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Qualitative study on open innovation

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Abstract

The purpose of this study is to examine the relationship between the processes through which a firm introduces or absorbs knowledge, and those through which it is applied within the firm by focusing on the in-bound type of "open innovation" process. Existing studies do not pay much attention to knowledge application and have hardly examined the relationship between knowledge transfer and application. If the transfer and application are qualitatively different, or in a mutually obstructing relationship, knowledge application would require specific management. We offer three key findings based on qualitative analysis of interviews and participant fieldwork data. As a result of the analysis, we assert the following conclusion. First, if the knowledge is more novel to the recipient, the motivation for open innovation increases, but the uncertainty in knowledge application increases at the same time. Second, if the uncertainty in knowledge application is high, or if the knowledge is novel or implicit to the recipient, the need for additional investment by firms such as establishing a new department or managing specialists will increase in order to maintain or accumulate the knowledge. Finally, if the recipient homogenizes to the source as scientific researchers, the homogenization promotes transfer but obstructs application.

***Keyword*:** open innovation, knowledge transfer, absorptive capacity, knowledge management, grounded theory approach

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Introduction

Open innovation (OI) has been among the most debated topics by management scholars in the last years (Baldwin and Von Hippel, 2011; Bogers et al., 2016; Christensen et al., 2005; Dahlander and Gann, 2010). While prior research has been done from various view points, OI generally involves a process by which firms transfer knowledge and technology from the external source. In addition, the transferred knowledge creates value by 'application', the development or refinement of products and processes within the firm. The transfer and application of knowledge are extremely important in OI. So we pick up in-bound type of OI (Chesbrough et al, 2006) and focus on two processes, transfer and application (Bierly et al., 2009; Zahra and George, 2002).

In existing studies on OI and knowledge transfer, the conditions that encourage the knowledge transfer have been paid much attention and examined from a variety of angles, for example network theory (e.g., Ghosh and Rosenkopf, 2015), stickiness of knowledge (e.g., Szlanski, 2003; Szulanski et al., 2016) and absorptive capacity (e.g., Volberda et al., 2010). And research on knowledge application is scarce, especially compared to research on transfer (Lavie and Drori, 2012). However, the knowledge transfer itself does not bring great value to firms. Firms can achieve innovation and gain great value only by applying the transferred knowledge. Therefore, application should be more important practically.

One of the main reasons for poor attention to application is that it is considered to be easier than transfer. Firms must explore the necessary knowledge first for OI, and transfer them sufficiently. Prior research on OI is strongly paying attention to exploration and transfer, on the other hand, it seems that application can be done comparatively easily after transfer. Especially in the in-bound type of OI, OI is sometimes seen as looking for a piece of puzzle and putting it in firm's own missing hole. It is thought that firms can apply the transferred knowledge immediately if they succeed in exploring necessary knowledge from external sources, absorbing them to their own firm

and transferring it.

However, application may not be done in such a way actually. Even if knowledge is fully transferred, it is not always easy to apply it. There is a possibility that another specific management is necessary for application, which is different from what is necessary for transfer. Furthermore, prior research haven paid little attention to the relationship between transfer and application. Transfer and application are continuous in time series. However, if firms perform similar management on a continuous basis, it does not always succeed. Application may be obstructed by the transfer process affecting the application process. If so, it is necessary for firms to manage by understanding the difference in the nature of transfer and application and paying sufficient attention to application.

Based on the above, our purpose is to examine the nature of the application stage and the relationship between the transfer and application in the in-bound type of OI. Knowledge application plays an important role because the ultimate goal of OI is value creation and acquisition through application. However, prior research has paid less attention to application, and also hardly examined the relationship between transfer and application. Drawing from these concerns, we examines the relationship between knowledge application and transfer based on qualitative analysis of fieldwork data.

Knowledge Transfer and Application

Knowledge Transfer

The capacity to transfer knowledge is important for an organization because it can be a source of dominance in competition. Several factors that promote or obstruct the knowledge transfer process have been identified; the nature of source, recipient, the relationship of transfer partners, and the transferred knowledge.

First, the nature of the source or recipient is the key factor that affects transfer. Motivation of the source affects transfer (Szulanski, 1996). Several studies focus on the accumulated knowledge base of the recipient. In terms of the factors that promote knowledge absorption, Cohen and Levinthal (1990) take the view that the capacity to absorb knowledge is formed proportional to the accumulation of knowledge in the related fields in the firm.

The nature of the relationship between transfer partners also affects transfer. Lane and Lubatkin (1998) argue that, rather than the accumulation of knowledge in the related fields in the past, similarity between knowledge and knowledge process systems between transfer partners promotes knowledge transfer and learning. Moreover, several studies have pointed out that if knowledge bases are similar, knowledge application is easier; on the other hand, because it reduces the benefits of acquiring knowledge, the motivation is weakened, resulting in slow absorption of knowledge (Ahuja and Katila, 2001; Lane and Lubatkin, 1998; Simonin, 1999). Other studies on the relationship between transfer partners are based on the structure of the social network (Burt, 1997; Ghosh and Rosenkopf, 2015; Granovetter, 1973), trust and informal relationship between individuals (Colquitt and Rodell, 2011; Szulanski, 1996; Reagans and McEvily, 2003). Following social network theory, it is noted that the strength of the connection between nodes (Dyer and Nobeoka, 2000; Granovetter, 1973; Hansen, 1999; Levin and Cross, 2004; Tortoriello, Reagans and McEvily, 2012) and the openness of the network (Inkpen and Tsang, 2005) exert an influence on knowledge transfer. Besides, informal socializing and the length of time spent together could sometimes exert an influence on the trust relationship. Transfer methods as not psycological but cognitive perspective, affect transfer (Szlanski, Ringov and Jensen, 2016).

The type and nature of knowledge to be transferred has been pointed out as important factor for the fluidity of knowledge transfer (Nonaka, 1994; Polanyi, 1966; Von Hippel, 1994). The claim here is that, regardless of the relationship among transfer partners, knowledge transfer is obstructed

because knowledge has a certain feature. The feature of knowledge that impedes transfer is described as "stickiness," and the following factors are noted to produce stickiness: a) quantity of information; b) low capacity to absorb; and c) tacitness (Von Hippel, 1994; Teece, 1986). In contrast, knowledge demonstrability (Kane, 2010) and observability (Rogers, 1983; Winter, 1987) promote transfer.

Knowledge Application

One point is often overlooked in the discussion of knowledge transfer, namely: as not much value can be extracted from the knowledge transfer even if obstructing factors are removed and knowledge transfer is completed with appropriate cost, the transfer itself cannot be the ultimate aim of the firm; value is created only when knowledge is applied. It is necessary to extract value from the transferred knowledge by applying it within the firm. Nevertheless, the knowledge management literature has traditionally concentrated on knowledge transfer while paying less attention to knowledge application (Lavie and Drori, 2012).

Existing studies pointed out the factors that promote or obstruct application. The inability to apply external knowledge can be due to many barriers, including a firm's resistance to change (Ford et al., 2008), its inability to assimilate ideas generated externally (Katz and Allen, 1982), lack of effective knowledge-sharing techniques (Tushman and Scanlan, 1981) and not-sold-here attitude (Lichtenthaler et al., 2010). There is the trade-off between knowledge utilization and team coordination (Reagans et al., 2016). Goal setting is important to utilize shared knowledge (Quigley et al., 2007). However, these studies don't keep on track in the analytic units and the definition of terms.

Studies on absorptive capacity (e.g. Cohen and Levinthal, 1990; Zahra and George, 2002), articulate a process with two stages: the stage in which knowledge is actually absorbed and

accumulated in the firm, and transformed to fit the organizational context of the firm and applied to solve problems. In addition, Jansen et al. (2005) examined the influence of an organization's coordinating and socialization capabilities on its units and separated stages between acquisition and understanding of knowledge, and internalization and implementation of knowledge. However, in empirical operationalization, studies argue that organizational capacities are constituted by organizational routines about inter-organizational relationships (Dyer and Singh, 1998) or by organizational structure (Lane et al., 2001; Meeus et al., 2001). Neither claim discusses the issue by separating the processes of knowledge absorption or accumulation from the application aspect. While both of the knowledge transfer and application are nature of absorptive capacity, prior research pay less attension to application or the dynamic relationship between them (Volberda, Foss and Lyles, 2010).

Szulanski (2002) demonstrates that the level of stickiness varies from transfer stage to application stage. Taking the case of transfer of best practice as an example, Szulanski examined stickiness in knowledge transfer by setting up four milestones and stages: initiation, implementation, ramp-up, and integration. Still, Szulanski views phases of transfer and application independently and incrementally. In addition, while Szulanski have pointed out that the lack of motivation and the organizational contexts are influential variables at the application stage, it is argued that these arise mainly due to the boundaries of transfer partners, and that they are not due to qualitative differences between transfer and application. Bierly et al. (2009) separated the application into the two aspects, application to gain knowledge unrelated to their current areas of expertise and one to use knowledge that advances their existing technologies and products; exploratory application and exploitative application (Cohen and Levinthal, 1990; Lane et al., 2006). And they indicated that it is different that factors influence the exploration and the exploitation, and tacitness of knowledge moderates application. However,they made a subject the relationship between organizational capability and

application, and don't mention to the relationship between transfer and application.

In OI research, the importance of the "business model" and "application" has been repeatedly pointed out as the factor influences the effectiveness of OI (Chesbrough, 2003). Lichtenthaler and Lichtenthaler (2009), who conceptualizes organizational capacity in OI, include the capacity to apply knowledge in addition to capacities related to seeking and holding knowledge, as capacities that constitute OI. At the same time, it has been pointed out that commercialization of knowledge itself has inherent difficulties because the core ideas for innovation are varied regardless of whether it is transfer or open innovation (Von Hippel, 1988).

As shown above, among studies on knowledge transfer that make reference to the application stage, there are few that regard features of the application stage as different from those of the transfer stage. The purpose of this study is to examine the nature of relationship between the application and transfer stages in knowledge transfer. Existing studies' contribution to the study of the interaction is limited to the recognition that transfer is a necessary condition for application. However, if transfer and application are qualitatively different in terms of the necessary resources and organizing principles, or if they are in a mutually obstructing relationship, the transfer stage needs to be recaptured as a process that considers application. The study considers that the transfer and application phases are not independent from each other, but interact with one another and sometimes, are in a contradictory relationship; it examines knowledge application.

Methods

Case studies are suitable for "how" research questions (Yin, 2013), and this study adopts the case study approach because of its research question. The case under examination is the open innovation project of Firm A and Firm B between 2009 and 2010. As the project includes the knowledge transfer from Firm A to Firm B, it is judged to be a suitable case for examination of the research

question.

This study aims to theorize based on careful fieldwork and description, and the analysis is based on the grounded theory approach (GTA). This study draws from GTA as discussed in Corbin and Strauss (2008). With regard to the validity of using GTA, the case satisfies the conditions listed in Langley (1999); it deals with undefined and ambiguous process data and uses a detailed description of the individuals. While this study uses GTA, it should be noted that it does not adopt a purely inductive approach that excludes deductive reasoning. This study rejects the claim that clear theories and meanings would emerge without any room for interpretation because of inductive analysis of data based on a certain method; rather, it presupposes that analysis is accompanied by the researcher's interpretation. The case is analyzed based on the understanding that no matter how strictly one tries to adhere to data, in the empirical process of analysis theoretical loads will emerge, which means deductive interpretation is inevitable; therefore, while based on an inductive method such as GTA, analysis is always carried out through deductive theories and interpretations. At the analysis stage, both inductive and deductive methods are used.

Data Sources and Analysis

Data sources of this study are a) 18 interviews with 15 people of Firm A, Firm B and Firm C (in English and Japanese); b) participant observation of 25 meetings and informal, wide-ranging observation and communication; c) relevant secondary sources. Two sets of interviews were conducted: unstructured and semi-structured interviews with those who were involved in the pre-project stage in order to capture the development and overview of the project; semi-structured interviews with meeting participants in order to describe what they thought and felt. In the data analysis stage, drawing from methods discussed in Eisenhardt (1989), Miles and Huberman (1994), Plowman et al. (2007) and Volkoff et al. (2007), the following method was adopted:

Step 1. Since the interviewer/fieldworker is not the same person as the coder, the two engaged in information sharing by explaining and discussing the summary of content.

Step 2. Based on the sharing in Step 1, new notes were drawn to record the interview details. The notes contained the date and place of interviews, details of interviewees, questions, summary of interviews and major points.

Step 3. To capture and understand the case chronologically, a timeline was drawn based on the notes. In this study, time is not seen as an especially relevant variable to the research question, but in order to assist the reader's comprehension of changes in the case and process, a table is attached.

Insert Table 1 about here

Step 4. Following Steps 1 to 3, qualitative coding for analysis was conducted. Coding was done at the sentence or paragraph level.

Step 5. With regard to securing validity and paying attention to the fact that this is a qualitative study dealing with a single case with ambiguous process data, the procedures, and methods discussed in Section 1 were followed. In addition, since this is a single case study, it is not necessary to secure external validity.

Open Innovation Project

This case study analyzes relationships between the partners and nature of knowledge as factors that promote or obstruct knowledge transfer. This case study, as aforementioned, takes as its subject matter a project between Firm A and Firm B in 2009-2010. This paper, for simplicity and comprehension, divides the project into four phases. Furthermore, a number of components are outlined that form the basis of key concepts, such as knowledge, open innovation, transfer, source,

recipient, communication, and application, and the summary is listed in Table 2. These components are theoretically important abstract concepts, and they are in place to describe the specific phenomena in this case study, or rather, the kind of abstract concepts that were identified in the specific phenomena.

Insert Table 2 about here

Phase 1: Pre-Project

The catalyst for this project was an introduction by a third party, an employee of Firm C, who had connections with both firms. Therefore, as per the plans made by the employee quoted above and Firm A, the offer was first made to Firm B's managers. After discussions at the top management level, they decided to proceed with the project. The constituent project members from each firm were assembled, and the project began. The decision to initiate this project was made based on its objective of starting a collaborative project between the two firms; transferring knowledge through activities, and subsequently, the recipient (Firm B) would start a business.

Knowledge and Application. "Improvement of white collar productivity" was established as a major theme of this project. An approach was envisaged, in terms of a more broadly outlined theme, which would aim for qualitative improvements, building on the strengths and knowledge on the source's side. Specifically, this was observation through "ethnography". Options for business proposals were suggested, such as whether to use ethnography in a consulting service business; to observe customers' offices, discover problems, then propose ideas for improvements; or to use ethnography in the development phase of productivity improvement packages and software for its sale. Furthermore, the principal knowledge transferred in this case is ethnography, a qualitative methodology. Ethnography was first mentioned in a paper by Malinowski (1922), and originated as

an academic methodology. However, it must be acknowledged that this case did not employ academic methodology, but was applied to business as "business ethnography." Consistent methodology and expertise exist for ethnology, as a method that uses an unstructured and exploratory mind and, based on careful and comparatively long-term observation, uncovers the observed subjects' problems and characteristics. In light of this, this study labels ethnography as knowledge.

Although knowledge of ethnography has been made explicit, it strongly depends on individual aspects, and with comparatively high stickiness. At the very least, as with some types of patents, even after it has left its owner it cannot be easily transferred or absorbed. Because of this, cumulative and direct employee communication has been considered necessary for knowledge transfer.

Phase 2: Beginning of the Project

Project activities started and progressed in Phase 2. Members from both firms, who were brought together after the decision to implement the project, began the knowledge transfer process.

The project started with Firm A and Firm B each assigning five employees. Among them were core members, three from Firm A and four from Firm B, who were involved with the project from start to finish, and who communicated with their counterparts. The primary communication among members occurred through two types of meeting attendance: face-to-face meetings, and remote virtual meetings using telephones and videoconferencing. Firm A is headquartered in the United States, and Firm B in Japan; therefore, there is considerable geographical distance between them. This resulted in a high frequency of digital communication, as distance prevented direct meetings. The main communications were in English, as Firm A members' mostly spoke English.

Nature of Source and Recipient. The source side's core members were researchers specialized in ethnography, some of whom had experience doing collaborative research with Japanese firms. All

members were also non-Japanese and were native English speakers, with the exception of one person. Some members were motivated by the desire to contribute to scholarship by publishing the project's research results in papers and articles.

Almost all members from the recipient side were also involved in R&D work. Many of them could be categorized as "researchers." However, in contrast with many of the source, who tended to be high-level researchers engaged in academic research, the recipient were specialists in the fields of business and development. It can be observed from the above that before they joined the project, most of the members had been researching knowledge and technology that were required based on business needs. The ubiquity of their remarks were also confirmed, such as, *"We need to show visible results, since the time is limited,"* or, *"Let's pass this on to the business division."* This indicates their consciousness of the knowledge's practical use in business.

Conflict: Communication, Theme, and Knowledge. Conflict occurred during this phase, while the project had begun and was progressing, which obstructed the knowledge transfer. Specifically, this consisted of (1) problems with communication, starting with language, (2) changes to the theme, and (3) confusion regarding the knowledge.

First, communication problems occurred, and friction and confusion were most noticeable in matters of language. English, as aforementioned, was the primary language used in meetings. The recipient could speak English; however, there were many members whose native language was Japanese. The recipient agreed regarding language problems, demonstrated their difficulty in participating in discussions during meetings where native speakers were speaking fluently in English. The source were also concerned about working with a Japanese firm and providing support in English only. However, a Japanese person on the source did sometimes step in as an interpreter, as the situation required. Otherwise, the first meetings started late due to device malfunctions, such as the videoconferencing equipment, and the meetings began in a fairly negative atmosphere. This was

a cause of communication failure.

The next step involved changing the project theme. Originally, as described in Phase 1, the clearly stated theme was the “improvement of white collar productivity.” However, as the project proceeded, the theme suddenly changed. A request came from beyond the project’s members, and the original theme was gradually modified. The theme was ultimately transferred from “white collar productivity” to “the creation of a proposal-writing system,” however, the difficulty both sides had in reaching a consensus regarding theme awareness, which caused anxiety on the recipient, and how it invited such a situation.

Finally, confusion existed surrounding the knowledge. The recipient, whose level of understanding of the knowledge known as ethnography was limited, needed to deepen their understanding of ethnography through negotiations with Firm A, as representatives of Firm B in the project. The discussions were sometimes bottlenecked because they had insufficient understanding of the knowledge. Furthermore, ethnography itself is unstructured, and the methodology sometimes requires intentionally discarding goal orientation and goal setting. Situations surfaced in which the recipient doubted the knowledge itself, such as their anxiety regarding the source’s repeated suggestions that they have *“no preconceived notions, [and] think of your mind as a blank sheet of paper.”*

Opacity of Knowledge Application. Knowledge application was extremely important, due to the objective of commercialization, and transfer was interpreted as managing this separately. Regarding how to use the knowledge in a practical sense, there was also a tendency toward skepticism regarding applications and cases used for this knowledge. This can be inferred from comments indicating that even if they understood ethnography as knowledge and it was transferred, it most likely could not be put to practical use.

This was the primary reason for the conflict; however, it was evident that it would be resolved

during that phase. It is noteworthy that the source trusted their partners, and they perceived that the conflict was not a major issue affecting the project's progress; in fact, this conflict was a necessary part of this progress.

Phase 3: Promotion of the Transfer

The project progressed during Phase 3, as meetings accumulated after its initiation, and this phase included processes that promoted knowledge transfer. The transfer of the knowledge progressed, and the project entered a period where one goal, commercialization, became more clearly in focus, and actual practice began.

Decreasing Conflict. The recipient had a positive impression of the source, and they continued to resolve communication conflicts. Frequent comments were made during this time that their approximate identification as researchers helped to enhance communication.

A tendency to accept changes to the theme also became evident. The recipient had begun to perceive the change in theme positively, which had been a large source of anxiety in Phase 2. However, although the specific target had changed, comments, such as *"It's not as though we want to become ethnography specialists. How will we apply it to our business?"* show that the goal of commercializing had not completely changed on the recipient.

Promoting Knowledge Transfer. Comments during interviews, such as *"I thought that ethnography would be interesting and had possibility,"* and *"I had the feeling that it would be useful for something,"* reflect that the recipient had deepened its understanding of the knowledge. They acknowledged the value of ethnography as knowledge, and they were accumulating knowledge themselves.

Opacity of Knowledge Application. On the other hand, there was a consciousness of knowledge application. However, although the knowledge transfer transition was made, many situations

occurred in which doubts and problems regarding application could not be solved. The recipient encountered the issue that it could be very difficult to apply the knowledge for commercial purposes in a way that would particularly relate to business profitability, and that could be profitable and evaluated quantitatively.

Summary. This phase confirmed that conflict, which had been regarded with uneasiness in previous phases, was headed for a resolution. Knowledge transfer was underway in conjunction with this, and preparations were being made to conduct tests for commercialization purposes. However, doubts were raised during meetings regarding commercial applications, and discussions occurred regarding concrete business-related applications.

Phase 4: Project Downsizing, Termination, and Failure to Apply Knowledge

Phase 4 involved the project's heading for termination. An event occurred that became the turning point leading to the project's termination; When top business development employees at the source made a presentation to the Firm B R&D center's vice-CTO. While there had been a sudden change from the original plan, in terms of timeframe and funding, the downsizing decision should not be interpreted as unrelated to trends in the project. The comment, *"it wouldn't be monetized any time soon,"* illustrates the decision as a reaction to the lack of clarity of its profitability, due to the failure to apply the knowledge.

Finishing Transfer. The course of events, whereby they collaborated with the source, the source taught and the recipient gained knowledge, and this knowledge output explicitly resulted in a research paper, would lead to the generally reasonable idea that the knowledge transfer was complete.

Failure of Knowledge Application. The original concepts of "white collar productivity" and the "proposal-writing system" were scrapped, and prospects for knowledge, to be used for tasks and

business that could be marketed to external customers, disappeared. So the recipient decided to look for a different method of application. When they looked inside the Firm B for uses for the transferred ethnography knowledge, they planned to use the knowledge in healthcare-related work. Discussion events, called "User Meetings" were set up starting with healthcare customers. Therefore, although a certain amount of understanding occurred, there was no favorable response, and not enough of a response to indicate that commercialization was possible. Although they continued to study commercialization, they concluded that they would omit ethnography. They judged, in other words, that commercialization was not possible, although they had changed the activity's exit point; as a result, the knowledge was not applied.

In this case, although the transfer was complete, the previously established themes changed multiple times, and halfway through the project, the budget and timeframe were downsized. The recipient tended to perceive the project itself negatively. Although they felt the effects of the knowledge transfer, while they were working on the project they harbored the concern that this might not lead to concrete commercialization. Interviews were also conducted with top decision-making managers, even though they had not been directly involved in the project. The exit point that was finally posited was not considered as something that would lead to business success. Comments were made after the fact, regarding the communication during the comprehensive retrospective.

"...why was the shift made, first of all, 'collaboration is needed'." (Firm B's manager)

This comment raised the possibility that the recipient overvalued communication with the other party, and this is why they lost sight of the goal of commercialization.

Finally, Firm B's managers indicated that the project was influenced by the difference in

identification, between people in the research field and those in business management. It resulted in the observation that researchers were on the sidelines, devoting themselves to their main calling of research, and managers should carry the responsibility for decision-making, regarding the direction toward commercialization, and setting priorities. The fact that there was weak management intervention and there was no collaboration birthed the inadequacy of goal-setting and practical application.

Proposition Development

In the present case, conflicts that would block knowledge transfer were resolved and the transfer was completed. However, at the application stage there was a failure, which led to the scaling down and termination of the project and scrapping of the idea of application. The reasons why the case did not complete the application were, as suggested in the reflections in Phase 4, relative neglect of the aim of commercialization due to the emphasis placed on communication, the absence of affinity or synergy between new knowledge and existing in-house knowledge, and blocking of commercialization by the identity as a researcher. The absence of affinity has been discussed in existing studies and negative views have been expressed. And the case examined in this study was an international OI case between a US and a Japanese firm. However, cultural differences was overcome with relative ease.

In this case study and interviews, the relative neglect of business goals and the obstruction of business initiatives due to researchers' identities were found to be influential factors in application failure. However, examining phases 2 and 3 revealed that the intention to commercialize never really diminished in the recipient. As researchers, the initiatives they undertook were consistent with concerns for application. In view of this, anomalies arise or the explanations become less persuasive if only factors such as emphasis on communication or lack of business initiative because of conflict

with researchers' identities are highlighted. In this study, we present some of our propositions. Table 3 provides a summary of the propositions.

Insert Table 3 about here

Motivation

Proposition 1 deals with the novelty of knowledge as it relates to existing resources. At the recipient, ethnography as knowledge was regarded as highly novel, so it was perceived to be likely to bring in business value that was not achievable with in-house knowhow and highly motivated. However, very little information was accumulated regarding application of existing resources. Therefore, it can be surmised that even after the knowledge transfer was complete, little progress could be made in applying the acquired knowledge. If the knowledge in question is novel for one's firm, the possibility is recognized of it giving rise to the creation of value not previously possessed. Therefore, the more novel the knowledge, the higher the motivation toward the project, and it is likely to be easy to select highly novel themes for one's firm later. At the same time, uncertainty in knowledge application gets high because novelty of knowledge brings lack of information and resource for application. This leads to the following propositions.

PROPOSITION 1A. *The more novel the knowledge, the stronger the motivation toward knowledge transfer.*

PROPOSITION 1B. *The more novel the knowledge, the higher the uncertainty surrounding knowledge application.*

Combining Propositions 1a and 1b leads to a trade-off between motivation toward the project and

the possibility of application. When novel knowledge is the object of transfer, the prospect of the production of greater value strengthens motivation, but a dearth of related knowledge increases the uncertainty in knowledge application. However, knowledge with a high overlap with existing resources is easy to apply and the catch is that any value produced will therefore be relatively low, weakening the motivation toward the project.

In contrast, more information possessed in-house regarding the knowledge helps to promote its transfer and application. However, if there is sufficient knowledge, this can also be interpreted as an indication of a large overlap with existing in-house resources. This can result in lower perceived novelty, which in turn may relatively diminish the perceived value derivable through transfer and application of the knowledge. Based on the aforementioned logic, proposition 1 is presented. While the perceived value of novel knowledge is higher, transferring and applying such knowledge is also much more difficult. In contrast, it is relatively easy to transfer and application knowledge that already has some overlap with existing resources, but this raises the dilemma that the value derivable is perceived to be relatively low.

Knowledge Maintenance and Accumulation

Given such a premise, is it impossible for firms to application knowledge if it is novel? We do not believe that this is unconditionally true. Improvement in likely application can be achieved if additional investment can be made in the organization to application the knowledge. However, there are also issues with additional investment.

The knowledge was safely transferred to the recipient. However, given that the search for application of the knowledge was conducted under circumstances of high uncertainty (with comments such as *"we tried it for six months, but we can't say that it is unsuccessful"*), it inevitably took a long time to discover how, and in what business, to apply it, and the search indeed continued

for months after the transfer. However, it would not be true to say that the work of project participants focused only on application of the knowledge for months. Although it was the division involved in the healthcare business that investigated application, project participants were from outside the division. Moreover, as underlined by the comment *"I want to indicate that I feel that the knowledge has prospects, but the basis for judging whether it has prospects is indicated for us by the business department,"* there was a situation that the participants likely to be most familiar with the knowledge were unable to make the final decision about the potential for application. This was mainly because of the boundaries of their jobs within the firm. Therefore, although the potential for application was searched, it was dropped. The above implies the following proposition.

PROPOSITION 2A. *If the uncertainty is high at the application stage, there is an increased necessity to maintain and accumulate the transferred knowledge.*

When the uncertainty in knowledge application is high, more time and resources are required for application. Moreover, when searching for application potential across divisions, a person's actions and authority end up being restricted in line with his/her position and department. Under those circumstances, for example, it will likely become necessary to maintain and accumulate the knowledge by specifically putting in place new divisions or specialists.

Moreover, when the knowledge is novel, management systems are not in place to tackle application, at least at the time of transfer, which inflates the additional investment for maintenance and accumulation of the knowledge. The same is true when the knowledge is tacit. Because tacit knowledge has a greater dependency on personal qualities, there is a necessity to preserve the knowledge via embodiment by the person concerned. Therefore, firms must further increase the allocation of resources to accumulate the knowledge within the firm, such as by setting up new

divisions with staff who embody the knowledge. This leads to the following proposition.

PROPOSITION 2B. *If the novelty and tacitness of the transferred knowledge is high, maintenance and accumulation of the transferred knowledge is costly.*

Institutional Complexity

It is abundantly clear that since transfer precedes application, no application can materialize without completing the transfer. In the beginning, things such as communication and nature of knowledge caused conflicts between the partners, seriously obstructing the knowledge transfer. To promote knowledge transfer, the recipient strove to better understand the source, leading to successful mitigation of the conflicts. However, in the process of striving to better understand the source, identities of partners were homogenized. In the end, the researchers (recipient) responsible for contemplating the business shifted their identity to the more research-oriented researchers (source). As the result, as the recipient homogenizes with the source through the knowledge transfer, the application path for commercialization, which the recipient is supposed to contemplate, becomes unclear.

Let us use concepts from institutional logics (Friedland and Alford, 1991; Thornton and Ocasio, 1999) and institutional complexity (Besharov and Smith, 2014) to explain the case theoretically. First, we will consider the two institutional logics of "science logic" and "business logic." These two logics can be characterized in the current case in the Table 4, referring to Thornton and Ocasio (1999).

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Insert Table 4 about here

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In the current case, science logic had been dominant in the source before the project, despite some consideration of application when the project began and the knowledge was transferred to the recipient. Meanwhile, even if the recipient favors science logic, there were some posts in the project strongly aware of business logic. The dominance of business logic especially was strengthened. In the repeated communication of the two in the transfer process, the dominance in the recipient of both business logic and science logic grew and conflict increased.

Given the possibility that conflict, if allowed to go unchecked, would ruin the transfer, the recipient chose to increase communication and homogenize the source. In actively communicating with the source, where only science logic got dominant, the result for the recipient was that science logic became more dominant and business logic weakened. This could be because conflict was mitigated and business logic became less dominant. Therefore, the recipient was unable to bring the knowledge to commercialization. The above implies the following proposition.

PROPOSITION 3. *If the knowledge transfer recipient and source become more homogenous, application of the knowledge is obstructed.*

If pressed to say what must be borne in mind regarding this proposition, it would be the high likelihood that complete transfer will not occur, no matter how hard the recipient strives, if the transfer occurs with business logic stubbornly at the dominance. If business logic remains dominant, the conflict caused by the two logics will remain unresolved. Inviting poor communication, it is possible that no knowledge at all will have been transferred. Given the very fact that such a possibility is envisioned, Firm B's managers will at least have shown an attitude of having *"put cooperation first."*

As application cannot precede transfer, application completion cannot materialize without

knowledge transfer. However, if homogenization occurs during knowledge transfer, this may also obstruct knowledge application. The inherent reciprocity and isolation of the two components, research and business, can thus be considered as the transfer/application dilemma.

Conclusion and Discussion

We examine why knowledge transfer was completed and application was not completed with three propositions. Our contribution of this study is demonstrated in Proposition 1 by the impact of the novelty of knowledge on motivation and the uncertainty in knowledge application. Prior research has made no mention of the relationship between novelty of knowledge, and motivation and possibility of application. It is in this point that the novelty of our proposition lies. The contribution of Proposition 2 demonstrates that additional investment input in the form of maintenance and accumulation of the knowledge is necessary, depending on the uncertainty in knowledge application and the nature of the knowledge. Even if knowledge is transferred, there is no guarantee of immediate application. The novelty of this study lies in the demonstration of the fact that additional investment is required to maintain and accumulate knowledge for application when uncertainty is high or the knowledge is novel or tacit. Taking Propositions 1 and 2 together, in designing OI, the higher the novelty of the knowledge, the stronger the motivation and the higher the uncertainty in knowledge application. As uncertainty rises, there are additional costs for maintenance and development of the knowledge. This can also occur because of the nature of the knowledge. The stronger the motivation with which a project began, the higher the backend costs and, if uncertainty is not anticipated, evaluation after the event is likely to be undermined by such unexpected costs. Conversely, there is the possibility that there will be no OI planning at all because with novelty low and uncertainty in knowledge application reduced, motivation is weak from the beginning. Thus, a trade-off relationship is formed between motivation and costs, implying a difficult choice between

the motivation to realize the project and the required costs. This suggestion has not been made in prior OI research. Rather, prior OI research has assumed lean total optimization, with application of knowledge occurring as external dead storage is attached to the appropriate place. This study is original in introducing a mechanism to respond to this assumption at the root of the OI concept. The contribution of Proposition 3 could said to lie in demonstration of the fact that transfer and application are not independent but mutually impact each other and have a relationship whereby they sometimes impede each other. Deepening of understanding and homogenization because of transfer essential to application impedes application. The concept of homogenization in prior research has referred to increased similarity of the transfer partners' identity and characteristics that are of interest and closing of the psychological distance that constructs trust and cordiality. This controversial but important point includes suggestions not in prior research. Prior research mentions that knowledge transfer is promoted by homogenization of the source and the recipient, mainly from a psychological perspective.

Based on Propositions 1-3 above, this study, as OI research or knowledge transfer research, focused primarily on the application stage after knowledge had been transferred. Most OI or knowledge transfer research has made transfer its focus. However, the ultimate object of OI and knowledge transfer is to benefit from application. It is insufficient that most studies have stopped argument at the transfer stage. Also, they do not consider the possibility that such full transfer will obstruct the application. The originality of this study lies in making observations, via three propositions, regarding the mechanism that occurs when there is no application even when transfer is completely successful, and the relationship of transfer and application when a distinction is drawn between the two. Moreover, especially in regards to Proposition 2, we acknowledge that there are elements of a lack of evidential rigor in that there is no basis for examples of successful application of knowledge thanks to investment in its maintenance and accumulation.

We consider the boundary conditions to which this research argument holds. First, we examine the condition about nature of knowledge. When knowledge is tacit and difficult to transfer essentially, thorough communication is necessary for transfer. It is also necessary to make the knowledge embodied to maintain and accumulate. In such a case, problems like those pointed out in proposition 2 and 3 are more likely to occur. It is similar when knowledge is highly scientific and unclear in application. If knowledge is deemed highly valuable scientifically, firms will motivate strongly to transfer and apply it. However, high scientific value does not guarantee business success. Therefore, it tends to fall into the problem pointed out in proposition 1 or 3.

Next, we examine the condition about nature of the source and recipient. When the following differences are noticeable in the nature of both, our argument is conformant. In other words, since the source is in a position to produce scientific knowledge, emphasis is placed on research, and recipient emphasizes business because it promotes commercialization. Such condition setting is universally found in the inbound type OI, for example collaboration between universities and industries (e.g. Sauermann and Stephan, 2013). As described above, the boundary conditions are not limited and are somewhat universal.

We have sufficient adequacy in the qualitative research procedure. We also believe that internal validity and construct validity are sufficient. However, external validity may not be sufficient. The propositions of the present study are based on analysis of only one case of open innovation, and therefore do not hold true for any industry, country, or era other than that of the case study. However, the only thing we can possibly do is come up with a set of theories, each developed based on a particular case study. If our study can provide hints for corrections in the generalization of theoretical explanations, we believe that we have achieved our objective. Regarding future research, Propositions 1 and 2 (especially), lend themselves to empirical study and experimental proof is required.

Table 1

Timeline of Open Innovation Project

Period	Event/Action
Prior to June 2009	*Preparing open innovation, formulating the theme, defining knowledge*
	Introduction by Firm C
	Managers-level discussions
	Improved white-collar productivity
	Transfer of ethnography
June 2009	*Characteristics of source and recipient, communication, perception of knowledge*
	Decision to begin collaborative effort
	Selection of members
	Asymmetricality of the understanding of ethnography
July 2009	*Conflict among communication, theme, and knowledge*
	Meetings commence
	Disparity in English language ability and sense of discomfort
	Issues with communication tools and devices
	Changing the theme to the proposal-writing system
	Vagueness of the understanding of ethnography
August 2009	Multiple meetings
September 2009	Multiple meetings
January 2010	*Decreasing conflict, and lack of clarity regarding application*
	Similarity of identification as researchers
	Positive impressions of the other party
	Acceptance of the theme change
	Enhancement of the understanding of ethnography
	Problems with quantification
	Problems with business feasibility
January 8th	*Lack of clarity and insufficient understanding regarding application*
	Confusion around creating surveys
February 2010	*Exposure of application failure, and change in the theme*
	Doubts about application expressed during presentation
	Decision to change/downsize the project
	Decision to apply to the healthcare division
September 2010	*Abandonment of application*
	Discontinuation of application in healthcare division; omission of ethnology

Table 2

Evidence for the Construct Components

・"i" means interview data and "f" means fieldwork data in "Data source".

Phase 1

Construct	Evidence	Data source
Transfer at routine level	"At Firm B, in addition to talk of transplanting Firm A's innovation DNA, the explanation was along the lines of …, if there was a specific project."	Firm C employee/i
Deciding project theme	"Theme selection was determined by brainstorming. Issues such as collaboration and innovation overload came up and it was finally decided to investigate the process of proposal production with the client. Initially having shared Firm B's circumstances and Firm A's strengths to a certain extent, several candidate projects from Firm A were put forward and, afterward, there was further brainstorming."	Firm A employee/i

Phase 2

Fields of employee's research	"As a personal perception, there has been development regarding productivity of non-routine tasks." "Having undertaken research regarding collaboration domains, we worked on themes such as information sharing. Up until last year, the central theme targeted improving efficiency by managing the relational nature of information. "	Firm A employee/i Firm B employee/i
Conflict on communication	"In as far as communicating about the things we were still – we were supposed to be achieving, clearly we were not communicating some critical information that the senior manager wanted at the end, right." "(The problem for me was that) my English language ability was not sufficient. What specifically was a problem for me was that I did not have the English language ability to move the flow of the discussion from the direction it was headed to what I was thinking about, so after the meeting I ended up sending another proposal by e-mail." "I had a problem with the language...that is what I found really hard about working together."	Firm A employee/i Firm B employee/i
Conflict on change of theme	"The purpose has been changed midway. Initially, research investment was made from a long-term viewpoint but the question arose of wanting to engage in projects with a more direct relationship to business. We considered that the purpose of the research project had changed." "Regarding the fact that the purpose of the project had changed, change prompted from within a research project often occurs with Firm A but change prompted by non-research factors may be a little unusual. " "…Eventually, they changed the target and began to focus on research intended to support unstructured activity. ...It seemed that he (Firm B employee) does not fully understand…why there was a change to a focus on proposal writing as an unstructured activity." "At the time of participation in the project, productivity improvement was a keyword. …The project target moving was a bit concerning. The initial plan included coming up with a system solution, but the broadening of ethnographic skills was revealed. Although that may become important, I wonder why there is coexistence without switching."	Firm B employee/i Firm B employee/i Firm B employee/f Firm A employee/i
Conflict on knowledge	"Are you really doing the right unstructured chaotic activity to get the best results?" "Ethnography is more like an extra perceptual capability. It's much more open-ended. " "It was very strange to me because I guess they understood so little about it that they didn't get that. It's not – ethnography is not something that you can do in 3 months really." "Because this is a first for us, we do not know the definition of an interesting result." "Ethnography is new to me and so I do not know whether we are moving in the correct direction." "We do not know how ethnography can be used and so cannot answer the question (as to what we	Firm A employee/i Firm B employee/i

	intend to do). Even if asked what we intend to do in an unfamiliar domain, we don't know. " "The analysis methods shown here (at this meeting) are very old. There is not much development in terms of methodology. Therefore, I think that people from Firm B are a little perplexed."	Meeting/f
Opacity of knowledge application	"Last year, when talking about the results of the ethnography, the idea came out that reuse and organizational learning were important, but this itself is obvious when seen from the business departments; they cannot see how this relates to improving white collar productivity." "It is an interesting project, but I am a little concerned. A great deal of effort has been expended, but it is not possible to see the fruits of this labor."	Firm B employee/i
catching conflict positively	"Because Firm B staff are researchers, they understand change and uncertainty. Everyone is saying different things. Everyone has a different opinion. They express different opinions, and that is alright as long as they pursue them and behave in accordance with the spirit of the contract. I think the project is making progress because they get involved in the details."	Firm A employee/i

Phase 3

Decreasing conflict	"The collaboration was working just fine." "I think at the beginning she (Firm B employee) was the most skeptical about ethnography and by the end she was very supportive. She just said she really, really enjoyed and looked forward to our meetings and working with us and it was very fulfilling for her." "There was a big change with a direct meeting. With a video conference, the richness of communication ends up being different. Only limited information is passed on. Having spoken face to face and socialized together, there is are significant elements of trust and commitment rising." "I think the fact that, typical of Japanese culture, people on the opposite side (Firm A) are able to share sensibilities is helpful for Firm A. For software development, it is fine if a person is not Japanese but when struggling as to how best to proceed it is hard if you do not share the same culture. "	Firm A employee/i Firm B employee/i Firm B employee/f
Identity as researcher	"People's reactions were better than I expected. Use of the technical term "ethnography" got through to them. There was a feeling that they didn't fully understand the term but they felt it was important." "Having them (Firm A employees) as researchers and discussion partners is stress-free, and happy...I think being able to experience communication with researchers like them will have a positive effect."	Firm B employee/i
Transfer progressing	"During the goal-setting phase, I thought that ethnography would be interesting and had possibility." "I had the feeling that it would be useful for something."	Firm B employee/i
Opacity of knowledge application	"I do not want to become an ethnography specialist. How can it be applied as a business?" "In learning about ethnography, initially there were no specific techniques. Therefore, it is not possible to simply return this feedback. I feel that it is difficult to return this feedback to the operations division within the company." "In an internal company review there was evaluation of Firm B learning about ethnography and the evaluation was that research has no direct business contribution. Thus, it became necessary to show the basis of the business contribution. "	Firm B employee/i Firm B employee/f

Phase 4

Faliure of knowledge application	"Not knowing when ethnography could be made into a business was seen as a problem. In looking at it from the viewpoint of Firm B's current business, it was not something that could be monetized on a short timeframe and so the project was scaled back, maintained for a year and then discontinued. Because there was no fit with current business at Firm B, we have so explained it to Firm A. The feeling was that we have now accepted that direct value cannot be found at present, but "no thank you."" "In conclusion, there are many elements that we cannot resolve from a technical viewpoint and the ability to solve problems with ethnographic results was not overly successful. We reached the	Firm A employee/i Firm B employee/i

	decision that other fields of application should be sought.” “The timing of proposing application to the business division was too late. It was not a short-term priority.”	Firm B employee/i
Finishing transfer	“Ultimately, a consensus was reached that it had a certain level of significance.” “As output, a jointly produced paper was published, representing visible success. ” “I think that the research team learned a powerful methodology.”	Firm B employee/i
Opacity of knowledge application	“I started with the idea that we could achieve something using ethnography. However, looking back, no clear targets were set for what we were doing. As we progressed, we looked for what was possible. … I felt that what I understood would be useful in some way, but I could not pin point how. Ethnography is not a tool or a method but rather a way of thinking and so it was not something about which we could learn the principles and then apply them for explosive leverage. ”	Firm B employee/i
Putting cooperation first	“...why was the shift made, first of all, ‘collaboration is needed’.”	Firm B manager/i
Qualitative difference between science and business	“Firm B must now increase the scale of its business. The research center must contribute to this. … The necessity of thinking about the research portfolio is the management’s responsibility. Researchers can fend for themselves.” “The fellow participant, with whom I first had discussions when we were about to start joint research, now has no connection with the relevant workplace. Thus, in some ways, it has become impossible to see whether the initial idea is reflected in current progress.”	Firm B manager/i Firm B employee/i

Table 3

Summary Table for Propositions

Proposition	Contribution	Knowledge transfer explanations
1A. *The more novel the knowledge, the stronger the motivation toward knowledge transfer.* 1B. *The more novel the knowledge, the higher the uncertainty surrounding knowledge application.*	The more novel the knowledge, the stronger the motivation toward transfer. However, the uncertainty in knowledge application increases, and a trade-off arises between motivation and the possibility of application.	
2A. *If the uncertainty is high at the application stage, there is an increased necessity to maintain and accumulate the transferred knowledge.* 2B. *If the novelty and tacitness of the transferred knowledge is high, maintenance and accumulation of the transferred knowledge is costly.*	Additional management input in the form of maintenance and accumulation of knowledge is necessary, depending on the uncertainty in knowledge application and the nature of the knowledge.	When application is looked at from a long-term viewpoint, the cost of application is vastly higher than the cost of transfer itself.
3. *If the knowledge transfer recipient and source become more homogenous, application of the knowledge is obstructed.*	Institutional complexity gives rise to a trade-off relationship between transfer and application.	Aiming for smooth transfer ends up obstructing application.

Table 4

Science Logic and Business Logic

	Science logic	Business logic
Basic logic	Professional logic	Market and corporate logic
Organizational identity	Working as academic person	Working as business person
Legitimacy	Approval of scholarship	Success on business
Mission	Academic output	Application knowledge
Focus of attention	Researcher networks	Bridging research and business
Learning mode	Exploration	Exploitation

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