The effects of interpartner resource alignment and absorptive capacity on knowledge transfer performance

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Against a background of increasing international competition and rapid technological change, universities and industry have often engaged in collaboration as a means of improving cross-unit transfers of the resources, capabilities, and knowledge. Following this frontier, this study examines the effects of university and firm interpartner resource alignment and absorptive capacity on knowledge transfer performance from the university-industry (U-I) perspective. Regression analysis is used to test the hypotheses in a sample of 120 Taiwanese firms. The research findings suggest that, interpartner resource utilization is positively related to U-I interaction; that when the effect of a firm’s absorptive capacity is higher, U-I interaction is more favorable; and that U-I interaction is positively related to knowledge transfer performance. Our empirical results support the process-oriented view and indicate that U-I interaction plays the mediating role between resource alignment, absorptive capacity and knowledge transfer performance. The implications of this study are two-fold. First, it emphasizes the value of creative financial and general performance in knowledge transfer by incorporating the U-I interaction perspective. Second, the research results offer support for suggestions that interpartner resource alignment provides a necessary element for capacity and resource exchange. Hence, one interesting further research would analyze practical cases of some Taiwanese companies with the described approach. This is an important practical issue that should be examined in the future.

Key words: Absorptive capacity, knowledge transfer performance, interpartner resource alignment, university-industry (U-I) interaction.

INTRODUCTION

Against a background of increasing international competition and rapid technological change, universities and industry have often engaged in collaboration as a means of improving cross-unit transfers of the resources, capabilities and knowledge that they regard as the sources of their respective sustainable competitive advantages. There are a number of compelling reasons for universities and industry to undertake activities related to collaborative research, talent transfer, patent grants, spin-outs or equity participation. For example, the costs of research have risen dramatically and universities are, of necessity, increasingly seeking financial support from industry because conventional sources of funding, such as the government, have been systematically eroded (Davies, 1996).

Moreover, firms’ attempts to be self-sufficient in creating knowledge are quite risky, with a significant chance of not being successful, whereas, working with universities, academics, and research institutions can considerably improve their chances of gaining valuable knowledge. Successful companies are able to create knowledge within their boundaries as well as expose themselves to a variety of new knowledge from outside in order to prevent rigidity and encourage reshaping of their own competencies (Leonard-Barton, 1995; Gold et al., 2001; Chen and Lin, 2003). Therefore, a firm’s competitive advantage increasingly depends not only on its internal capacities and resources, but also on the external collaborations that it pursues, with universities and research institutions often providing key knowledge and
and abilities that would otherwise be inaccessible (Parkhe, 1991; Barnes et al., 2002). University-industry (U-I) collaboration thus constitutes perhaps the most appropriate, but challenging, vehicle for internalizing the competencies of each side of the partnership, and such partnerships are becoming an essential feature of many firms’ overall corporate strategy.

Owing to the increasing importance of U-I partnerships, the rate at which firms have been formally collaborating with such institutions has increased dramatically over the last two decades. Indeed, since the 1980s, many countries have implemented specific policies to promote and sustain U-I interactions. In light of this phenomenon, an increasing number of academic studies have attempted to understand, explain and justify these interactions in economic terms (Fontana et al., 2006). In Taiwan, since the passage of the Science and Technology Basic Law in 1999, U-I collaborations have been analyzed mainly from a qualitative point of view or by relying on case studies from the universities’ side (Woodcock and Chen 2000; Chang et al., 2006, 2004). These studies have examined mainly activities related to innovation, such as patenting, licensing and incubating startups, in the context of Taiwanese higher educational institutions (Chang et al., 2006). However, very little research has been undertaken with the support of systematic data analysis from the side of the related firms. Commercial knowledge, transferred from universities to practitioners, has helped to develop new technologies or to apply new knowledge as an engine of economic growth (Siegel et al., 2003). However, despite the potential importance of such U-I collaborations, many do not achieve their goals of knowledge transfer and often fail outright (Kenney, 1987). Consequently, there is still a need for a more systematic understanding of the organizational practices involved in successful U-I collaboration and knowledge transfer (Barnes et al., 2002).

This study primarily examines the role of U-I interaction between specific theoretically plausible variables and knowledge transfer performance. Once firms decide to establish U-I collaboration for transferring knowledge from academia and research institutions, some questions arise: first, does U-I interaction intervene between a firm’s interpartner resource alignment and knowledge transfer performance in any important way? Interpartner resource alignment is the way in which the resources of partners are matched and integrated in an alliance (Das and Teng, 2003). This alignment may provide the support and incentives necessary to promote such collaborations, because the more reliant a firm is on the resources of its academic partner, the more it will try to manage the relationship well. Some prior studies have emphasized the importance of social interaction between organizations in dealing with knowledge exchange (Chen, 2007; Kanter, 1988; Lovelace et al., 2001), and it has also been shown that organizations can leverage valuable resources and knowledge by interacting with one another (Hansen, 1999; Kogut and Zander, 1992).

However, little empirical work has been done in examining specifically, the role of interpartner interaction between universities and industry with regard to knowledge transfer. Consequently, in this study, we first adopt the process-oriented view to investigate the mediating effect of this interaction on the relationship between interpartner resource alignment and knowledge transfer performance.

Secondly, we examine how U-I interaction affects the relationship between absorptive capacity and knowledge transfer performance. The characteristic of absorptive capacity has been recognized as a prolonged process of investment and knowledge accumulation within the firm, and its development is path-dependent (Mowery et al., 1996). Moreover, the ability to absorb knowledge is an imperative condition for a firm’s successful exploitation of knowledge outside its boundaries (Chen, 2004). However, in the related literature, little work has been done in investigating the role of absorptive capacity in the process or outcome of the knowledge transfer performance. This deficiency is serious, because the absorptive capacity of the organization’s members is primarily responsible for the successful learning or transfer of knowledge from outside a firm’s boundaries. Therefore, in this study, we attempt to examine whether absorptive capacity directly affects the outcome of knowledge transfer, or whether it has an indirect effect on knowledge transfer through intermediate variables such as U-I interaction.

Finally, we focus this study on the industrial firm side of this relationship for two reasons. First, in Taiwan, several National Science Council (NSC) research initiatives have already looked at the university side (Chang et al., 2004, 2006), while neglecting the industry perspective. Second, university research centers and firms have different motivations for collaborating with one another (Santoro and Gopalakrishnan, 2004; Barnes et al., 2002), and a better understanding of these from the industry side will both address the gaps in the current literature and aid the successful planning and implementation of such partnerships in the future. Accordingly, the main purpose of this study is to examine the intermediate roles of U-I interaction on the relationship between the university and firm’s interpartner resource alignment, absorptive capacity, and knowledge transfer performance. The rest of the paper is organized as follows. Section 2 considers the previous literature and sets forth the hypotheses of this study; the methodology is presented in Section 3. Section 4 presents the results of the empirical study and Section 5 provides the discussion and conclusions of this work.

LITERATURE REVIEW AND HYPOTHESES

Interpartner resource alignment

Scholars have confirmed that the relative resources of each partner play a critical role in a strategic alliance (Wernerfelt, 1984; Majumdar, 1998; Das and Teng, 2000).
and a number of resource typologies have been proposed: tangible and intangible resources (Grant, 1991); physical, human and organizational capital resources (Barney, 1991); financial, physical, managerial, human, organizational and technological resources (Hofer and Schendel, 1978); and property- and knowledge- based resources (Miller and Shamsie, 1996). U-I collaboration is one kind of strategic alliance that pursues mutual strategic objectives - including joint ventures, joint production, joint R&D, licensing (Das and Teng, 2003), collaborative research, talent transfer, patent grants, spin-outs and equity participation - by developing and exploiting the resource bases of both partners (Das and Teng, 2000a).

Resource analysis is thus one element of partner analysis, with resource alignment referring to how the resources contributed by partners are matched in various ways (Das and Teng, 2003). In more detail, Das and Teng (2000a) propose that resource alignment should encompass both resource similarity and resource utilization in such collaborations.

Resource similarity is defined, following Chen (1996: 107), as the extent of the resource contribution of each partner that is "comparable, in terms of both type and amount." Moreover, Reagans and McEvily (2003) argued that, it is easier to transfer knowledge from the source to a recipient when both parties have knowledge in common. Consequently, knowledge is more likely to be transferred between a university and an industry with similar resources and background characteristics. We thus conclude that resource similarity will be positively related to the performance of knowledge transfer in a U-I collaboration.

Resource utilization on the other hand, refers to the degree to which the resources contributed are used to achieve the goals of the alliance (Das and Teng, 2000a). Resource utilization is an important function in a resource-based perspective, along with the functions of resource accumulation and capability building, since management capabilities are also revealed by a firm’s efficiencies. In order for resources to be acquired and effectively employed, firms must be willing to facilitate social interaction that can serve as the conduit for knowledge flow, further strengthening the partnership. Thus, since the acquisition and use of resources are predominantly social processes (Kogut and Zander, 1992), resource utilization itself may be a critical factor contributing to the long-term social interaction between universities and firms that is necessary for a productive relationship to be maintained.

Accordingly, U-I interaction among partners would be influenced by the interpartner resource alignment. If the university possesses a strong resource base, its partner firms would want to develop their relationships with it in order to gather and share knowledge. As Seabright et al. (1992: 124) note, the criterion for partner selection is "the fit between one organization’s resource needs and another’s resource provision." We thus argue that, interpartner resource alignment plays a critical role in U-I interaction. Therefore, we would expect that interpartner resource alignment, in terms of similarity and utilization, can provide a positive contribution to the U-I interaction. Thus, the following hypothesis is proposed:

H₁: The degree of resource similarity and resource utilization is positively related to U-I interaction.

Absorptive capacity

In addition to resource alignment, absorptive capacity is also likely to affect the U-I interaction among collaborative partners. Cohen and Levinthal (1990) define absorptive capacity as a firm’s ability to recognize the value of new, external knowledge, to assimilate it and to apply it to commercial ends. This definition succinctly captures the steps involved in the inter-organizational learning process (Lane and Lubatkin, 1998). Through learning, firms can speed capability development and minimize their exposure to technological uncertainties by acquiring and exploiting knowledge developed by others (Grant and Baden-Fuller, 1995). Absorptive capacity plays an essential role in sharing a partner’s knowledge and influencing the perception of knowledge transfer; thus, absorptive capacity remains part of a firm’s competitive advantage. One of the keys to keeping a competitive advantage is to foster the relationship of trust and coordination between the university and firm. Nicholls-Nixon (1993), examining the role of absorptive capacity in pharmaceutical firms, found that those with high levels of absorptive capacity invested more in effectively managing their communication behaviors with collaborative partners. Gambardella (1992) further argued that higher levels of absorptive capacity would improve a firm’s ability to exploit sources of technical knowledge outside its boundaries (1990). Understanding relevant knowledge permits firms to understand the assumptions that shape it and thereby, be in a better position to evaluate the importance of new knowledge for its own operations (Lane and Lubatkin, 1998).

Communication behaviors, such as coordination, interdependence and trust, are important attributes of partnerships (Anderson and Narus, 1990; Day and Klein, 1987; Frazier et al., 1988; Salmond and Spekman, 1986). The existence of these attributes implies that both partners acknowledge their mutual dependence and willingness to work for the survival of the relationship (Mohr and Spekman, 1994). Partners who have rapport, effective channels of coordination and mutual trust, are more likely to engage in a successful collaboration. Because trust and coordination processes underlie most aspects of U-I effective collaboration, a mutually trusting relationship and coordinated actions are critical to U-I interaction, and universities and firms can achieve this kind of relationship by formulating a common recognition.
With an appropriate absorptive capacity, when U-I members of collaborative projects encounter certain problems, they are more likely to participate actively in their work teams and to interact with each other to find the necessary solutions (Hoegl et al., 2003). Moreover, when collaborative partners possess a higher level of absorptive capacity, members are more inclined to develop mutual trust and coordination from their increased level of interaction and therefore, to be more able to exchange knowledge that will improve organizational performance.

Trust is a critical part of absorptive capacity because it encourages the “teacher” firm to help the “student” to apply the knowledge it is offering (Lane et al., 2001). Trust functions as an ongoing social control mechanism and risk reduction device (Gulati, 1995; Florin, 1997), influencing both the extent of knowledge exchanged in U-I collaboration (Inkpen, 1997; Inkpen and Currall, 1997; Johnson et al., 1996; Lyles and Baird, 1994; Smith et al., 1995) and the efficiency with which it is exchanged (Kogut, 1988; Parkhe, 1991). Following this line of logic, the following hypothesis is proposed:

\[ H_2: \text{The degree of absorptive capacity is positively related to U-I interaction.} \]

**University-industry interaction**

U-I interaction refers to the extent to which university and industry members interact with each other in terms of trust and coordination. Several prior studies recognized the importance of interorganization social interaction for enabling knowledge transfer performance among strategic alliance partners (Barnes et al., 2002; Hoegl et al., 2003; Janz, et al., 1997; Koskinen et al., 2003; Inkpen and Tseng, 2005). Chen (2004) has argued that performance generally depends on transaction costs, which in turn reflect the level of trust. Without trust, transaction costs tend to be high because more monitoring and safeguards against opportunistic behavior are needed (Casson, 1991). To this end, Larsson et al. (1998) concluded that successful collaborations rarely depend on formal contracts for compliance, and thus, trust is the necessary component for successful strategic arrangements. Barnes et al. (2002) examined six collaborative research projects, identified factors that, if managed correctly, increase the probability that a collaboration will be perceived as successful by both academic and industrial partners and found that trust is an important characteristic of successful collaborations. However, trust takes considerable time to develop among partners, particularly among companies keen to protect technological advantages in a highly competitive industry. Considering this problem, Bartol and Srivastava (2002) suggested that mutual understanding and trust among work partners can allow companies to release valuable and previously private information and to make efforts to integrate their distributed expertise more efficiently.

Trusting relationships thus improve the willingness of partners to exchange and absorb information, thereby leading to even greater knowledge sharing (Bouty, 2000; Levin and Cross, 2004; Tsai and Ghoshal, 1998).

In addition to trust, coordination also affects the sharing and utilization of tacit knowledge between universities and industry. The U-I relationship among different organizational members is an important forum in which members can share their tacit knowledge and its subsequent application (Bartol and Srivastava, 2002; Levin and Cross, 2004; Singh, 2005). Because of the complexity of transforming organizational tacit knowledge into a shared understanding of explicit knowledge, the development and growth of interaction networks would increase the likelihood that important information is passed on and remembered over time (Hoegl et al., 2003; Singh, 2005). Thus, the establishment of U-I interaction networks is necessary for organizational members to foster the knowledge variety required for the work (McGrath, 2001) and for the timely integration of knowledge across organizational boundaries (Szulanski, 1998). Through U-I interaction, the diverse knowledge and expertise of organizations from various functional areas can be assembled, integrated and applied to the task at hand.

Accordingly, we can expect that when U-I interaction, including trust and coordination, is more favorable during the period of collaboration, the outcome of knowledge transfer will be more satisfactory. Following this line of reasoning, the following hypothesis is proposed:

\[ H_3: \text{The degree of trust and coordination of U-I interaction is positively related to knowledge transfer performance.} \]

**Mediating effect**

\[ H_4: \text{U-I interaction mediates the effect of interpartner resource alignment and absorptive capacity on knowledge transfer performance.} \]

\[ H_5: \text{The degree of trust and coordination of U-I interaction is positively related to knowledge transfer performance.} \]
resource alignment on knowledge transfer performance. 

H$_5$: U-I interaction mediates the effect of absorptive capacity on knowledge transfer performance.

**RESEARCH METHODS**

**Data collection and sample**

To conduct the empirical study, a questionnaire approach is designed to collect data for testing the validity of the model and research hypotheses. Variables in the questionnaire included background information, resource alignment, absorptive capacity, U-I interaction, and knowledge transfer performance. All of the independent and dependent variables were based on a seven-point Likert-type scale ranging from “strongly disagree” to “strongly agree.” The population in this study was the top 5,000 Taiwanese firms listed in the yearbook published by the China Credit Information Service Incorporation. A stratified random sampling method was used to select 120 firms in each of the five levels of 1,000 firms, and 600 questionnaires were distributed with a request that they be completed by top executives (that is, Presidents, Vice-Presidents, Directors or General Managers) who were familiar with the topic of this study. Follow-up letters, emails and phone calls were undertaken after three weeks. Of the 130 returned questionnaires, 10 responses were incomplete, and the remaining 120 complete and valid questionnaires were used for the quantitative analysis, representing a usable response rate of 20.0%. Appendix A presents the comparisons of some characteristics between respondent and non-respondent groups. The possibility of a non-response bias was checked by comparing the characteristics of the respondents to those of the original population sample. The calculated t-statistics for the capital (t = 1.757, p = 0.581), the firm’s age (t = 0.562, p = 0.575), and the industry type of the company (t = -0.298, p = 0.765) were all statistically insignificant, suggesting that there were no significant differences between the respondent and non-respondent groups.

**Measures**

**Dependent variable**

In this study, the knowledge transfer performance construct was adopted from the work of Yli-Renko et al. (2001) and Chen (2004). A nine-item scale was developed to measure the degree to which the knowledge acquired contributed to the firm’s innovativeness in terms of improving financial performance, strengthening innovation capacity and shortening innovation process and thus the transferred knowledge can enhance 1) the company’s sales, 2) the company’s unit gross profit and 3) the company’s average net profit. In addition, 4) the degree to which the company can acquire the targeted knowledge and the knowledge acquired contributes to 5) the company’s technology development, 6) new product development, 7) human resource quality, and 8) production efficiency and 9) it shortens the time period required for innovation. The Cronbach’s α coefficient was computed to assess the internal consistency reliability of the variables, and it was above the suggested value of 0.70 (Hair et al., 1998).

**Independent variables**

The interpartner resource alignment construct was assessed with an eight-item scale, whereby the resources of partner firms are matched and integrated in a U-I collaboration. Based on the work of Das and Teng (2003), we adopted two dimensions of resource alignment, namely, resource similarity and resource utilization. The Cronbach’s α coefficients were computed to assess their internal consistency and for both dimensions it was over 0.70 (Hair et al., 1998). The similarity factor was measured with a four-item scale to assess how much the informants agreed with the following statements: the company and partner offer extremely similar 1) physical resources for the project, 2) financial resources for the project, 3) knowledge resources for the project, 4) managerial resources for the project (α = 0.803). In addition, four indicators measuring resource utilization reflected whether the project made efficient use of the company’s 1) physical resources, 2) financial resources, 3) knowledge resources and 4) managerial resources (α = 0.852).

The construct of absorptive capacity was assessed with eight items that reflected the extent to which firms assimilated and replicated the knowledge gained from external sources (Cohen and Levinthal, 1990; Szulanski et al., 2004), and the Cronbach’s α coefficient for this factor was above the suggested value of 0.70 (Hair et al., 1998). An eight-item scale was used to measure this dimension, reflecting whether the recipient 1) had a common language for dealing with the practices, 2) had a vision of what was supposed to be achieved through the transfer, 3) had information on state of the art related practices, 4) had the necessary skills to implement the practices, 5) had the technical competence to absorb the practices, 6) had the managerial competence to absorb the practices, 7) was aware who could best exploit new information about the practices, and 8) was aware of who could help solve problems associated with the practices (α = 0.889).

The U-I interaction construct was based on seven items, adapted from Sivadas and Dwyer (2000), to reflect the degree of interaction among the members of the university and industry collaboration. According to Sivadas and Dwyer (2000), the two factors of the U-I interaction construct are trust and coordination. The trust factor was assessed by an eight-item scale aimed at measuring the extent to which collaboration partners 1) are capable of fulfilling their roles, 2) have high integrity, 3) could be counted on to do the right thing, 4) have motives that do not need to be questioned, 5) can be trusted to act in the company’s best interests, 6) could be informed of changing project needs, 7) could share proprietary information, and 8) could provide helpful information (α = 0.942). The coordination factor was reflected by two items: 1) people from the different organizations worked together and planned their assignments well and 2) the routines of the different organizations that had to work with one another were well established (α = 0.924). The Cronbach’s α coefficients for both factors were found to be above the threshold of 0.70 (Hair et al., 1998).

**Control variables**

Three control variables were included in the analysis. The first two control variables, firm size and age, may influence knowledge transfer performance because differences in these variables could lead to different organizational characteristics and resource deployment. Also, firms in different industries may behave differently in the process of knowledge transfer. Consequently, these three variables were included as controls to measure their potential effects. Firm size was measured as the amount of capital in NT dollars, while firm age was calculated as the number of years from the founding date. A dummy variable was included for the industry type to indicate whether a firm belonged to a manufacturing or high technology industry (general manufacturing industry = 1, high technology industry = 2).

**RESULTS**

This study investigates the relationships among
interpartner resource alignment, absorptive capacity, U-I collaboration, and firms' knowledge transfer performance, as shown in Figure 1. Table 1 shows the means, standard deviations, and correlations for all the variables measured in this study. The values of variance inflation factors (VIFs) associated with each of the predictors are within a range from 1.221 to 1.592, with a mean of 1.428. The effects of multicollinearity are within acceptable limits, suggesting no need for concern with respect to multicollinearity (Hair et al., 1998).

Table 2 displays the results of the regression analyses of the effects of resource alignment and absorptive capacity on U-I interaction. Models 1a and b in Table 2 are the base models that include the three control variables. They indicate that this combination of variables does not have any significant effect on the dependent variable (F = 1.09, \( R^2 = 0.03 \); F = 1.45, \( R^2 = 0.04 \)). Models 2a and b capture the effects of resource alignment on U-I interaction. These two models are significant at the p < 0.001 level (F = 7.56, \( R^2 = 0.25 \); F = 6.25, \( R^2 = 0.22 \)) and explain an additional 22 and 18% of variance over what the control variables alone explain, respectively. The coefficients for resource utilization are positive and statistically significant for trust (p < 0.001) and for coordination (p < 0.001), indicating that firms would achieve a higher degree of U-I interaction if they developed better interpartner resource alignment. Conversely, resource similarity is statistically insignificant for trust and coordination. These findings partially support H1 - that resource alignment is positively related with U-I interaction.

Models 3a and b show the relationships between absorptive capacity and U-I interaction. These two models are significant at the p < 0.001 level (\( R^2 = 0.37, F = 16.53 \) and \( R^2 = 0.20, F = 7.26 \)), explaining an additional 12% of variance over what the control variables alone explain. The coefficients of the absorptive capacity are positive and statistically significant for trust (p < 0.001) and for coordination (p < 0.001), indicating that organizational members interact more favorably if they have more absorptive capacity.

Further, we examined how U-I interaction affects knowledge transfer performance, and the results are shown in Table 3. Models 4a and b are the base models that include the control variables. They indicate that this combination of variables does not have significant
Table 2. Results of regression analyses of university-industry interaction*.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Trust</th>
<th>Coordination</th>
<th>Trust</th>
<th>Coordination</th>
<th>Trust</th>
<th>Coordination</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>M1a</td>
<td>M1b</td>
<td>M2a</td>
<td>M2b</td>
<td>M3a</td>
<td>M3b</td>
</tr>
<tr>
<td>Firm age (Log)</td>
<td>0.51</td>
<td>0.59</td>
<td>0.41</td>
<td>0.38</td>
<td>0.26</td>
<td>0.34</td>
</tr>
<tr>
<td>Industry typeb</td>
<td>0.18</td>
<td>0.50*</td>
<td>0.05</td>
<td>0.46</td>
<td>0.05</td>
<td>0.37</td>
</tr>
<tr>
<td>Capital</td>
<td>-0.03</td>
<td>-0.06</td>
<td>-0.05</td>
<td>0.07</td>
<td>-0.03</td>
<td>-0.06</td>
</tr>
<tr>
<td>Resource similarity</td>
<td>-0.11</td>
<td>0.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource utilization</td>
<td>0.43***</td>
<td>0.46***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorptive capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73***</td>
<td>0.72***</td>
</tr>
</tbody>
</table>

$R^2$ 0.027 0.036 0.249 0.215 0.365 0.202  
F 1.09 1.45 7.56*** 6.25*** 16.53*** 7.26***

*p<0.05 ** p<0.01 ***p<0.001; n=120 (two tailed test); bDummy variable coded as manufacturing industry, 1; high technology industry, 2.

Table 3. Results of regression analyses of mediating effect*.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Financial</th>
<th>Generality</th>
<th>Financial</th>
<th>Generality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M4a</td>
<td>M4b</td>
<td>M5a</td>
<td>M5b</td>
</tr>
<tr>
<td>Firm age (Log)</td>
<td>-0.05</td>
<td>0.60*</td>
<td>-0.41</td>
<td>0.28</td>
</tr>
<tr>
<td>Industry typeb</td>
<td>0.38</td>
<td>0.33</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>Capital</td>
<td>-0.10</td>
<td>-0.05</td>
<td>0.07</td>
<td>-0.02</td>
</tr>
<tr>
<td>Trust</td>
<td></td>
<td></td>
<td>0.35**</td>
<td>0.43***</td>
</tr>
<tr>
<td>Coordination</td>
<td></td>
<td></td>
<td>0.31***</td>
<td>0.16**</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.050</td>
<td>0.048</td>
<td>0.300</td>
<td>0.385</td>
</tr>
<tr>
<td>F</td>
<td>2.05</td>
<td>1.95</td>
<td>9.78***</td>
<td>14.30***</td>
</tr>
</tbody>
</table>

*p<0.05 ** p<0.01 ***p<0.001; n=120 (two tailed test); bDummy variable coded as manufacturing industry, 1; high technology industry, 2.

effects on the dependent variable. Models 5a and b in Table 3 present the effects of the two U-I interaction factors, trust and coordination, on knowledge transfer performance. These two models are significant ($p < 0.001$), yielding an $R^2$ of 0.30 and 0.39, and $F = 9.78$ and 14.3, respectively. The results for trust ($p < 0.001$) in Model 5a and for coordination ($p < 0.001$) in Model 5b suggest that they are significant determinants of knowledge transfer performance. The positive and significant coefficients indicate that the degree of knowledge transfer performance is enhanced when the organizational members trust each other and coordinate their actions more frequently and effectively. In summary, these two factors of U-I interaction have the expected signs and also have significant effects on knowledge transfer performance. Accordingly, $H_3$ is supported.

A sequential procedure, recommended by Baron and Kenny (1986), is then employed to test the mediating effects of U-I interaction knowledge transfer performance. In the first step of the analysis, the dependent variable, knowledge transfer performance, was separately regressed on interpartner resource alignment and absorptive capacity. The results of Models 6a and b indicate that one of the interpartner resource alignment factors, resource utilization, has a significant effect on knowledge transfer performance but that resource similarity has no significant effect. The results of Models 8a and b in Table 4 indicate that absorptive capacity has significant effects on knowledge transfer performance. In the second step, the mediator, U-I interaction, was regressed on the independent variables, interpartner resource alignment, and absorptive capacity. The results, shown in Models 2a, 2b, 3a and 3b in Table 2, indicate that interpartner resource alignment and absorptive capacity have significant effects on U-I interaction. The third step was to examine the relationship between the mediator and the dependent variable and the results, shown in Models 5a and b in Table 3, indicate that U-I interaction has a significant effect on knowledge transfer performance. Lastly, the mediator, U-I interaction, was included in the models to examine whether it reduces the effects of the antecedents to non-significance. Mediation occurs if the
DISCUSSION

This study proposes a conceptual model for examining the role of U-I interaction among interpartner resource alignment, absorptive capacity and knowledge transfer performance. Our regression analysis results indicate that, in general, if firms and universities possess a high degree of interpartner resource utilization, the U-I interaction among them will be more favorable and thus, the degrees of knowledge transfer performance will be enhanced. These findings show that each partner’s resource utilization can promote the firm’s financial performance and deliver a higher degree of knowledge application and innovation in knowledge transfer performance, primarily through the mediating effects of U-I interaction. The main point is that interpartner resource alignment works its beneficial effect on knowledge transfer performance through increasing trust and coordination behaviors among firms and universities. The present results are also quite instructive in helping to explain the effects of absorptive capacity on knowledge transfer performance. If the characteristics of absorptive capacity are more clearly recognized and applied more efficiently, the U-I interaction will be more favorable and the level of knowledge transfer performance will be further enhanced. Absorptive capacity can lead to favorable U-I interaction, which in turn results in improvements to financial performance, technology development, new product development and human resource quality, as well as shortening the time required for innovation. Thus, U-I interaction plays a mediating role in the relationship between absorptive capacity and knowledge transfer performance. There are several theoretical implications in the study:

1. Our research findings contribute by incorporating the U-I interaction perspective into the knowledge transfer performance literature by showing that U-I interaction is effective for financial and general performance in knowledge transfer. The existing knowledge transfer performance literature (Chen, 2004; Kotabe et al., 2003) emphasizes the value of creative financing and promoting innovation to generate new products and technology. Our work provides support for the arguments of prior studies (Bartol and Srivastava, 2002; Hoegl et al., 2003; Janz et al., 1997; Koskinen et al., 2003; Nahapiet and Ghoshal, 1998) that U-I interaction among partner members and their networks of interrelationships enable firms not only to have access to capacity and resource, but also to transfer and utilize knowledge efficiently.

2. Our study contributes to the literature by investigating factors that may promote network building by different organizations. By specifying the critical antecedents of U-I interaction behaviors, we show that interpartner members with a higher degree of resource utilization are more inclined to build up a higher degree of U-I interaction.

Table 4. Results of regression analyses of mediating effect*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Finance (M6a)</th>
<th>Generality (M6b)</th>
<th>Finance (M7a)</th>
<th>Generality (M7b)</th>
<th>Finance (M8a)</th>
<th>Generality (M8b)</th>
<th>Finance (M9a)</th>
<th>Generality (M9b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm age (Log)</td>
<td>-0.23</td>
<td>0.48</td>
<td>-0.42</td>
<td>0.28</td>
<td>-0.21</td>
<td>0.44</td>
<td>-0.408</td>
<td>0.28</td>
</tr>
<tr>
<td>Industry type</td>
<td>0.30</td>
<td>0.24</td>
<td>0.18</td>
<td>0.16</td>
<td>0.30</td>
<td>0.25</td>
<td>0.168</td>
<td>0.17</td>
</tr>
<tr>
<td>Capital</td>
<td>-0.11*</td>
<td>-0.06</td>
<td>-0.08</td>
<td>-0.03</td>
<td>-0.09</td>
<td>-0.05</td>
<td>-0.065</td>
<td>-0.02</td>
</tr>
<tr>
<td>Resource similarity</td>
<td>0.01</td>
<td>-0.05</td>
<td>0.01</td>
<td>-0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource utilization</td>
<td>0.49***</td>
<td>0.37***</td>
<td>0.27*</td>
<td>0.15*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorptive capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td></td>
<td>0.24*</td>
<td>0.37***</td>
<td>0.36**</td>
<td>0.42***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordination</td>
<td>0.24**</td>
<td>0.13*</td>
<td></td>
<td></td>
<td>0.31***</td>
<td>0.15*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.243</td>
<td>0.233</td>
<td>0.345</td>
<td>0.408</td>
<td>0.129</td>
<td>0.190</td>
<td>0.300</td>
<td>0.386</td>
</tr>
<tr>
<td>F</td>
<td>7.30***</td>
<td>6.92***</td>
<td>8.44***</td>
<td>11.03***</td>
<td>4.24**</td>
<td>6.77***</td>
<td>8.08***</td>
<td>11.85***</td>
</tr>
</tbody>
</table>

*p<0.05 ** p<0.01 ***p<0.001; n=120 (two tailed test); Dummy variable coded as manufacturing industry, 1; high technology industry, 2.
Our results offer support for suggestions that interpartner resource alignment provides a necessary element for capacity and resource exchange. Similarly, interpartner members have a general preference for interaction with one another when they perceive that the characteristics of absorptive capacity in such relationships are more efficient. The empirical evidence thus supports the assertions of previous researchers concerning the vital importance of absorptive capacity to U-I interaction.

3. Based on a process-oriented view, which we hypothesized that U-I interaction would mediate the effect of resource and capacity contextual factors on knowledge transfer, this mediation effect was demonstrated in our study. The findings echo those of previous research (Hansen, 1999; Singh, 2005; Szulanski, 1996; Tsai and Ghoshal, 1998), which has suggested that social capital serves as the vital conduit for obtaining and transferring useful knowledge, thus highlighting the strategic role of social interaction between different units.

Practically, this study suggests that firms should be aware of the importance of U-I interaction with regard to the links among interpartner resource utilization, absorptive capacity and knowledge transfer performance with academia and research institutions. The empirical results indicate that interpartner contact and linkages are imperative for knowledge transfer performance and that it is crucial for firms to develop such interactions in order to gain and apply outside expertise. To enhance U-I interaction, firms should provide incentives and support to encourage members to build up collaborative links rather than merely track the knowledge base of members. Furthermore, firms should carefully design and nurture the appropriate organizational capacity and resources to facilitate U-I interaction and knowledge transfer performance. Firms need first to enhance resource utilization to facilitate the intensity of interpartner interaction in order to enhance knowledge transfer performance. In addition, they need to improve employee training to raise the absorptive capacity of the relevant individuals. Employees would thus be motivated to work harder and more effectively in all efforts related to U-I interaction, which in turn would result in improved performance of both company finances and innovations. However, this study has some inherent limitations:

1) The small sample size raises concerns about the non-response bias, although we conducted a t-statistics test to verify that this was not a significant issue. In addition, the sample size was not large enough to generate meaningful results, as the regression models included 8 to 12 independent variables.

2) This study shows that U-I interaction is a potential mediator among interpartner resource alignment, absorptive capacity and knowledge transfer performance. The sequential procedure of regression analysis, recommended by Baron and Kenny (1986), is used to test the mediating effects. Future research could use a covariance structure model that would allow the direct and indirect relationships among the variables to be explored simultaneously.

3) This study focuses only on organizational resources and capacities, but other organizational constructs warrant discussion as well, such as organizational structure and climate. Future research might explore how these different constructs affect U-I interaction and knowledge transfer performance.

In conclusion, this study examines the relationships among interpartner resource alignment, absorptive capacity, U-I interaction, and knowledge transfer performance. The empirical evidence supports the process-oriented view and indicates that while interpartner resource alignment and absorptive capacity can deliver a better performance with regard to knowledge transfer, they do so primarily through improving university and industry interaction. An interesting further study would analyze practical cases of some Taiwanese companies with the described approach. This is an important practical issue that should be examined in the future.

REFERENCES

7-23.

APPENDIX

Appendix A. Characteristics of the respondents and non-respondents.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Respondents (n=120; %)</th>
<th>Non-respondents (n=480; %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High technology</td>
<td>79 (65.8)</td>
<td>388 (64.70)</td>
</tr>
<tr>
<td>Manufacture sector</td>
<td>41 (34.2)</td>
<td>212 (35.30)</td>
</tr>
<tr>
<td>Capital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 10 million</td>
<td>11 (9.2)</td>
<td>5 (1)</td>
</tr>
<tr>
<td>10 million -50 million</td>
<td>6 (5.0)</td>
<td>26 (5.4)</td>
</tr>
<tr>
<td>50 million - 100 million</td>
<td>4 (3.3)</td>
<td>43 (9)</td>
</tr>
<tr>
<td>100 million - 1 billion</td>
<td>34 (28.3)</td>
<td>246 (51.3)</td>
</tr>
<tr>
<td>1 billion - 2 billion</td>
<td>15 (12.5)</td>
<td>43 (9)</td>
</tr>
<tr>
<td>2 billion - 5 billion</td>
<td>19 (15.8)</td>
<td>50 (10.4)</td>
</tr>
<tr>
<td>More than 5 billion</td>
<td>31 (25.8)</td>
<td>67 (14)</td>
</tr>
<tr>
<td>Firm age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 6</td>
<td>4 (3.3)</td>
<td>7 (1.50)</td>
</tr>
<tr>
<td>7 years- 14 years</td>
<td>26 (21.7)</td>
<td>92 (19.20)</td>
</tr>
<tr>
<td>15 years- 22 years</td>
<td>21 (17.5)</td>
<td>125 (26)</td>
</tr>
<tr>
<td>23 years- 30 years</td>
<td>17 (14.2)</td>
<td>95 (19.80)</td>
</tr>
<tr>
<td>31 years- 38 years</td>
<td>25 (20.8)</td>
<td>97 (20.20)</td>
</tr>
<tr>
<td>39 years- 46 years</td>
<td>17 (14.2)</td>
<td>45 (9.40)</td>
</tr>
<tr>
<td>More than 47</td>
<td>10 (8.3)</td>
<td>19 (4)</td>
</tr>
</tbody>
</table>

n=number of subjects.