The Effect of Knowledge Protection, Knowledge Ambiguity, and Relational Capital on Alliance Performance

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ABSTRACT

This research examines the role played by ‘knowledge ambiguity’ and ‘relational capital’ in the process of knowledge protection between strategic alliance partners. Based on a cross-sectional sample of 95 firms in alliances and a structural equation methodology, this study empirically investigates the simultaneous effects of knowledge protection, knowledge ambiguity, and relational capital on alliance performance. This study’s findings highlight that the critical role played by knowledge protection as an antecedent of knowledge ambiguity and relational capital on alliance performance. We further analyzed, in order to balance between enhancing alliance performance and protecting individual firm’s critical knowledge, firms should build up both knowledge protection mechanism and relational capital simultaneously.

INTRODUCTION

There is a widespread consensus that we are moving towards an economy where competitive advantage will be determined by knowledge rather than access to raw materials and cheap labor. In this economy, knowledge protection will play a critical role, just as much as innovation. Global expansion has increased many firms’ exposure to expropriation and imitation efforts. Overseas firms are becoming increasingly involved in industrial espionage activities (Liebeskind, 1996). In many countries, legal protections against expropriation and imitation are extremely weak. Thus, protective organizational arrangements can be vitally important to sustaining competitive advantage in the global competitive context.

Learning alliances, in definition as associations in which the primary objective of the partners is to learn from each other, constitute an important class of inter-firm alliance (Hamel, 1991; Khanna, Gulati, and Nohria, 1998). In learning alliances, the partners strive to learn or internalize critical information, knowledge, or capabilities from each other. This ‘race’ creates a significant tension for firms. Literature on learning alliances dubbed them as a ‘learning race’ (Khanna, Gulati, and Nohria, 1998), in which partners often engaged in opportunistic attempts to outlearn each other. On the one hand, alliances may help a firm absorb or learn some critical information or capability from its partner. On the other, they increase the likelihood of unilaterally or disproportionately losing one’s own core capability or skill to the partner. Thus, firms are faced with the challenging task of managing the balance between ‘trying to learn and trying to protect’ (Kale, Singh, and Perlmutter, 2000). ‘Learning races’ often leave a firm in a situation: if it contributes too little to building the relationship, the alliance may be doomed to fail (Khanna, Gulati, and Nohria, 1998); on the other hand, if it contributes too much and too openly, its partner will gain the upper hand (Doz, 1988; Kale et al., 2000).

Current alliance research has failed to sufficiently address, theoretically and empirically, an important dilemma that often exists in learning alliances. Participants in learning alliances would not only like to access some useful information or know-how from the partner, but also internalize some complementary capabilities and skills possessed by the partner. At the same time, they would like to protect some of their own core proprietary capabilities from being unilaterally absorbed or appropriated by the partner. Thus there is an underlying tension between ‘trying to learn and trying to protect’. The dilemma arises because conditions that might facilitate the learning process are likely to expose firms to the danger of losing some of their crown jewels to the partners (Kale, Singh, and Perlmutter, 2000).
Beyond the development of knowledge taxonomies (Kogut and Zander, 1993; Zander and Kogut, 1995), very few studies have empirically linked the properties of knowledge and relational capital to knowledge protection across organizational boundaries. To address these limitations and further our understanding of knowledge protection in strategic alliances, this study will introduce and empirically investigate relational capital, knowledge ambiguity, knowledge protection, and alliance performance.

**KNOWLEDGE PROTECTION IN LEARNING ALLIANCES**

Firms that wish to learn critical information or know-how from their alliance partner must first understand where the relevant information or expertise resides in its partner and who possesses it (Dyer and Singh, 1998). Close personal interaction between the partnering entities enables individual members to develop this understanding. Learning or transfer of such know-how is then contingent upon the exchange environment and mechanisms that exist between the alliance partners (Kale, Singh, and Perlmutter, 2000). Marsden (1990) have argued that close and intense interaction between individual members of the concerned organizations acts as an effective mechanism to transfer or learn sticky and tacit know-how across the organizational interface. Thus, partners in an alliance often specify what is core or proprietary to each party and develop informal or formal codes of conduct to restrict behavior or action that leads to the appropriation of such assets (Kale, Singh, and Perlmutter, 2000).

**Economic rents and ‘isolating mechanism’**

According to Bowman (1974) and Rumelt (1984, 1987), firm’s primary purpose is to create, exploit and defend sources of economic rents. The managerial strategies of firms can be understood as representing rent-seeking behavior, directed both at innovation—the discovery or creation of new processes and products—and at the discovery or creation of ‘isolating mechanisms’ that serve to protect a firm’s innovations from expropriation or imitation by rivals (Rumelt, 1984). A firm’s own organization is a critically important isolating mechanism. Firms can both extend the scope of knowledge protection, and reduce the costs of such protection, relative to legal protections.

However, the argument that rents derives first and most from the knowledge of a firm depends critically on the assumption that a firm can protect its knowledge from appropriation or imitation by its competitors (Liebeskind, 1996). Nelson and Winter (1982) stress the importance of organizational routines in limiting imitation and the diffusion of best practice. For managers, the challenge is to identify, develop, protect, and deploy resources and capabilities in a way that provides the firm with a sustainable competitive advantage and, thereby, a superior return on capital (Amit & Schoemaker, 1993). The core of the resource-based view of knowledge is the condition of ‘heterogeneity’ (or ‘uniqueness’) that is so central to strategy theory depends critically upon the deployment of protective organizational arrangements by firms (Liebeskind, 1996). Firms are able to replace the limited and costly property rights in knowledge with far more extensive possession rights (Liebeskind, 1996). Thus, the organization of a firm can serve as an important ‘isolating mechanism’ (Rumelt, 1984).

**Knowledge protection mechanism**

Many assets can be defined according to property laws, so that ownership can be asserted unambiguously. These assets can then be protected by social institutions that enforce property ownership (Liebeskind, 1996). However, property rights in knowledge—patents, copyrights, and trade secrets—are very narrowly defined under the law, and are costly to write and enforce. Knowledge is also difficult to protect because it is difficult to detect its expropriation, or illegal imitation. Knowledge is inherently mobile, because it resides in the heads of individuals (Grant, 1996). In addition, knowledge is a public good (Arrow, 1962): one item of knowledge can be used by many individuals or organizations at the same time, without diminishing its productivity for any one user. Thus, illegal use of knowledge can be very difficult and costly to detect.

However, as institutions, firms play a critical role in creating and sustaining competitive advantage: that of protecting valuable knowledge. Specifically, because property rights in knowledge are weak, and are costly to write and enforce, firms are able to use an array of organizational arrangements that are not available in markets to protect the
value of knowledge. Thus firms can (a) differentially prevent expropriation of knowledge and (b) differentially reduce the observability of knowledge and its products, thereby protecting against imitation. In this way, firms are able to create ‘possession rights’ to knowledge that are just as valuable, if not more valuable, than the limited property rights to knowledge accorded under the law (Liebeskind, 1996).

Norman (2001) suggests that knowledge protection mechanism can be grouped into three major categories: (1) human resources; (2) legal structure of alliance agreement and contracts; and (3) alliance processes. In this article, instead of focusing on legal structure, we propose that knowledge protection mechanism is an organizational capability consists of four aspects that enhance a firm’s ability to sustain a competitive advantage: top management support, human resource, information flows, and partner access.

Because top management often plays an important and vital role in alliance negotiation and oversight, they have several responsibilities in protecting critical knowledge and capabilities. First, they have to make the knowledge protection policies— they have to decide what information can and cannot be transferred. Second, they have to emphasize the importance of knowledge protection and keep the employees aware of this issue. Third, they have to allocate necessary resources in protecting knowledge and educating employees.

The human resource function in a firm can provide education and training programs aimed specifically at protecting knowledge. The human resource function must ensure that employees understand the importance of maintaining confidentiality, especially those who directly involved in an alliance. Furthermore, human resource division can structure and implement reward and incentive programs for protecting core capabilities. Under appropriate reward and incentive systems, employees will be more willing to protect critical knowledge actively, and therefore can enhance a firm’s knowledge protection capability.

While involved in an alliance, a firm needs to monitor and control the information flows cautiously. First, a firm should specify who is allowed to exchange information as well as what information may be shared. Second, designated managers with different information access and exchange permissions should be responsible for the procedures used to protect information, whereas they are the primary individuals who are actively engaged in exchanging information with the alliance partners on a daily basis.

Partner access to both facilities and non-alliance personnel should be limited. Limiting partner access to a firm’s facilities can prevent the partner from observing how the firm conducts business and thus inadvertently gaining access to information that is not intended to be part of the alliance. Non-alliance personnel should be aware of what information is to be shared and what information is off-limits to the partner. Therefore, in order to protect a firm’s critical knowledge, partner access to both facilities and non-alliance should be planned, monitored, and controlled cautiously.

KNOWLEDGE PROTECTION AND KNOWLEDGE AMBIGUITY

Simonin (1999) argues that knowledge ambiguity is a lack of understanding of the logical linkages between actions and outcomes, inputs and outputs, and causes and effects that are related to technological or process know-how. He found that there is multiple factors determine the level of knowledge ambiguity of a competence. In the context of this study, knowledge ambiguity refers to the same underlying notion of non-transferability of knowledge. According to Simonin’s (1999) research, we propose that knowledge ambiguity is a multidimensional construct, which consists of three sub-constructs: tacitness, complexity, and specificity.

Tacitness

Reed and Defillippi’s (1990) define tacitness as the implicit and non-codifiable accumulation of skills that results from learning by doing. Tacit knowledge, which cannot be easily communicated and shared, is highly personal, deeply rooted in action and in and individual’s involvement within a specific context (Nonaka, 1994). Tacitness is often associated with the work of Polanyi (1961), who asserts that we can know more than we can tell. Reed and Defillippi’s (1990) identify this construct as a source of ambiguity that raises barriers to imitation. Zander and Kogut (1995) establish empirically that the degrees to which manufacturing capabilities are codifiable and teachable (i.e., tacitness
according to these authors) significantly influences the speed of their transfer. Overall, tacitness is expected to increase the difficulty of imitation and decrease the mobility of knowledge. Thus, we hypothesize that:

**H1: Tacitness is positively related to knowledge ambiguity**

**Complexity**

Complexity refers to the number of interdependent technologies, routines, individuals, and resources linked to a particular knowledge or asset (Simonin, 1999). Complexity is expected to affect the comprehension of the totality of knowledge and to impair its transferability.

Grant (1996) argues that a wider span of a knowledge to be integrated leads to more complex problems in creating and managing organizational capability: transferring new capabilities requires integration across broad-spans of knowledge and expertise. Therefore, the complexity of knowledge could increase the difficulty of transferability of knowledge and the level of knowledge ambiguity. Thus, we hypothesize that:

**H2: complexity is positively related to knowledge ambiguity**

**Specificity**

Specificity refers to Transactions Cost’s asset specificity—i.e., durable investments that are undertaken in support of particular transactions (Williamson, 1985); transaction-specific skills and assets that are utilized in production processes and provision of services for particular customers (Reed and Defillippi, 1990). In Williamson’s (1999) terms, specificity is ‘the ease with which an asset can be redeployed to alternative uses and by alternative users without loss of productive value. Reed and Defillippi (1990) argue that dedicated assets (plants specifically designed for the production of goods and services for a specific customer) are protected by the security and exclusivity of the firm-customer relationship. That relationship between the firm and the customer produces ambiguity for rivals and creates a barrier to imitation. Simonin (1999) suggests that asset specificity is mainly considered a source of ambiguity and a barrier to transferability. Thus, we hypothesize that:

**H3: specificity is positively related to knowledge ambiguity**

According to resource-based view of knowledge, because valuable knowledge is unlikely to be distributed evenly across innovators, so that its ownership can potentially earn both Richardian and monopoly rents (Winter, 1998). In terms of individual firm, because knowledge ambiguity can increase the barrier to transferability, a firm’s critical knowledge will not easily been appropriated. So far as an alliance is concerned, knowledge ambiguity provides both a firm and its partners with certain level of ‘isolating mechanism’ against non-alliance firms, and thus can sustain the competitive advantages of an alliance. Therefore, knowledge ambiguity could have positive impact on alliance performance. Thus, we hypothesize that:

**H4: knowledge ambiguity is positively related to alliance performance.**

In the learning alliances, when the level of a firm’s knowledge ambiguity is high, knowledge is difficult to be transferred, and therefore the firm needs to build up greater relational capital in order to facilitate knowledge exchanging and creating activities with partners. Thus, we hypothesize that:

**H5: the higher level of knowledge ambiguity, the greater the relational capital.**

Firms have generalized institutional capabilities that may allow them to protect knowledge from expropriation and imitation more effectively than the limited and costly legal protections than are available in markets. By deploying institutional capabilities, firms can ensure that knowledge that arises within their organizational boundaries remains their own, unique asset for extended periods of time (Liebeskind, 1996). In a sense, a firm’s knowledge protection routines can prevent from knowledge leakage and increase the barrier to transferability. Thus, we hypothesized that:

**H6: The greater the extent to knowledge protection, the greater will be the knowledge ambiguity.**
Relational capital can help companies successfully balance the acquisition of new capabilities with the protection of existing proprietary assets in alliance situations. On the one hand, relational capital facilitates learning through close one-to-one interaction between alliance partners. On the other hand, it minimizes the likelihood that an alliance partner will engage in opportunistic behavior to unilaterally absorb or steal information or know-how that is core or proprietary to its partners (Kale, Singh, and Perlmutter, 2000). Hence, here we discuss relational capital from three dimensions: trust, commitment, and communication.

Trust
‘Trust’ has been referred to in several ways in the literature. First, it is considered ‘a type of expectation that alleviates the fear that one’s exchange partner will act opportunistically’ (Bradach and Eccles, 1989). Madhok (1995) suggests that trust between exchange partners has two components: a structural component which is fostered by a mutual hostage situation, and a behavioral component, which refers to the degree of confidence that individual partners have in the reliability and integrity of each other. Similarly, Gulati (1995) differentiates knowledge-based trust from deterrence-based trust. Knowledge-based trust emerges between two firms as they interact with each other and learn about each other, to develop trust around norms of equity. Deterrence-based trust is based on utilitarian considerations which lead a firm to believe that a partner will not engage in opportunistic behavior owing to the costly sanctions that are likely to arise. Mutual trust creates the basis for an enduring and effective relationship between contracting firms (Kale, Singh, and Perlmutter, 2000). Moreover, Kale et al., (2000) argue that trust-based relational capital can contribute to a freer and greater exchange of information and know-how between committed exchange partners. This is because decision-makers do not feel that they, have to protect themselves from the others’ opportunistic behavior (Blau, 1977; Jarillo, 1988).

Overall, we believe that strong relational capital between alliance partners facilitates greater learning across the alliance interface.

\[ H7: \text{Trust is positively related to relational capital.} \]

Commitment
Commitment refers to the willingness of trading partners to exert effort on behalf of the relationship (Porter et al., 1974). A high level of commitment provides the context in which both parties can achieve individual and joint goals without raising the specter of opportunistic behavior (Cummings, 1984). Because more committed partners will exert effort and balance short-term problems with long-term goal achievement, higher levels of commitment are expected to be associated with partnership success (Angle and Perry, 1981). Commitment suggests a future orientation in which partners attempt to build a relationship that can weather unanticipated problems (Mohr and Spekman, 1994).

\[ H8: \text{Commitment is positively related to relational capital.} \]

Communication
Three aspects of communication behavior are discussed here: communication quality, extent of information sharing between partners, and participation in planning and goal setting (Mohr and Spekman, 1994). Quality includes such aspects as the accuracy, timeliness, adequacy, and credibility of information exchanged (Daft and Lengel, 1986). Timely, accurate, and relevant information is essential if the goals of the partnership are to be achieved (Mohr and Spekman, 1994). Information sharing refers to the extent to which critical, often proprietary, information is communicated to one’s partner. Devlin and Bleackley (1988) argue that information sharing is an important predictor of partnership success. Participation refers to the extent to which partners engage jointly in planning and goal setting. Dwyer and Oh (1988) suggest that input to decisions and goal formulation are important aspects of participation that help partnerships succeed. When one partner’s actions influence the ability of the other to effectively compete, the need for participation in specifying roles, responsibilities, and expectations increases. Joint planning allows mutual expectations to be established and cooperative efforts to be specified (Mohr and Spekman, 1994).
In sum, more successful partnerships are expected to exhibit higher levels of communication quality, more information sharing between partners, and more participation in planning and goal setting than less successful partnerships. Thus, we hypothesize that:

\( H_9: \text{communication is positively related to relational capital.} \)

Because the relational capital can help develop trust with partners, facilitate communication with partners, and make commitment to alliances. All of these benefits can increase the knowledge accumulation, sharing and creating within partners, and therefore improve the alliance performance. Thus, we hypothesize that:

\( H_{10}: \text{The greater the extent to relational capital, the greater the alliance performance.} \)

Firms in industries may need to be able to access external sources of knowledge in order to stay abreast of the competition (Foray, 1991; Teece, 1992). However, accessing external sources of knowledge may require the firm to reveal some of its own valuable knowledge (Schrader, 1991), especially in the learning alliances. This will expose a firm under the risk of unwanted knowledge appropriation. Thus, a firm has the incentive to build up relational capital in order to decrease the risk of knowledge appropriation and facilitate cooperation with partners. During the process of building relational capital, a firm also need to set up a knowledge protection mechanism to manage and balance the inward and outward knowledge flow simultaneously, otherwise it couldn’t prevent itself from unilaterally leak its knowledge to the partners. In this context, knowledge protection mechanism is the antecedent of building up relational capital in alliances.

Knowledge protection mechanism can help a firm to develop relational capital while involved in alliances. In this article, we argue that knowledge protection mechanism is a set of formal routine, which focuses on top management, human resources, information flows, and partner access. Knowledge protection mechanism consists of a series of policies and rules, which helps control and monitor knowledge sharing and creating process in alliances. With a strong knowledge protection mechanism, a firm will be more willing and able to trust its partners, communicate with its partners, and make commitment to the alliance. Thus, we hypothesis that:

\( H_{11}: \text{The greater the extent to knowledge protection, the greater will be the relational capital.} \)

Alliance performance

Following various learning views on alliances (Hamel, 1991; Inkpen and Beamish, 1997; Khanna et al., 1998) and other perspectives, they suggest that alliances provide firms with valuable stepping-stones in order to commit sequentially in uncertain investment contexts (Balakrishnan and Koza, 1993; Kogut, 1991). We focus on a firm’s overall achievement of its objectives in the alliance as well as the degree to which the collaboration contributes to the firm’s accumulation of knowledge and to the creation of new opportunities for the firm.

We used thee perceptual indicators of alliance performance, which proposed by Zollo et al. (2002), to directly gauge the implications of alliances for partnering firms. First, Respondents indicated on a five-point Likert scale their satisfaction with the knowledge accumulated from participation in the collaborative agreement. Alliance research identifies knowledge accumulation as a key organizational out come of interfirm collaboration (Hamel, 1991; Inkpen and Beamish, 1997; Khanna et al., 1998). Second, respondents indicated the extent to which the alliance created new opportunities for the firm. Many alliances evolve beyond partnering firms’ initial expectations, and the real option view of alliances in particular emphasizes the creation of new, often unexpected, opportunities as an important source of value from collaboration (Kogut, 1991). Finally, to capture other elements of firms’ strategic intents in engaging in alliances, respondents were asked to rate the degree to which the alliance satisfied the partnering firm’s initial objectives. These three indicators were standardized and summed to construct a global measure of alliance performance.

RESEARCH METHODOLOGY

To understand the dynamics in learning alliances, we not only studied extant literature in the areas of strategic alliances but also supplemented this knowledge with fieldwork in a few companies. We used these two sources to
develop the theoretical model that addresses the research question. This exercise also provided richness of contextual detail permitting grounded specification of the framework and constructs. We then collected data that would allow us to test our framework and hypotheses.

Data collection and sample

Although in-depth interviews provide a rich tapestry of information, it was beyond the scope of this project to collect data through interviews from a large sample. Instead, we decided to collect the data through survey questionnaires administered to relevant managers across a large sample of alliances formed by Taiwan-based companies.

The population in this study is the top 5000 firms of Taiwan listed in the China Credit Information Service Incorporation. A random stratified sampling method was used to select 100 firms in each of the five 1000 levels. 500 questionnaires were mailed. Follow-up letters, emails and phone calls were done after two weeks. Of the 500 questionnaires mailed, 114 responses were received and 19 of them were incomplete. The remaining 95 valid and complete questionnaires were used for the quantitative analysis. It represents a useable response rate of 19%. Given our research question, it was necessary to study firms that have engaged in alliances and that operate in industries where alliances are a critical means of competing. Past research shows that industries such as pharmaceuticals, chemicals, computers, electronics, telecommunications, and services fall within this category (Culpan and Eugene, 1993).

RESULTS AND ANALYSIS

When multiple-item scales are used to measure latent constructs and a composite score based on these items is used in further analyses, it is important to assess the validity and reliability of the scales used (Gerbing and Anderson, 1988). Selection of scale items on the basis of prior literature, fieldwork, and pretesting of the survey instrument helped ensure content or face validity. To assess scale reliability, we computed Cronbach alphas for each multiple scale item and found these to be well above the cut-off value of 0.7 in each case (Nunnally, 1978).

Structural equation modeling is one useful technique that can handle multiple dependent relationships and latent variables. It consists of two stages: (a) a measurement model that assesses reliability and validity of the scales used to measure each latent construct, and (b) a structural model that lays out and estimates multiple dependent relationships between the constructs of interest. The true value of structural equation modeling comes from the benefit of analyzing the structural and measurement models simultaneously. An additional advantage of this technique lies in its ability to estimate a series of dependence relationships, wherein one dependent variable becomes the explanatory variable in subsequent relationships. It also allows researchers to assess the impact of explanatory variables on two or more dependent variables, at the same time (Hair et al., 1998).

Figure 1 provides the path diagram for the model that includes the multiple dependent relationships that we proposed. We estimate the model using the maximum likelihood estimation procedure of Amos 5.0, which is robust, efficient, and unbiased, when the assumption of multivariate normality is met (Joreskog and Sorbom, 1988). Results of the analysis are discussed in the following section.

The first step in structural modeling is to assess overall model fit with one or more goodness-of-fit measures. The first measure we report is the likelihood ratio chi-square of 166.307 (d.f.=139). If the model is to provide a satisfactory representation of the data, it is important for the chi-square value to be non-significant (p>0.05). The significance level of 0.057 for the chi-square of our model is beyond the usually acceptable threshold of 0.05, indicative of acceptable fit. The second measure we report is the normed chi-square (Joreskog, 1969), where the chi-square is adjusted by the degrees of freedom to assess model fit. Models with adequate fit should have a normed chi-square less than 2.0 or 3.0 (Carmines and McIver, 1981). With a normed chi-square of 1.196, the proposed model provides a fairly satisfactory representation of the data. The third measure reported is the GFI index. It is a non-statistical measure ranging in value from 0(poor fit) to 1(perfect fit). We get a GFI of 0.858 for our model, which is sufficiently close to the generally acceptable level of 0.9 (Hair et al., 1998). We also assessed the incremental fit of the model compared to the null model by examining the Norm Fit Index. The Normed Fit Index of 0.865 is sufficiently close to the desired threshold level of 0.90. Overall, although not perfect, the level of fit seems sufficient enough to proceed with the assessment of the
measurement and structural models. Because of the page limitation of this journal, the relevant tables and figures about measurement model fit are omitted, and only the table of structural model is left (see table 1).

According to table 1, ‘Knowledge protection’ is positively significant to both ‘knowledge ambiguity’ and ‘relational capital’. Meanwhile, ‘knowledge ambiguity’ is also positively significant to ‘relational capital’. Knowledge protection increases the level of knowledge ambiguity, and thus enhances a firm’s ability to protect its critical knowledge. Because higher level of knowledge ambiguity can increase the difficulty of knowledge transfer, a firm requires higher level of relational capital to facilitate the process of knowledge and resource exchange with partners. Moreover, knowledge protection mechanism can prevent a firm from knowledge appropriation by partners, and give a firm the confidence and ability to build up relational capital more actively.

Although most of all the parameter estimates are significant, there are differences in the level of significance. For ‘relational capital’, the estimate of knowledge ambiguity is slightly higher than that of knowledge protection. This could imply that knowledge transfer concern is slightly more important than the knowledge protection concern when building up relational capital with partners in alliances. Moreover, ‘Relational capital’ has the highest estimate value on ‘Alliance performance’, and ‘knowledge ambiguity’ alone is not significant to ‘Alliance performance’.

Statistically, it is possible to estimate several more models to examine which of them explains the data best. However, in this paper our primary goal in using structural modeling is to assess the basic adequacy of a model that simultaneously accounts for the multiple dependent relationships that we theoretically propose, rather than to ex post identify the best-fitting model that had not been theoretically proposed ex ante. Because these relationships could probably address very different questions from the one proposed here, we are not intended to test competing models that estimate other theoretically plausible relationships between the constructs.

DISCUSSION AND CONCLUSION

The aim of this study is to advance our understanding of the process of knowledge protection in strategic alliances. It revealed that both knowledge-specific variables and relation-specific variables impacted and also influenced by this process. The study further established the critical role played by the construct ‘knowledge protection’ by showing that it enhances a firm’s knowledge ambiguity in the relational capital context.

From our findings, knowledge protection mechanism could prevent from knowledge appropriation, and contribute to building up of a firm’s relational capital. Moreover, higher level of knowledge ambiguity would increase the need for a firm to build up relational capital, especially in alliances. This conclusion is supplement to the relational view of competitive advantage offered by Dyer and Singh (1998), who suggest that trust-based governance is an important source of inter-organizational rents, because it provides alliance partners with appropriate incentives to share valuable knowledge with each other. We argue that a firm with strong knowledge ambiguity would raise the need to building relational capital, especially in strategic alliance context. With higher level in knowledge ambiguity, firms’ various kinds of knowledge will be difficult to be transferred. Thus, it requires relational capital playing the role of ‘bridge’ to facilitate knowledge transfer and maintaining certain amount of knowledge flow and exchange among partners, or otherwise the alliance will collapse.

Knowledge protection is the antecedent of both knowledge ambiguity and relational capital in balancing and strengthening both intra-organizational knowledge protecting mechanism and inter-organizational cooperative capability. First, a firm’s knowledge protection routines will increase a firm’s knowledge ambiguity, in that knowledge protection routines can prevent from knowledge leakage and increase the barrier to transferability. Second, knowledge protection is the antecedent of building up relational capital. Before building relational capital, a firm also need to set up a knowledge protection mechanism to manage and balance the inward and outward knowledge flow simultaneously, otherwise it couldn’t prevent itself from unilaterally leak its knowledge to the partners. Moreover, a firm’s knowledge ambiguity suggests the need to build up relational capital in order to facilitate knowledge exchange. From our findings, we conclude, the higher the level of knowledge ambiguity, the greater the relational capital.

We argue that knowledge protection is a kind of organizational capability, which can both sustain a firm’s competitive advantage and enhance alliance performance. Not all firms may be equally competent at deploying their
institutional capabilities to protect their knowledge. Some firms may be more efficient than others at impeding knowledge flows to rival firms (Liebeskind, 1996). Thus, we would expect to observe differences in profits among firms are that firms have differences in their protective capabilities. From our findings, although knowledge ambiguity is not significant to alliance performance directly, through relational capital, knowledge ambiguity can still have positive impact on alliance performance indirectly. In order to enhance alliance performance, the results point to the importance of building up knowledge protection mechanism and relational capital simultaneously.

The contributions and limitations of the present study indicate several additional avenues for future research. The study of the implications of knowledge protection remains one of the more important yet difficult areas of research on inter-firm collaboration, and future research similarly needs to move beyond relational capital and knowledge ambiguity to study the ways that knowledge protection affect participation organizations.

APPENDIX

Figure 1 Path diagram (structural modeling)

Table 1 Structural model: Parameter estimates

<table>
<thead>
<tr>
<th>Construct relationship</th>
<th>Standardized parameter estimate</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Knowledge protection --&gt; Knowledge ambiguity</td>
<td>0.514</td>
<td>***</td>
</tr>
<tr>
<td>Knowledge protection --&gt; Relational capital</td>
<td>0.326</td>
<td>**</td>
</tr>
<tr>
<td>Knowledge ambiguity --&gt; Relational capital</td>
<td>0.411</td>
<td>***</td>
</tr>
<tr>
<td>Knowledge ambiguity --&gt; Alliance performance</td>
<td>0.065</td>
<td>N.S.</td>
</tr>
<tr>
<td>Relational capital --&gt; Alliance performance</td>
<td>0.819</td>
<td>***</td>
</tr>
</tbody>
</table>

NFI=0.865  $\chi^2$(139 d.f.) = 166.307  GFI=0.858  $\chi^2$/ d.f. = 1.196

REFERENCES


