of Subsidiary's Absorptive Capacity and Search Intention

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Abstract

In this paper knowledge transfer between MNCs has been considered. The focus of the study goes to performance implication through the attribute of knowledge which is being transferred. Specifically, the main research question is whether there exists ideal level of knowledge complexity that facilitates internal replication, at the same time, prevents imitation from external competitors. And, this study also attempts to find the role of foreign subsidiary that might moderate the relationship between knowledge complexity and performance.

Key words: knowledge transfer, knowledge complexity, absorptive capacity, search intention

Introduction

There have been several researches on knowledge transfer between multinational corporations(MNCs) and foreign subsidiaries, as well as knowledge transfer among foreign subsidiaries in strategic management area and international business management. From resource-based view or knowledge based perspective which those two areas have laid their theoretical background, every firms constitutes its own knowledge bundle(Barney, 1991; Penrose, 1959), what type of knowledge is being transferred and shared within firm ultimately generates resource heterogeneity and competitive advantage(Dierickx and Cool, 1989; Ahuja and Katila, 2004). Based on these theoretical reasoning, many theorists have attempted to test knowledge transfer and its implication on performance empirically.

Traditional resource based view defines the attributes of a firm which can generate competitive advantage, it should be inimitable, and hard to transfer, and hard to be substituted by other resources (Dierickx and Cool, 1989). Grant(1996) also explained the reason detre of a firm by examining attributes of knowledge, and concluded that the most important resource of a firm is 'knowledge'.

In this manuscript, theoretical background also has been laid on resource based view as well as knowledge based view, and would investigate knowledge transfer between MNCs which possess multiple production facilities in several countries and their foreign subsidiaries. Ultimately, the focus of the study goes to performance implication through the attribute of knowledge which is being transferred. Specifically, the main research question

is whether there exists ideal level of knowledge complexity that facilitates internal replication, at the same time, prevents imitation from external competitors. And, this study also attempts to find the role of foreign subsidiary that might moderate the relationship between knowledge complexity and performance. The possible moderators suggested in this research are absorptive capacity of foreign subsidiary and its search intention.

Literature And Hypotheses

Knowledge Transfer and Performance

Grant(1996) emphasized knowledge as a source of competitive advantage. He described that a firm is a bundle of resources. As in many literatures, knowledge plays central role in the process of innovation(Phene and Almeida, 2008), as input and output. Specially, knowledge assimilation among MNCs and performance implication have been studied by various International Business researchers.

Recent IB researches view MNCs as global but differentiated networks, emphasizing interdependence between subsidiaries and MNC headquarters, as well as among subsidiaries.. Though each subsidiary possesses certain level of autonomy, it is still true that it needs to assimilate, transfer knowledge from headquarter. Ultimately, subsidiary's main task is achieving innovation with utilization of assimilated and transferred knowledge.

In this study, the logic dictates transferred and assimilated knowledge at the foreign subsidiary level has an appropriability on subsidiary-driven innovation.

Knowledge Complexity in International Knowledge Transfer

Szulanski(1996) defined international knowledge transfer as replication of internal practice that has been successfully executed by a certain foreign subsidiary. He also specified the international knowledge transfer process into four stages: imitation, implementation, ramp-up, and integration. In his research, Szulanski(1996) emphasized the stickiness of knowledge that cannot be perfectly transferred. He argued that this knowledge stickiness makes hard internal knowledge transfer, and the source of knowledge stickiness would be knowledge attributes, and the attribute of the recipient, as well as environmental characteristics.

From resource based perspective, knowledge as well as resource should have causal ambiguity so that other competing firms cannot imitate in order to maintain competitive advantage (Barney, 1991). However, if the knowledge complexity or ambiguity is too high, that is to say too much knowledge stickiness, it would be also hard to transfer the knowledge with firms. This would be more difficult for global MNC with multiple foreign subsidiaries which put higher emphasis on knowledge transfer within organizations.

Therefore, MNCs need to solve the dilemma of knowledge complexity, since too simple knowledge could be easily imitated by competitors, while too complex knowledge could be hard to be replicated within organizations.

Zander and Kogut(1995) attempted to solve this knowledge transfer dilemma through an empirical study on innovation of Swedish firms. In this study, they explained within firm replication is receiving information for new innovation. From this reason, a firm attempts to accumulate capability(knowledge) which is idiosyncratic and inimitable. Assessing knowledge complexity, they operationalized knowledge complexity as the types of institutional process. In other research, there has been lack of direct measurement of knowledge complexity. Simon(1962) also didn't mention direct measurement of knowledge complexity in his study. Instead, he operationalized knowledge complexity with a proxy: the parameter of technology functions. From similar logic, Zander and Kogut(1995) measured

the numbers of distinctive skills and competences. They inferred knowledge complexity by assessing multiple competencies.

Regarding the speed of knowledge sharing, the speed of within firm replication is faster than that of imitation from external imitators. Zander and Kogut(1995) inferred the reason because imitators are under competition pressure, and high level knowledge transfer cannot be done by the limited information in markets. In this study, Zander and Kogut(1995) classified knowledge attributes into five categories: codifiability, teachability, complexity, system dependence, and product observability. Based on these knowledge attributes, they suggested linear relationship between knowledge attributes and time to imitate. That is can be said that if a firm possesses knowledge with higher level of codifiability, teachability, complexity, system dependence, and product observability, it takes more time for competitors to imitate that knowledge.

Following the definition of Zander and Kogut(1995), knowledge complexity can be defined as the variation in combining diverse capabilities. In this study, among the five attributes of knowledge, we would like to solely consider one dimension of knowledge attributes: knowledge complexity.

Rivkin(2000; 2001) also contented the inference of Zander and Kogut(1995), so he also set his logic as the internal knowledge transfer is replication. Rivkin(2000; 2001) mainly hypothesized that there would be ideal point of knowledge complexity which maximizes within-firm replication while prevents imitations from competitors.

In his recent study(2001), Rivkin measured knowledge complexity as the number of decision making elements, and the interactions among them. Through the simulation of NK simulation model(N: number of decision making elements, K: number of interactions among elements), he argued that when k is at the moderate level, performance gap between replication and imitation is maximized.

From traditional perspective, this can be explained with the logic of loosely coupled system. Loosely coupled system is able to make balance between the benefit of centralization and decentralization.

However, there could be alternative explanation: the loosely coupled system is not the result of choice, rather than choice, it has been done because it has been exposed different environment. Whatever the logic we select, it is very noteworthy that Rivkin(2001) empirically found actual support for moderate level knowledge complexity could maximize the benefit gap between replication and imitation.

Applying the logic of Rivkin(2001) to MNCs with multiple foreign subsidiaries and their knowledge transfer, we would like to suggest that this moderate knowledge complexity would also maximize the gap between internal replication and external imitation of MNCs.

Therefore, when a MNC attempts to transfer the knowledge of headquarter to one of its foreign subsidiaries, knowledge transfer becomes harder than that of single business firm because of remote location and different level of knowledge assimilation level. Therefore, if a certain practice(knowledge) is being transferred from MNC headquarter to one of foreign subsidiaries, the dilemma of knowledge transfer would be also applied. This logic can be interpreted knowledge with lower complexity is easy to replicate internally, but it is exposed to imitation of competitors. Similarly, knowledge with high complexity would be safe from external imitation, while difficulty of internal replication is also substantial.

Though it has been studied from different point of view, Lee, MacMillan, and Choe(forthcoming) empirically investigated how Korean *Chaebol* groups attempt to make a balance between exploitative learning for performance improvement in the short-run and explorative learning for the long-run. And they also examined how do strategic knowledge management processes affect the performance of their foreign subsidiaries. In that study, their

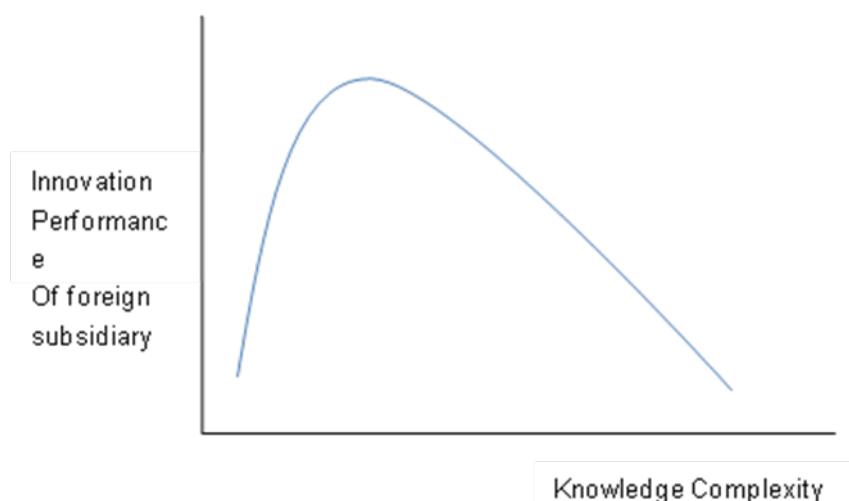
theoretical logic was based on March(1991)'s explorative and exploitative learning. March(1991) defined exploitative learning as the refinement and extension of existing competences, technologies, and paradigms while explorative learning as experimentation with new alternatives. In their empirical study, it has been proved that the degree of knowledge transfer from headquarter to the recipient subsidiary is positively associated with subsidiary performance. For a subsidiary, exploiting current competencies or knowledge can be translated into low level of knowledge complexity. However, if a subsidiary seeks to innovate through explorative learning, it is required to assimilate new knowledge. Therefore, explorative learning can be understood as high level of knowledge complexity. When a subsidiary seeks innovation through both exploration and exploitation, performance could be maximized. If we view this balance between explorative and exploitative learning from knowledge complexity perspective, the moderate knowledge complexity level is still ideal.

Based on above discussion, the relationship between knowledge complexity and foreign subsidiary performance is as follow:

Proposition 1: There will be inverted-U shaped relationship between knowledge complexity and innovation performance of a foreign subsidiary.

Figure 1 illustrates the relationship between knowledge complexity and subsidiary innovation performance.

Figure 1 Knowledge complexity and innovation performance



However, this main relationship could be moderated by the abilities of subsidiaries, as well as their intention. Hence, following section will regard those two possible moderators, and how they moderate knowledge complexity and its implication on performance.

Absorptive Capacity

In their seminal paper, Cohen and Levinthal(1990) defined absorptive capacity as the ability to value, assimilate, and apply new knowledge. Their main logic was if a firm with high level of prior knowledge which can appreciate, assimilate usefulness of new knowledge and higher intensity of effort, a firm could absorb complex and new knowledge.

Later Mowery and Oxley(1995) suggested new definition of absorptive capacity, a broad array of skills, reflecting the need to deal with the tacit components of transferred technology,

as well as the frequent need to modify a foreign-sourced technology for domestic applications(Zahra and George, 2002).

Kim(1998) also specified absorptive capacity by investigating the success of Hyundai Motors. In his work, he defined absorptive capacity requires learning capability and develops problem-solving skills. According to his definition, learning capability is the capacity to assimilate knowledge and problem-solving skills to create new knowledge for innovation. Kim(1998) emphasized prior knowledge base and intensity of effort.

Though the concept of absorptive capacity is logically convincing, and there have been many theorists to define and measure the concrete concept of absorptive capacity clearly. However, the ambiguity and diversity of its definitions, components, antecedents, and outcomes have not been fully resolved(Zahra and George, 2002).

In their recent theoretical paper, Zahra and George(2002) summarized four dimensions of absorptive capacity: acquisition, assimilation, transformation, and exploitation. The components of acquisition are prior investments, prior knowledge, intensity, speed, and direction. And acquisition components are crucial to determine scope of search, perceptual schema, and speed of learning.

Assimilation is understanding or interpretation. Transformation is internalizing and conversing for synergy creation and recodification. The last dimension of absorptive capacity is exploitation, which is for implementing and using core competencies(Zahra and George, 2002).

Minbaeva et al.(2003) have empirically tested knowledge transfer would be influenced by absorptive capacity. They operationalized subsidiary's absorptive capacity as employees' ability and motivation. It is noteworthy that while the main effects of employees' ability and motivation are positive but not statistically significant, the interaction of ability and motivation is positive and significant. This can be interpreted that neither ability nor motivation is not enough for knowledge transfer. However, only when employees' two dimensions of absorptive capacity were satisfied, knowledge transfer can be facilitated.

As a conclusion, even though knowledge that is being transferred is complex, a subsidiary with absorptive capacity would have the ability to moderate this relationship. Therefore, proposition regarding moderating effect of a subsidiary's absorptive capacity is as follow.

Proposition 2: The inverted-U shaped relationship between knowledge complexity and subsidiary innovation performance will become weaker by a subsidiary's absorptive capacity.

Search Intention

In the study of defining resource heterogeneity, Ahuja and Katila(2004) suggested antecedents and outcomes of resource heterogeneity: science search and geography search.

Following their chains of logic, this study also speculates a subsidiary's search intention would moderate the relationship of knowledge complexity and innovation performance implication. Next will regard search intention orderly.

1) Technology search

By executing search in science area, a firm could increase innovation productivity by increasing possible combinations(Ahuja and Katila, 2004). Especially, when current technology base reaches limitations, science search would be helpful to overcome those limitations. Therefore, technology limitation legitimates opportunity for firms to go beyond local technology search, and to search science(Ahuja and Katila, 2004).

Moreover, firms working in well-exploited technological domains are likely to search the science base more intensely in order to have access to a more heterogeneous resource base.

In this manuscript, science search is replaced to general technology search. Technology search encompasses basic science search in larger context. If a foreign subsidiary executes technology search consistently, then it could moderate the impact of knowledge complexity on innovation performance. Therefore, proposition regarding technology search is as follow.

Proposition 3a: The inverted-U shaped relationship between knowledge complexity and subsidiary innovation performance will become weaker by a subsidiary's technology search intensity.

2) Geography search

A foreign subsidiary also can increase innovation productivity by intensified geography search(Ahuja and Katila, 2004). The mechanism is if a subsidiary exposes itself to diverse local experiences, it would be able to access various knowledge areas as well as increase the number of possible combinations. Other than that, a foreign subsidiary also could build regional network faster than market mechanism.

If a foreign subsidiary increases its geography search, it can be said that the subsidiary possesses non-location-bounded firm specific advantages(Rugman and Verberke, 1992).

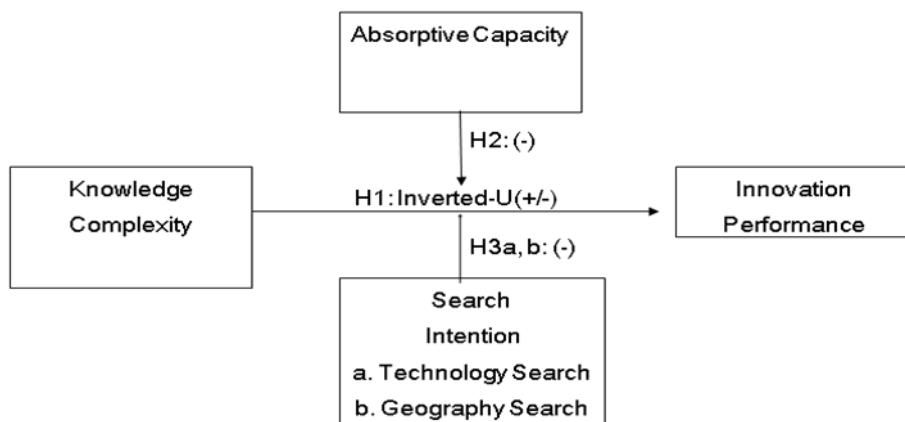
Non-location-bounded firm specific advantage can be exploited globally, and is not necessarily be created within the parent company, but may be also created by a foreign subsidiary.

From above discussion, a proposition can be drawn regarding a foreign subsidiary with high level of geography search in the relationship of knowledge complexity and innovation performance.

Proposition 3b: The inverted-U shaped relationship between knowledge complexity and subsidiary innovation performance will become weaker by a subsidiary's geography search intensity.

Figure 2 illustrates overall propositions and the relationship among them.

Figure 2 Research Model



Conclusion And Future Research

From above discussion, we have investigated the impact of knowledge complexity on subsidiary performance. It is noteworthy that this manuscript has reviewed the knowledge attribute(knowledge complexity) and its impact on knowledge assimilation, and performance. And we also assumed subsidiary's absorptive capacity and search intention could moderate above relationship. A subsidiary with high absorptive capacity would be insulated itself from the impact of knowledge complexity. Form similar logic, a subsidiary with high level of technology search and non-subsidiary specific search would also able to manage itself as an efficient knowledge recipient.

Therefore, refined measurement to capture correct knowledge complexity level is highly required. In the following study, empirical study should be designed to capture the impact of knowledge complexity.

In addition, this manuscript only concerned the knowledge complexity and the knowledge assimilation between HQ and foreign subsidiaries. However, knowledge complexity is also highly crucial for knowledge transfer among foreign subsidiaries. Therefore, subsequent study is also suggested to investigate the impact of knowledge complexity on knowledge assimilation among foreign subsidiaries and compare that of HQ-subsidiary relationship.

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