25 The Choice of Forms in Licensing Agreements: Case Study of the Petrochemical Industry

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When a company enters a market, it is necessary to acquire manufacturing technology. When importing manufacturing technology, sometimes the joint venture form is selected, as well as simply license agreements. In actuality, many JVs between licensor and licensee have been established in the petrochemical industry.

From the perspectives of JV functions, knowledge-based theory considers that a JV possesses organizing principles that codify knowledge and mechanisms to promote knowledge transfers, while transaction-cost theory considers that a JV includes mechanisms to control the opportunistic behavior of partners. Consequently, this research focuses upon the petrochemical industry and examines factors that influence the choice of form of a licensing agreement by performing a case study and quantitative analyses, and explains why a JV is selected. The results being, that a JV is selected, not to promote knowledge transfers between partners, but to control the opportunistic behavior of licensor and licensee.

1 Introduction

Alliances with another firm are important for a firm due to limited management resources and lack of capability. Various matters, such as research and development, procurement of raw materials and components, production, and marketing, can be subjects of an alliance. This analysis focuses on licensing agreements. There are two types of licensing agreements: licensing-in and licensing-out. The former agreement provides technology that was developed by one firm to another firm in exchange for royalties. The latter is sometimes used to avoid patent infringement, but its main purpose is to import another firm's technology and to industrialize it. Considerable research of licensing has been conducted, but this analysis focuses on technology imports from the perspective of acquiring management resources and capabilities.

When a firm imports technology from another, potentialities for opportunism and absorptitive capacity are especially important. First, opportunism will be reviewed. For example, a transaction contract may be incomplete due to individual bounded rationality and cost of information gathering and specifying terms and conditions. Parties involved may take action that prioritizes their own benefit, while sacrificing the benefits of other, i.e., opportunistic behavior (Williamson, 1975, 1985). Licensing agreements involve asymmetric information regarding behavior of the parties. A licensor may later find a better partner and so deliver less know-how to the original licensee than described in the contract, and, possibilities exist for licensees using transferred technology beyond the contractual scope (Oxley, 1997). The background lies in the potentially competitive relationship between the parties, since licensing is executed between firms with related technologies. Licensors may hesitate to provide expertise, while licensees try to assimilate technology as much as possible to develop better technology of their own. These issues are generally argued regarding alliances. It is important to obtain more capability from partners, while avoiding leakage of one's own capabilities in an alliance (Hamel et al., 1989).

A licensee's purpose for licensing is to cover insufficient management resources or

capabilities, so it is essential to assimilate the licensor's technology. Effective acquisition and use of technology requires licensees not only to control licensor opportunism, but also internally develop capacity to assimilate technology (absorptive capacity) (Cohen and Levinthal, 1990). In short, firms must accumulate absorptive capacity while avoiding potential licensor opportunism to use licensing effectively.

On the other hand, when a firm imports technology, it may use a joint venture ("JV") together with licensing agreements, and many occur in the petrochemical industry. Theories explaining JV are knowledge-based theory and transaction cost theory. Knowledge-based approaches (Kogut and Zander, 1992; Conner and Prahalad, 1996) purport JVs have mechanisms to promote knowledge transfer; transaction cost approaches (Pisano, 1989 and Oxley, 1997) advocate JVs involve mechanisms to control opportunism. A partner's high potential for opportunism, or the licensee's poor absorptive capacity, support using a JV. Selecting the form of licensing (a contractual agreement alone, or, establishing a joint venture), is an essential decision.

Furthermore, licensing agreements are important for not only firm strategy but technology diffusion. Technology trading involves issues of common goods, and asymmetrical information. Patents respond to such issues by granting inventors property rights for disclosure, incentives for utilizing technology, and disseminating the invention (Goto, 1993). Analyses have focused on patent effectiveness, i.e., the appropriatibity of innovations by patent; analysis of technology dissemination via licensing is also required. Technology imports involve concerns over opportunism and absorptive capacity, and their impacts on decision-making and performance deserve more focus. Such a statistical analysis is lacking, especially in Japan.

This analysis focuses on the Japanese petrochemical industry, performing empirical analysis of licensing forms. A reason which this analysis focuses on petrochemical industry is that licensing data are plentiful. Unlike machinery manufacturing, a primary feature of petrochemicals is every manufactured product is based on one technology, demonstrating a clear product-technology relationship.

Another reason is that contracts may be incomplete due to high uncertainty over the extent of petrochemical technology and the environment during the 1950s and 1960s, and the resulting high potential of opportunism. Since petrochemicals expanded in Europe and the U.S. prior to World War II, Japan had problems overcoming insufficient technology due breaks with Europe and the US. Japan's reaction to such unfavorable circumstances is interesting.

This analysis focuses on the last half of the 1960s until the first half of the 1980s, and reviews potential for opportunism or absorptive capacity to influence selection of forms of licensing with a case study and econometric analysis.

2 Theoretical background

Section 2 of Chapter 1 focuses on four factors: 1) the possibility of opportunistic behavior; 2) alliance skill; 3) absorptive capacity; and 4) the JV, and explains why these are important for licensing agreements.

The first factor is the possibility of opportunistic behavior. When negotiating a license agreement, the following possibilities exist based on asymmetric information about other party, or based on the competitive relationship: licensors may provide less know-how than described in the contract after a licensor finds a better partner, or, the licensee may use transferred technology beyond the contractual scope (Oxley, 1997).

Opportunistic behavior is considered related to the number of potential licensors. If potential licensors are few, because of difficulties of changing partners, incentives for licensor's opportunism increases.

The second factor is alliance skill. Alliances have coordination issues due to competitive relationships, different partner goals, asymmetric information, and differing management practices (Doz & Hamel, 1998;

Sampson, 2005). A firm with plentiful alliance experience has had many learning opportunities and accumulated the management skill for performing agreement-related procedures, partner selection, effective agreement preparation and enforcement, all to successfully control opportunism.

The third factor is absorptive capacity. It is important for licensees to absorb technology and overcome the original purpose of licensing, i.e., insufficient management resources or capability. Consequently, licensees must accumulate capacity to assimilate technology (absorptive capacity) and improve it during implementation (Cohen & Levinthal, 1990).

Absorptive capacity is related to the licensee's opportunistic behavior. A licensee with high absorptive capacity understands the technology's broader applications, and increases possibilities of technology use beyond contractual scope. And High absorptive capacity enables licensees to improve transferred technologies too, although this is not opportunism.

The fourth factor is a joint venture. JVs involve organizing principles that codify implicit knowledge, a knowledge-substitution and a flexibility effect, and promote knowledge transfers (Kogut & Zander, 1992; Conner & Prahaland, 1996). JV provisions of capital sharing, dispatch of directors, veto rights, etc., improve incentives and facilitate control of opportunism (Pisano, 1989; Oxley, 1997). Consequently, high potentials for opportunism or poor absorptive capacity contribute to selection of a JV.

3 Licensing agreements in the petrochemical industry

In Chapter II, section 1, petrochemical industry technology imports are reviewed, and in section 2, the case of Nippon Zeon is examined. Results of the Nihon Zeon case study are reviewed here.

Nippon Zeon Co., Ltd. ("Zeon") and its petrochemical business involve many suggestions regarding technology importation. First, Zeon's history is briefly summarized. Zeon initially imported and industrialized PVC technology from Goodrich and entered the related field of synthetic resins stemming from development of the imported technology. In the 1960s, Zeon developed the GPA process for VCM technology due to the necessity of material conversion, then developed and industrialized butadiene technology (GPB process) using the fundamentals of GPA, since butadiene was costly (raw material of synthetic rubber). This experience also resulted in development of IR technology (GPI process).

The relationship of the Zeon case and the four theoretical causes for concern mentioned in Chapter 1, section 2 may be summarized. The first is the possibility of opportunistic behavior. Goodrich, the licensor, emphasized controlling its expertise and selected JV as the licensing form; it was concerned about technology leakage to other firms at the establishment of Zeon's related firm, Furukawa Chemical. These facts demonstrate that JV is useful from the perspective of controlling licensee behavior, that controlling transferred technology is difficult, and that licensee opportunism exists potentially. Conversely, Zeon successfully industrialized the imported technology in a relatively short time. Goodrich's potential for opportunistic behavior uncertain, but it is believed that Zeon received sufficient technical direction due to the JV form.

The second aspect is alliance skill. Zeon chose Goodrich and accepted capital participation to import technology. Running royalty reductions were also negotiated successfully, demonstrating effective use of the licensing agreement. Zeon realized PVC royalty reductions in the second contract negotiations in 1960, and the first synthetic resin negotiations in 1964. Their negotiation skills became one key for achievement, making effective use of them in the Goodrich licensing agreements.

The third aspect is absorptive capacity. Zeon established a central research center in 1959 and poured effort into improvement of

imported technology, developing its own technology and processes, while receiving technology transfers from Goodrich. The results facilitated entry into synthetic rubber and the GPA, GPB, and GPI processes.

Effects of the JV indicate JVs promote knowledge transfer and control opportunism. Issues regarding decision-making flexibility and the corporate actions of Zeon were quite restricted by Goodrich when the relationship ended. JVs involve operational issues as well as other characteristics mentioned.

4 The choice of forms in licensing agreements

In Chapter III, various data are quantitatively analyzed (licensing agreement, manufacturing plants, patents, and firm) from perspectives of each licensing form. Japanese firms entering product markets must select either internally developing manufacturing technology or importing it. Importing technology may entail JV together with licensing agreements. In the petrochemical industry, many JVs between licensor and licensee have been established.

Regarding JV functions, mechanisms promote knowledge transfer and control of opportunistic behavior. Chapter II, section 2 reviews the case of Zeon as a specific JV example illustrating that control of transferred technology and expertise are difficult, the potential for opportunism exists, and JV is useful to an extent for controlling a licensee.

In Chapter III, possibilities of licensor opportunism, alliance skill, and absorptive capacity are reviewed statistically for influence over choice of licensing form in order to clarify reasons for utilizing a JV.

In case studies, analyses of technology alliance forms have been performed against the recent rising concern that opposes alliances, and the necessity of high investments in R&D (Pisano, 1989; Oxley, 1997; Arora & Fosfuri, 2000; Sampson, 2004a, 2004b), an also have examined in what cases the JV was selected. Studies revealed the number of potential partners, alliance content complexity, alliance experience, and absorptive capacity all influence the selection of an alliance form.

The following hypotheses of potential licensor opportunism, alliance experience, and absorptive capacity are examined.

Hypothesis 1-1:
JV is not selected if a greater number of potential licensors exist, because the possibility of a licensor's opportunistic behavior becomes lower.

Hypothesis 1-2:
As the number of potential licensors increases, JV will not be selected since the possibility of a licensor's opportunistic behavior is low, when the number of firms that executed exclusivity agreements is excluded.

Hypothesis 2:
JV is not selected as a firm's experience with alliances increases since the firm can easily control a partner's opportunistic behavior.

Hypothesis 3-1:
JV is selected as a Japanese firm's absorptive capacity increases, since a JV facilitates absorption of a licensor's technology.

Hypothesis 3-2:
JV is not selected as partner-specific absorptive capacity of a Japanese firm increases, since JV becomes less needed to absorb a licensor's technology.

Hypothesis 3-3:
JV is selected as the absorptive capacity increases of a Japanese firm, since the possibility increases of the Japanese firm to apply imported technology from the licensor outside the scope of the agreement or to develop improved technologies.

The following points became evident as predicted. First, agreements are selected (JV is not selected) as the number of licensors increases after firms selecting exclusivity agreements are eliminated, and not as the simple number of potential licensors

increases. The results demonstrate that the number of licensors after eliminating exclusivity agreements more accurately represents the possibility of a licensor's opportunistic behavior, the possibility for a licensor to engage in opportunistic behavior decreases as the number of such licensors increases, and thus, an alliance form with only an agreement is selected.

Second, regarding experience with alliances, the results indicate that experience of Japanese firms does not have any effect on the choice of form for licensing agreements, while alliance experiences of foreign firms increase the percentage of selecting JV. Such results are based on the fact that alliance experiences of Japanese firm contain the two factors of accumulation of alliance skill and technology leakages to other firms, while alliance experience of foreign firms contain the former factor only.

Finally, the results indicate that the number of employees partially has a negative effect on the choice of utilizing a JV, while technological similarity has a positive effect. If partner-specific absorptive capacity increases, it becomes easier to absorb a licensor's technology. The possibility exists for a licensee to use imported technology from a licensor outside the contract scope, but much more than that, the possibility to develop improved technology increases. Therefore, these results suggest that a licensor selects JV in order to control such licensee behavior. Thus, the analysis results of the number of potential licensors and absorptive capacity indicate that JV is used, not for promoting knowledge transfers, but for controlling a partner's opportunistic behavior.

5 Conclusion and further issues

In this analysis, the possibility of opportunistic behavior, skills of forming alliances, and absorptive capacity in the petrochemical industry were focused upon, and how those factors influence the choice of a licensing agreement form have been reviewed by case study and quantitative analysis. In the results of this analysis, the following two points are illustrated.

First, licensing agreements include the possibility of a licensee's opportunistic behavior according to the case study. Goodrich, a licensor, emphasized control of their expertise, and selected JV as the form of licensing agreement. Goodrich was also concerned over technology leakage to other firms during the establishment of Furukawa Chemical Industries. These points indicate that it is difficult to control imported technology and expertise, that opportunistic behavior of a licensee exists potentially, and that JV is effective from the perspective of controlling a licensee's behavior.

Second, quantitative analysis demonstrated that the possibility of opportunistic behavior of a licensor and licensee might have an impact on the choice of licensing agreement forms. Regarding the functions of JV, it is believed that JV has mechanisms to promote knowledge transfers and to control opportunistic behavior. The results of quantitative analysis, however, indicated that a JV is used to control opportunistic behavior, and not for promoting knowledge transfers.

Some further issues should be considered. First, the case study did not demonstrate the possibility of the licensor's opportunistic behavior. Quantitative analysis indicated that possibility; such behavior does influence the choice of form for licensing agreements. It is, however, still necessary to prove this with actual case data. To explain this possibility, it is necessary to review cases of a licensor having experience with industrialization and sufficient expertise, while a licensee fails to industrialize the technology or requires a long period in order to implement industrialization.

A second issue is whether a joint venture truly does not promote knowledge transfer. It was indicated that JV mechanisms to promote knowledge transfer have no impact at the time of a licensing agreement. However, once a licensing agreement is negotiated, more knowledge may be transferred from licensor to licensee within a

license pair that establishes a JV than a pair without a JV. The relationship between JV and knowledge transfer needs to be analyzed both at the time of negotiating a licensing agreement, and during the subsequent period.

Third, an issue concerning the effect of alliance skill remains. In the quantitative analysis, experience with alliances was used as a proxy. However, this parameter contains not only the factor of alliance skill, but also the factor of technology leakage to another firm, therefore these results did not reveal any significant effect. Meanwhile, the result of the case study indicates that alliance skillfulness is important when negotiating a reduction of royalties. These effects need to be analyzed in greater detail.

Fourth, an analysis of a firm's performance should be included. For example, Asahi Kasei imported acrylonitrile technology from SOHIO (Standard Oil Company of Ohio) in a nearly instantaneous process and has maintained the top production capacity share since 1971. In this manner, absorptive capacity of a firm may influence the firm's performance as well as the selection of licensing agreement form. Thus, analyzing these factors may enable demonstrating the importance of possibilities of opportunistic behavior and absorptive capacity from the perspective of corporate strategy.