ABSORPTIVE CAPACITY AS FIT IN INTERORGANIZATIONAL TECHNOLOGY TRANSFER CONTEXT

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ABSTRACT

In the present study, the primary objective is to empirically examine the concept of specific firm dyad's absorptive capacity (AC) in a technology transfer context. In such context, the dissimilarity between partner firms maybe obvious but often neglected in assessing the absorption effectiveness. Extending the concept of AC in an age of business cooperation, we examine the concept of AC in specific technology transfer project. Multiple regression analysis, using survey data from managers of ninety-eight high-tech companies for hypothesis testing, demonstrated different contents of absorptive capacity than it was defined in prior research. We argue that a fundamental spirit of the absorptive capacity in technology transfer context is fit. The R&D investment, as included in our proposed model, does benefit the capacity for absorption. However, after the fit factors enter the model, their effects suppress the R&D investments'. Specifically, Cultural fit and interaction between both ends of transfer have significant impact on the absorptive capacity, and in turn on the TT performance. Innovativeness each partner firm articulates for the project is found significant too.

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Keywords: absorptive capacity; technology transfer; fit in innovativeness; culture fit; interaction

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INTRODUCTION

In recent decades, the importance of technology transfer makes researchers and practitioners involved in knowing this phenomenon as one complex system of events. Many careful works for technical, managerial, or policy concerns (Digman, 1977; Jayaram, Kannan & Tan, 2004; Masuchun, Davis & Patterson, 2004; Neaga & Harding, 2005; Park, 2005; Xie, Xu & Tu, 2005; Zanoni & Grubbstrom, 2004; Zou, Pokharel & Piplani, 2004) have been investigated. Beside, accompanying by increasing complexity and competition, firms and countries tend to acquire external technology to increase internal capability and knowledge. Technology transfer thus has been the phenomena that worth to be investigated at different level of analysis and various boundaries in the world (e.g. Branstetter & Chen, 2006; Costa-font & Mossialos, 2006; Miesing, Kriger & Slough, 2007).

High-tech business relies on R&D investment and technology development to create rapid advancement of product features, cost structures, or new market demands. Furthermore, for organization to succeed and grow, it has to maintain technological edge in this competitive global market place. This can be accomplished through either internal technological innovation, or through acquisition and adaptation of external knowledge (Atuahene-Gima, 1992; Lambe & Spekman, 1997). Technological development is then transferred to different units of the organization at different locations. Transferring and applying of technologies will depend largely on management of the process. Thus, there has also been concerted effort in the last decades on absorptive capacity (AC) (Cohen & Levinthal, 1990; Zahra & George, 2002) as a mean to stretch R&D investment and to develop greater use science & technologies in order to generate better economic return. Some of the existing models argue that TT
can be accomplished in well-defined conditions such as Intel model "Copy Exactly" (McDonal, 1999), or Business Excellence Model (Shergold & Reed, 1996) practiced in Western world. In either case, the performance depends on the effectiveness of the absorption and internalization of technology.

Thus, absorptive capacity of a firm's technology transfer has been a very critical issue within this research field. Traditionally, it is a measurement of a firm's effort on sourcing, acquiring, and exploiting new technologies developed externally (Cohen & Levinthal, 1990). Some research has been done to understand the importance of absorptive capacity to technology transfer performance (Atuahene-Gima, 1992; Cohen & Levinthal, 1990; Levinson & Asahi, 1995; Sher, 1997). Absorptive capacity is also commonly accepted as the basis for technical learning for organizations. As is argued, one should focus on the structure of communications and information dissemination between external environment and the organization to understand the origin of AC (e.g. Zahra & George, 2002). In sum, past research has mostly followed the seminal work of Cohen and Levinthal (1990), which investigated AC and AC's impacts by treating it as certain sort of ability of specific firm.

However, the present study tends to extend the meaning of absorptive capacity by arguing that it should be grounded as one that reflect the extent to which knowledge is mobilized and internalized in every different projects, every combination of firms, beyond the original notion that absorptive capacity is one identical firm's own fixed capacity. Put differently, most extant research assume there is fixed capacity of specific firm across different contexts. Critical work that make efforts on re-conceptualizing absorptive capacity have emerged significantly, according to different viewpoints and rationale on AC, as well as the different settings where AC is taken into research concerns (Lubatkin, Florin & Lane, 2001; Van den Bosch, Volberda & de Boer, 1999, Zahra & George, 2002). Characteristics of specific cooperation case/project as a whole are one of the most important contexts when investigating collective technology transfer activities conducted by firms of dyad or more (Chen, 2004). Such importance implies the need for further research on the fit between each partner, which is often determined by the extent to which partners form their alliance-specific characteristics,
culture, norm, etc (Douma, Bilderbeek, Idenburg, & Looise, 2000; Garcia & Calantone, 2002; Kedia & Bhagat, 1988). However, as models on successful TT bloom in recent years, they have been few models dealing of the conditional or contextual issues (cf. Kremic, 2003). Taking research of technological and innovation studies for Taiwan or China context for instances, Lai, Chiu and Leu (2005) found that even within the Chinese mainland context, the determinants of innovation capacity cross the industrial clusters were significantly different. Such endorsement extends the meaning of differentiated context in that every pair of TT partners has unique composition of absorptive capacity, one that is shared as overall partnership capability rather than single party's ability. While co-location of knowledge organizations means the creation of interdependence and similarity due to pre-transfer attributes, locating at plural contexts of technology is seen as embedding in various knowledge and cognition environments (Maskell, 2001; Porter & Stern, 2001). Therefore, variant construct definition or targeted samples may make the effects of main factors on TT become contingent. AC as main factor that affects the success of the transfer is supposed to be put in the same concern. While existing research assumes AC of one focal firm is fixed in certain time point (e.g. this firm's AC is 8 out of 10 points currently whether it goes anywhere), we try to make explicit the diversified, relative AC that goes beyond past contention (e.g. this firm's AC is 7 points when its partner is firm B while this firm's AC is 3 points when the counterpart of technology activities is firm C). Our research questions include: What is absorptive capacity in the context of specific technology transfer project? What are the antecedents of absorptive capacity as fit? What is the AC's influence on technology transfer performance?

LITERATURE REVIEW

Absorptive Capacity

Absorptive capacity is referred to as a count of limit to the pooling space of technology or knowledge a firm could internalize (Cohen & Levinthal, 1990). Such limit measures the capacity of R&D and its potential 'upper ceiling' of future developments. Since the widespread of the work proposed by Cohen and Levinthal,
absorptive capacity is applied as a research variable, which was used to explain the role and relationships with other concepts regarding organizational innovation and technological development (e.g. Chen, 2004). A decade later, studies started to re-think the meaning of absorptive capacity. For example, Zahra and George (2002) lead our attention to the multidimensional nature of construct of absorptive capacity in the lens of knowledge management internally. This re-conceptualizing intention is later examined empirically by Jansen, Van Den Bosch and Volberda (2005). Jansen and colleagues empirically tested the distinctive realized and potential absorptive capacity at a large, European financial service firm.

The level of absorptive capacity can change because there is ongoing knowledge production belongs organizational tasks and new information acquired from external connections (Lane & Lubatkin, 1998). R&D is one of the strategic means for changing the level of absorptive capacity. One partial explanation of the legitimacy of firm’s R&D investments is that the ongoing R&D works influence the absorptive capacity constraint. Kamien and Zang (2000) proposed a firm’s ability to realize spillovers from other firms’ R&D activities as its absorptive capacity. It is influenced by firms’ effective R&D efforts reflected by its R&D methods and budget. Kamien and Zang argued, “For a firm to realize the benefits from whatever spillovers become available from other firms research and development activities, it has to buy a ticket in the form of engaging in research and development itself.” Tilton (1971) also claimed that in semi-conductor industry, “… an R&D effort provided an in-house technical capability that could keep these firms abreast of the latest semi-conductor development and facilitate the assimilation of new technology developed elsewhere.”

Cohen and Levinthal (1990) introduced the concept of “absorptive capacity” that derives from its own R&D efforts as a measure of its ability to benefit from other firm’s R&D activities. As they argued, the ability of a firm to recognize the value of the new information externally, assimilate it, and apply it to commercial end is very critical and thus is the major part of knowledge absorption. Introduction and application of new process are influenced more by characteristics of the manufacturing system infrastructure than the level organization’s receptivity. This shows that TT are highly
dependent upon organization's pattern of past investment, by its repertoire of similar
double solving procedures, by established working relationships across organizational
boundaries, and by its prior experience for developing R&D technological capabilities.
Sen, Rubenstein, and Albert (1989) suggested that in the process of TT, company R&D
ey early involvement is critical. Their participation of evaluation, preparation, and initial
phase of the execution is particularly important. The preliminary case study conducted
showed that many MNCs failed TT mission partly because of internal interference that
kept the R&D early participation of the TT process. Therefore, continuous learning
stimulated by ongoing R&D activities and knowledge activities are quality conditions
to facilitate better absorption. Therefore, R&D investment should be a necessary, if not
the full, condition for not only a firm's internal, absolute absorptive capacity, but it
should also be a critical antecedent of external, relative measure of absorptive capacity
of specific technology transfer relationship.

*Hypothesis 1: R&D investment positively influences absorptive capacity*

**Absorptive Capacity as Fit**

One of the important criticisms of absorptive capacity is that the construct needs
to be adjusted by re-conceptualizing and contextualizing its notion to fit the research
settings well (Jansen et al., 2005; Zahra & George, 2002). The absorptive capacity in
the context of cross-boundary transfer should not been taken so naturally as single
organization's level measure of capacity.

In contrast, it should be taken, in such context, as one concept considering the
distances between each partner firms' knowledge ability. Cohen and Levinthal's (1990)
original conceptualization of absorptive capacity referred it as a firm-level construct,
which can be thought as an ability of a firm in accumulating knowledge relating to its
development and innovation. They argue that the organization (often the innovative unit
such as R&D department) need to possess and accumulate knowledge related to prior
technology for better understandings and applications (i.e. absorption) of that new
knowledge. Lacking of such ability, organizations may encounter difficulties in
internalizing the external knowledge. The transfer of knowledge from one organizing unit to another would thus be ineffective (Tsai, 2001).

We tend to push such argument forward by proposing that lacking fit between partners’ capacity may significantly (usually negatively) affect absorptive capacity, and thus the effectiveness of transfer performance. The value and effectiveness of collective knowledge tasks conducted by more than one firm depend greatly on the joint efforts and coordination of all parties (Dyer & Singh, 1998; Tsai, 2002). In such premise, committing relevant technology-based capabilities from both partners become strategically necessary (e.g. Das & Teng, 2003; Mowery, Oxley & Silverman, 1996). As a result, by echoing the call for attention on the context-specific nature of competence and development of firm (Van de Ven, 2004), research on the antecedents of absorptive capacity should take into considerations the factors embedding in the relationship of both ends, beyond those reside within each end of transfer.

Absorptive capacity is thus extended from the Cohen and Levinthal (1990) and defined as the ally’s (partners) ability to collectively search, acquire, and exploit technology on the basis of co-aligned (fit) innovative strategy and management efforts. Lane and Lubatkin (1998) proposed the learning capacity of organizations are differentiated and thus could be measured in relative level perspective. Lubatkin et al. (2001) further argue the goal orientation of knowledge affect the trajectories of consequent inter-organizational learning processes. Moreover, realizing factors that affect the absorptive capacity catches more in-depth portions for the technology transfer successes. Numerous researches have been done to understand the importance of AC to company performance (Atuahene-Gima, 1992, Cohen & Levinthal, 1990, Levinson & Asahi, 1995; Sher, 1997). As a result AC is the basis for technical learning within an organization but to understand the origin of AC, one should focus on the structure of communications and information dissemination between external counterparts and the organization. Pursuing this idea in practical world, there are several important factors that could affect the possibility inter-partner fit for absorptive capacity could be well grounded. They include fit in each partner’s innovativeness orientation, cultural fit, and their interaction during the transfer procedures. The rationale proving the inclusion of
each of the three factors is addressed below.

First of all, innovation orientation is very important for a firm or even an industry's success (Christensen & Gordon, 1999; Park & Ungson, 1997). Organizations see technological efforts as one of the basic functions for the complex managerial procedures and for their ways of running business. In technology transfer settings, each partner's efforts on pursuing innovativeness could level up each of their own knowledge span. For technology transferring partnership, both partners should have agreements in this dimension to assure pace compatibility of innovation. Innovativeness of the firm could level up the opportunity of the organization because innovative-oriented organizations tend to invest more efforts into its technology or knowledge base, even if the targets invested would not be an instant use (Garcia & Calantone, 2002; Madhavan & Grover, 1998). It also influences the partnership pattern agreements in the technology transfer relationships (Dutta & Weiss, 1997). Therefore, each party of the ally could have enough pre-cooperation capability bases, and thus the improved possibility that the technology could be absorbed well. Based on this, we argue that

_Hypothesis 2: Innovativeness fit of partners' increases absorptive capacity_

Moreover, the interaction between partners during for the progress of improving their ability to know each other also constitutes very important antecedent, since the characteristics, the knowledge, and the ways partners pursuing knowledge changes overtime (Dyer & Singh, 1998; Fang, 1999; Koka & Prescott, 2002; Kumar & Nti, 1998). Partners need highly involved interactions to sensor, and catch up well the changes of each ends in transfer relationship. Kotabe, Martin and Domoto (2003) pointed out that, partners with prior duration of interorganizational interaction transfer knowledge more effective, as compared to those without prior interaction (see also Langfield-Smith & Greenwood, 1998; and Spekman, Forbes, Isabella & MacAvoy, 1998 for example of non-vertical transfer relationship). Therefore, we derive a third hypothesis addressing that:

_Hypothesis 3: Interaction between partners increases their absorptive capacity_
Finally, past research often treated cultural fit as the factor that determines the decision with whom a firm cooperates. However, it could also decide the overall success during the while collaborative processes once the alliance is formed. Fit in organizational culture includes managerial and strategic dimensions (Lorange & Roos, 1992) including components such as innovation strategies, technology routines or even the management design for the technology related tasks. Doz and Hamel (1998) also mentioned that the strategic compatibility in the soft dimensions is very critical for successful cooperation. In this vein, the cultural fit between partners influences how they could understand each other’s vision, norms, the atmosphere that best suites a collective working environment. Besides, they can achieve better interpretation on all event and knowledge they face together in similar ways (Nootenboom, 2000). As technology transmitted could be code by compatible schematic system embedding in a compatible inter-organizational platform, the absorptive capacity of accepting what the partner has given is improved.

**Hypothesis 4: Cultural fit between partners increases their absorptive capacity**

**Technology Transfer**

Technology transfer (TT), within or across borders, has been nowadays viewed worldwide as one of the most important successful factors that should be taken into policy considerations (Bozeman, 2000; Contractor & Sagafi-Nejad, 1981; King & Nowak, 2003). According to Guston (1999), for instance, the governmental unit for technology transfer in US even functions a critical task of stabilizing the boundary between national politics and science. Japan, as one of the leading nation in technology development, benefited from its technology transfer supported by its policy system (Odagiri & Goto, 1996). These successful economies all have common characteristics of long-term commitment in and allocation of resource to technological development and transfer, such as public or private R&D laboratory and equipments. For developing economies as Taiwan, which greatly emphasizes the entrepreneurial orientation and creativity system, the technological building and transferring intensity is even more
important (Lin, Tang & Chang, 2002).

When innovative policy and capacity improvement are critical for the development of regional economies' vitality (Bozeman, 2000; Lai et al., 2005; Shyu & Chiu, 2002), technology transfer is often the strategic means adopted to efficiently assist the implementation of these policies and the goal of capacity improvement. Researchers have categorized technologies into different types and used various nomenclatures based on their own research interests. Commonly acknowledged by most researchers, technology may be broadly divided into three categories: product, process and management (Capon & Glazer, 1987). Product technology is a group of ideas and techniques embodied in the product itself. Process technology is a set of ideas related to the making of the product, or the sequential steps and decisions necessary to combine the material to produce finished goods. Management technology is the procedures associated with making and selling the product, or the way in which the managers organized their work systems to make the best use of intellectual resources for achieving the company's objectives (Osman-Gani, 1999).

International technology transfer contains a more complex collection processes involving the shift of tacit and codified knowledge, know-how, and management techniques (Kedia & Bhagat, 1988). Formal enterprises technology transfer is a commercial operation that takes place through a firm-to-firm arrangement and involves flows of knowledge, or embodied in goods, or in the forms of ideas, technical information and skills through licensing, franchising, or distribution agreements, and movement of experts and skilled labor. Technology transfer can take place in the form of export of capital equipment, licensing agreement between unaffiliated firms transfer of production techniques within transnational corporation between affiliated firms (Digman, 1977; Farris, 2007; Miesing et al., 2007). Formal means of TT across borders could be in the ways of foreign direct investment ("FDI"), joint ventures, wholly owned subsidiaries, licensing, technical service agreement, joint R&D arrangement, training, information exchanges, and sales contract or management contract. FDI is so far a major channel for international TT flows. Besides what have been mentioned above, an increasingly popular stream on how TT is performed has been to develop a global
position through collaborative agreements, licensing of technology, or joint ventures with partners that already have presence in various targeted market areas. This approach is particular attractive to industries that are capital intensive, or involved large investment to maintain production economies of scale, or to achieve the requisite R&D advancements. It is further attractive to business of high risk, fierce competition, over-capacity manufacturing in international markets (Harrigan, 1988; Teece, 1986).

The importance of technology transfer, however, lies not only on providing opportunity to gain better return but also to enhance its ability of technical innovation through the process (Digman, 1977; Miesing et al., 2007; Osma-Gani, 1999). Transfer of technology involves the flow of proven technology from one firm, industry or country to another through adopting, modifying, or application. Generally, TT can be made in three phases: material transfer, design transfer, and capacity transfer. The first phase related to transfer of products or materials without adaptation to local requirements. The second characterized by the transfer of the capability of producing the product or process domestically. The third involved the transfer of knowledge and capability to develop new technology (Teece, 1986). The stages demonstrated the ultimate goal of technology transfer performance involves high-quality absorption capacity of the partners, in addition to the object of technology per se.

The effectiveness of technology transfer between firms depends not only upon the characteristics of the cooperative relationship, but it also depends upon how both ends align with each other in terms of absorptive capacity in order to ensure effective internationalization and efficient mobilization. In other words, factor like R&D investment may significantly influence the capacity given no relative counterpart partners exist; while, as there existed activities (e.g. technology transfer) that involve any partner firm, the absorptive capacity in the premise of better fit should result in higher technology transfer effectiveness.

*Hypothesis 5: Absorptive capacity is positively related the technology transfer performance*
METHODOLOGY

Sample and Data Collection

Considerable amount of studies on technology transfer have been conducted but those regarding to the context of Chinese communities (e.g. the mainland China, Taiwan, Singapore, etc) seems to start its rising (e.g. Farris, 2007). Past research reported that TT has not been very successfully practiced in China partially because the existing model cannot reflect the critical factors of "relationship and 5000 years of cultural influence" during the transfer across culture barrier (Sher, 1997). Therefore, the models appeared not directly applicable in Taiwan and China, and there has not been a model testable and workable developed for application this region. Therefore, we this time selected this challenging context as our target of research interests.

After discussion among the researchers of this study, one hundred firms were selected by judgment sampling method\(^1\) from the 2004 Directory of Hsinchu (and Tainan) Science based industrial park in Taiwan. The samples cover two categories of hi-tech firms: (a) Local Taiwanese firms have manufacturing in and technology transfer to China; and (b) Foreign invested firms that have presence in the abovementioned technology activities between Taiwan and China. In sum, firms that have great possibility and activities of TT are included as sampling structure. After initial contact via telephone calls, some one hundred in the identified companies agree to fill the questionnaires, which were sent out to one middle-to-top management members (for

\(^1\) See Peterson & O'Dell's (1950) first systematical introduction of how this sampling technique, and other counterpart techniques, should be applied in commercial studies. Judgment sampling (the often re-phrased as the purposeful sampling) is afterward then widely expanded and applied in management and social science until recently (e.g. Grant & Higgins, 1991; Maydeu-Olivares, 2001). Cooper & Schindler (2003) argue that this sampling method "occurs when a researcher selects sample members to conform to some criterion (p. 201)" and is appropriate when in early stages of research the researcher(s) "wishes to select a biased group for screening purposes. (p. 201)" Taiwanese high-tech firms residing in scientific parks used to put their business core in OEM tasks, and therefore many in this population do not have many chances to really get involved in technology transfer, not to say the international transfer ones. Therefore, for the present study, we need to ensure that the selected firms dedicate in technology transfer and it is one of their major innovation and profit sources. The leading author of this paper has senior experiences serving as company CEO in the industry; such experience has helped us in identifying useful sampling frame. Also, this study benefited high return rate of questionnaires. However, the leading author and co-authors in the research group work hard to retain academically independent and un-intervening in the whole research processes.
each company)² who deeply involved in technology transfer project across the strait. One of the authors contacted all sampled companies via phone-call, email follow-ups, as well as the owned personal relationships to top management of those companies. The final effective questionnaire returned include ninety-eight (98) copies, and thus resulted in a 98% return-rate due to sampling technique selected and the administration processes conducted.

**Measurement**

Varied sources of instruments are included (public company annual and financial reports, questionnaires). Secondary data as the sole source of information has the disadvantage of not meeting the specific need of this study particularly when consolidated financial reports are required to include performance from operation in China, the average volume of investment in R&D, and the alike. Moreover, interview of the selected managers may be required to support the validation process. The use of several different sources of data, objective vs. subjective, partially prevents this study from the common method variance (CMV) bias³.

The structured questionnaire was developed based on relevant previous studies and was pre-tested for its transferability with two CEOs of non-listed companies. Afterward, questionnaires were modified to reflect it appropriateness for this research, and revised one will be used. To minimize translation bias, the questionnaire was set in

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² Our conceptualization of absorptive capacity should theoretically reflect the fit nature of the construct. The word ‘fit’ here emphasizes the distances between transferring firm’s (giver) and the receiver firm’s technology handling capacity. We ground it in detail in theoretical development sections, while due to sampling difficulties and cost efficiency reasons, we chose to measure the fit-related constructs (variables) by the sampled higher managers from only one side. However, the raters were validated in the preliminary interview stage that they all have qualified knowledge on how the cross-strait technology transfer is proceed; such actionable knowledge serves as reliable information source in response to our questionnaire items. Generally, the rater’s position is at least above project managers. In addition, the raters’ average tenure in company is in an acceptable level (avg. = 3.09, s.d. = 2.11), as compared to research in leading journals when dealing with rating by referring to an overall organizational situation. For further descriptive statistics, we report here the gender (male (88) = 89.79%; female (10) = 10.2%), age (avg. = 42.9, s.d. = 9.22), and education background (junior college = 17 persons; undergraduate = 44; Graduate (student) or above = 37) of the raters.

³ Potential for partial CMV existed in relationships that do not deal with objective measures (e.g. cultural fit → performance). This is a potential limit for this paper. While recognizing the difficulty to collect matched data or data from multiple sources, we have tried reduce possible bias by randomize the order of groups of questionnaire items in order to prevent raters from guessing the causal logic of the proposed relationships (Peng, Kao & Lin, 2006).
translated English and back translated to Chinese for crosschecking its appropriateness. We benefit from the existing literatures (Atuahene-Gima, 1992; Bresman, Birkinshaw, & Nobel, 1999; Cohen & Levinthal, 1990; Fang, 1999; Katz, Resentisch & Allen, 1996; Kremic, 2003; Lane & Lubatkin, 1998; Lin, et al., 2002; Sher, 1997) in developing the measures in this study. The scales are:

Technology Transfer Performance

We measure the consequences of technology transfer by requesting the raters to answer the following items according to the actual situation of specific project (e.g. Sher, 1997; Spann, Adams & Souder, 1993), and the items include: ‘shortened product development and commercialization time,’ ‘increased predictability of future technology,’ ‘enhanced R&D staff quality and innovation capability,’ ‘cost down and increase profitability,’ ‘more knowledge and experiences of employees accumulated.’ Those items were in the form of seven-point Likert scale.

Control variables

We incorporate firm size and age as the control variables. Past research has reported that these two variables can be influential on absorptive capacity (Cohen & Levinthal, 1990; Lane & Lubatkin, 1998; Minbaeva, Pedersen, Bjoerkman, Fey & Park, 2003). Size is measured by counting the number of full-time employees. We transformed the data by mechanism of natural logarithm. Age is measured by the number of years since the firm was built up.

R&D Investment

This is a one-item objective measure rated by secondary data (the company’s historical records), asking the respondent ‘The average R&D expenditure during the past three years (per ten-thousand dollars).’ The unit of measurement is New Taiwan Dollar (NTD. per ten-thousand dollars). Recent three years’ foreign exchange rate of USD against NTD is about 1/34 to 1/34.5. Raters checked for company’s historical records in order to fill this item completely.

Innovativeness Fit

Based on the notion given to this variable (Dutta & Weiss, 1997; Stuart, 2000), a seven-item instrument using 7-point Likert scale was developed. We asked raters to
rate according to his/her perception if both partners fit in the following dimensions. These items are: ‘Key success factor is to have unique technology and products,’ ‘Managers are innovative and pursue growth,’ ‘Employees keep challenge the existing knowledge or ways of doing their jobs,’ ‘The organization has open-minded working atmosphere,’ ‘The morale atmosphere of R&D staffs is high,’ ‘The organization respects each employee’s uniqueness,’ ‘This organization is R&D oriented.’

**Interaction between partners (Interaction)**

Interaction is often assessed in previous research (e.g. Kumar & Nti, 1998). This scale constitutes of five 7-point Likert scale items, including: ‘The involvement and cooperation of management of both ends,’ ‘The involvement and cooperation of R&D of both ends,’ ‘The frequency of mutual communication of both ends’ R&D staffs,’ ‘The frequency of mutual communication of both ends’ management-level persons,’ ‘There are detailed mutual communication on work flow and process control between both ends.’

**Cultural Fit**

Cultural Fit (e.g. Weber, 2000) includes two items, asking the respondent about their agreements about: ‘The consistency of both ends’ innovativeness is high’ as well as ‘the consistency of both ends’ management culture is high.’ These items are also 7-point Likert scale.

All the items are screened by exploratory factor analysis. Items with low factor loadings were deleted. No items or factors were merged. We listed the results of factor analysis in Appendix for a comprehensive display of our instruments. Generally speaking, our instruments are suitable for our data using on this analysis (KMO>.50). They also explained considerable portions of variances as the statistics shown.

**RESULTS AND DISCUSSIONS**

Table 1 shows the mean, standard deviation, and correlations of this research’s core variables. According to the table, most correlations are as theoretically assumed. For example, the R&D investment is significantly correlated to the innovation culture, which response to the extant literature dealing with these two variables’
interrelationship. In addition, absorptive capacity correlates to several of its hypothesized predictors, with difference degree of significance. Besides, the problem of multicollinearity did not emerge after checking all of our models related indices such as the VIF index (all below 10) (Cohen, Cohen, West, & Aiken, 2003).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
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<th>2</th>
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<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tr>
<td>1. Firm size\textsuperscript{a}</td>
<td>1.98</td>
<td>.35</td>
<td>1.00</td>
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<td>2. Firm age</td>
<td>12.3</td>
<td>7.61</td>
<td>.32*</td>
<td>1.00</td>
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<td>3. R&amp;D Investment\textsuperscript{b}</td>
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<td>69318.9</td>
<td>.34**</td>
<td>.20</td>
<td>1.00</td>
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<td>4. Innovativeness Fit</td>
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<td>1.21</td>
<td>-.12</td>
<td>.07</td>
<td>.73**</td>
<td>1.00</td>
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<td>5. Interaction</td>
<td>4.81</td>
<td>1.07</td>
<td>.07</td>
<td>.23*</td>
<td>.16</td>
<td>.157</td>
<td>1.00</td>
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<td>6. Cultural Fit</td>
<td>4.22</td>
<td>.97</td>
<td>.11</td>
<td>.12</td>
<td>.033</td>
<td>.03</td>
<td>.54**</td>
<td>1.00</td>
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<td>7. Absorptive Capacity</td>
<td>4.55</td>
<td>.86</td>
<td>.27*</td>
<td>.15</td>
<td>.30**</td>
<td>.22*</td>
<td>.45**</td>
<td>.51**</td>
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<td>8. TT Performance</td>
<td>5.01</td>
<td>.77</td>
<td>.22</td>
<td>.17</td>
<td>.10</td>
<td>.08</td>
<td>.46**</td>
<td>.54**</td>
<td>.51**</td>
<td>1.00</td>
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</tbody>
</table>

Note: **p < .01, *p < .05; \textsuperscript{a} natural logarithm; \textsuperscript{b} Per ten-thousand dollars

Multiple regressions were performed to test our main hypotheses. All results were extracted and integrated into Table 2. R&D investment did has significant influence on the absorptive capacity if this factor is the only one predictor in the model ($R^2 = .26$, $\beta = .41$, p < .01). This result strongly supports the hypothesis 1. However, after other influencing factors of AC had entered in the direct relationship to AC model, the effect of R&D investment diminished ($\beta = .28$, p < .05). Due to the combined statistics mentioned above, the more independent variable is considered incorporated in the model. In the second model, the three fit variables were put into regression model, together with R&D investment in a stepwise fashion. The result (the three variables are significant beyond the impact R&D investment could unleash, see following texts, $R^2 = .44$, $\Delta R^2 = .15$, p < .01; $F = 17.97$, p < .001).

Hypotheses three to five try to empirically find out the influences of some critical fit predictors. Fit in innovativeness ($\beta = .19$, p < .05) and interaction ($\beta = .21$, p < .05) during the transfer are both significantly influence the AC; this result supports hypothesis 2 and 3. Besides, results show the cultural fit (i.e. the mutual alignment of
both partners’ innovative strategy and culture) plays the most significant predictor of absorptive capacity (β = .47, p < .001). This result supports hypothesis 4. Our proposed new thinking on the notion and implication of the cultural fit between partners has emerged explicitly. Organizational culture is often treated in researchers’ minds as characteristics for an organization and that distinguish the organization from other organizations; these characteristics constitute the essence of what the organization is and how it operates as a social collectivity (Meek, 1988). Extending this view upon the interorganizational contexts, partners are collectively operating entities in the inter-firm field as the aforementioned social collectivity, and so the ones with the shared culture in order to operate their cooperation jobs well, and more importantly, to distinguish the ally from others. Therefore, the alignment between two firms’ cultures, no matter innovative or managerial, should be very important to have barrier-free culture of the transferring partnership, instead of only barrier-free culture of each partner’s own.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>AC</th>
<th>TT Performance</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control variable</td>
<td></td>
<td></td>
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<tr>
<td>Size</td>
<td>.32*</td>
<td>.27</td>
<td>--</td>
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<tr>
<td>Age</td>
<td>.09</td>
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<td>Main Effects</td>
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<tr>
<td>R&amp;D Investment</td>
<td>.41**</td>
<td>.28*</td>
<td>--</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>--</td>
<td>.19*</td>
<td>--</td>
</tr>
<tr>
<td>Interaction</td>
<td>--</td>
<td>.21*</td>
<td>--</td>
</tr>
<tr>
<td>Cultural fit</td>
<td>--</td>
<td>.47**</td>
<td>--</td>
</tr>
<tr>
<td>Absorptive Capacity</td>
<td>--</td>
<td>--</td>
<td>.43**</td>
</tr>
<tr>
<td>R²</td>
<td>.26</td>
<td>.44</td>
<td>.35</td>
</tr>
<tr>
<td>Change in R²</td>
<td></td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>14.97***</td>
<td>7.81***</td>
<td></td>
</tr>
</tbody>
</table>

*** p<.001; ** p<.01; * p<.05

Hypothesis 5 indicates that the absorptive capacity serves as critical factor that benefits the TT performance. According to our results, this argument is strongly supported. We put the many leading factors into the model that the TT performance is
the dependent variable. Results show that effect of absorptive capacity is evidently is strong ($\beta = .43$, $p<.001$). Same to the prediction of our research intention on absorptive capacity, enlightened by Zahra and George (2002), there’s great necessity to re-conceptualize the inconsistent meanings and definitions of AC. The results of this study empirically examined the need and more the notion of this construct more clearly emerged in the evidentially basis.

**CONCLUSIONS**

Overall speaking, this study has presented that the absorptive capacity poses one key reason of technology transfer success. More importantly, this study adopts the perspective that extends the definition and constructs implications for the concept of absorptive capacity. Extending the view that absorption is the accumulation of past experiences and knowledge base (Cohen & Levinthal, 1990: 128), we argue that such accumulation is collectively aligned by and fits mutually to both partners’ capacity. In short, absorptive capacity should be a concept that is not merely operationalized at the firm level-of-analysis, but it should be considered seriously as coordinated fit between partners at dyadic or higher level. Past research often focus on the focal organization’s *ability to absorb*, while neglecting an important fact that this capacity can vary across partner combinations and depends on partner alignments in each combination.

For theoretical implication, the significance of the cultural fit in our Taiwan-Chinese context, which echoes to the works of Douma and colleagues (2000) and Medcof (1997), demonstrates that the fit of capability is more than a nationality or language matter. The gaps between these two economies are less serious than the gaps between other economies because they shared the same cultural roots, which influence the micro interaction and decision patterns. Even in such close context, however, pursuing of fit is important as well. The ‘culture’ should be more broadened beyond geography, customs, or tools of communication, as increasing attention is put on innovation–related aspects of culture. The pragmatic communication, rather than the

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$^a$ Few works like Becker and Peters (2000)’s analysis of the collective industrial absorptive capacity has been taken well.
merely routine task communication, should focused more on the coordinating strategic alignments, target technology essences, and a shared vision guiding both (all) involving partners (Garud & Nayyar, 1994). Furthermore, alignment for better absorptive capacity between systems beyond the firm-dyad level (i.e. groups of firms, regional cluster, etc.) should be a more complex but interesting issue for further study. So far, little research has worked on the absorptive capacity at the level beyond firm and firm dyad (which has been investigated in this study). In addition, further studies are encouraged to compare technology absorption capacity in the intra-cluster versus inter-cluster contexts, which geographical factors (e.g. distance) often constraint the availability of formal and informal interaction for knowledge flow (Krafft, 2004). Would firms residing within the same cluster transfer their technology better than those have to go across cluster boundaries do?

This study has several implications for the practitioners. Innovation policy-making is critical since it is a prerequisite for national, industrial and business-level innovation (Shyu & Chiu, 2002). Organizations facing the emergence of a knowledge–based economy and globalization should draw technology transfer in the policy agenda by strategic linking the capacity profile of every institutionalized project. It is argued that policy-makers should notice the importance of absorptive capacity distances in order to prevent failures and unnecessary investment in technological relationship. Knowing clearly the capacity volume may improve the possibility for successful match. For successful technology transfer, however, the directions of capacity investment may be more important than the quantity of capacity investment.

Furthermore, the post-ally-formation management can be more critical than the formation issue (Spekman, et al., 1998). The assessment of misfit between partners is vital, while the management of those misfits during the process of cooperation may determine the success of projects. Analysis of transfer partner in the perspective of fit may be useful at the initial stage of cooperation. Proactively, managers should develop better system so as to improve fit and co-action quality between partners. For instance, by developing practical technology transfer practices such as mutual interaction routines, cross-functional match meeting (e.g. the mix of RD unit of transferring firm
and the marketing unit of the receiver firm, in addition to the same-function meeting between partner firms), higher level of absorptive capacity of technology transfer maybe achieved. After all, the better governance of dissimilarity should be the most effective way by which organizations adopted to integrate external knowledge resources.

Future Directions and Limitation

Some issues generated from conducting this paper merit future discussions. First, in the present study, we take a more conservative attitude in thinking about the role of absorptive capacity. Because the major purpose is to understanding the meaning of absorptive capacity on a basis of technology transfer partnership relationship, we mainly care about the contents of absorptive capacity, its antecedents and consequence in accordance to the contextual boundary of technology transfer situation. Therefore, a framework is initially centered on the absorptive capacity as fit construct; then we discuss its antecedents and outcome, respectively. Theoretically, although laying the focus on AC, we tend to avoid treating absorptive capacity as a mediator, since the great number of influencing variables for technology transfer performance may generate competing results of impact levels on TT under conditions of differentiated model combinations. For more concise validity of exploratory constructs, it should not be deemed as one single study's scope to assert whether AC is posited as it plays such heavy theoretical and empirical role (Schwab, 1980). However, this issue is worth discussing as there are more related studies generated. Meta-oriented methodological approaches, such as Bibliometrics (Osareh, 1996), meta-analysis (Hunter & Schmidt, 1990; 2004), could be applied to discuss the unsolved question.

Discussion of some limits in this study could imply for further research. Due to difficulty of tracking longitudinal data, this study chose to collect data on a cross-sectional basis. Such design may lead to a concern of lagged effects of absorptive capacity on transfer performance. However, our original instruction of survey rating includes sentences that would neutralize the harm of non-longitudinal design. As we have already reported in the previous version, the independent variables are measured
by items requesting the raters to recall the situation during the past three years or in the duration the referent projects were implemented. Such instruction in the survey has incorporated the concern of the possible lagged effects on performance. While incorporating temporal consideration in technology transfer research is often for the purpose of investigating the ‘transformation’ of technology and capability as focused subject (e.g. Garud & Nayyar, 1994), we chose to focus on the subject of fit in technology transfer projects. Moreover, the present study of technology transfer should have benefited from collecting both partners’ opinions, ideally. However, for research feasibility and time efficiency, we replace it with the data collection from representative raters from on side. Because the raters are qualified with enough understandings of the field (see more for footnote 2), we are enabled reliable data set from them (e.g. Simonin, 1999). Future studies could try on different data collection sources to test if those combinations of sources differ significantly. Finally, the industrial environment in which firms operated could variably influences the relative impacts a firm can shed from the firm’s technological activities. Thus, it may be an interesting topic for future studies to include the variables of industrial impacts (e.g. the industrial life cycle; the velocity of industrial change, etc.).
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技術移轉情境下的吸收能力：組織間適配觀點

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中文摘要

本文主要在組織間技術移轉的情境下，延伸並檢驗組織吸收能力的定義。在適配觀點下，技術移轉雙方之個體差異性造成個別技術移轉專案吸收能力的不同。換言之，吸收能力不再只是個別組織的特性（絕對值），而應被視為面對不同情境及對象時，夥伴整體的能力（相對值）。透過對98件兩岸技術移轉專案所蒐集的問卷與分析，我們發現研發投入一如過去文獻所言，影響著吸收能力的高低。然而，在控制了該變數的影響之外，結果發現技術移轉夥伴雙方在創新傾向、互動模式、以及組織文化等面向上的適配，更進一步影響了吸收能力的高低。

關鍵字：吸收能力、適配、技術移轉、創新傾向、互動、組織文化

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