

A HOLISTIC MODEL OF THE INTER-FIRM TECHNOLOGY TRANSFER BASED ON INTEGRATED PERSPECTIVES OF KNOWLEDGE-BASED VIEW AND ORGANIZATIONAL LEARNING

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Abstract

The objective of this study is to propose a holistic model of inter-firm technology transfer (TT) based on an integrated knowledge-based-view (KBV) and organizational learning (OL) perspectives in conceptualizing the critical links between technology transfer characteristics: knowledge, technology recipient, technology supplier and relationship characteristics (TTCHARS) and degree of technology transfer (TTDEG) in international joint ventures (IJVs). Since the current TT issue now is centered on efficiency and effectiveness of technology transfer as an efficient formal vehicle to internalize foreign technologies as compared to direct import of goods, licensing and foreign direct investment, the advancement of the holistic model is to provide a complete view on the significant effect of technology transfer characteristics and their dimensions on degree of technology transfer in IJV which eventually could contribute to the increase of local companies' competitiveness, indigenous technical capabilities, technological development, and potential for local innovation. In the study's model, hypotheses are developed to describe the relationships between TTCHARS and TTDEG based on the underlying KBV and OL perspectives.

Key Words: Inter-Firm, Technology Transfer, International Joint Ventures, Malaysia, Knowledge-Based View, Organizational Learning.

INTRODUCTION

The presence of the MNCs through various formal market channels such as direct export of capital goods and products, foreign direct investments, licensing, and IJVs with local firms have become the primary sources of technology for local technological development and national economic growth (Marton, 1986). The inter-firm technology transfers (TT) in collaborative joint ventures (JVs) often involve tradeoffs between the willingness of technology supplier to transfer a considerable amount of their technologies to technology recipient and degree of protection of the proprietary technology, knowledge and competencies as the source of the supplier's competitive advantage (Inkpen, 2000; Hamel, Doz, and Prahalad, 1989). Technology transfers through JVs, although have been acknowledged in many studies as the most efficient mechanism in internalizing the partner's technologies, knowledge and skills, have frequently involved various facilitators, actors and complex relationship between partners that have direct impact on the degree or amount of technology transferred in JVs (Szulanski, 1996; Inkpen, 2000).

Past studies view that TT by MNCs to developing countries as a dynamic and on-going process (Shiowattana, 1987; Methe, 1991). Many studies on intra and inter-firm TT are in consensus that TT is a complex and difficult process even when it occurs across different functions within a single product division of a single company (Gibson and Slimor, 1991; Kidder, 1981; Smith and Alexander, 1988). The current issue

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is no longer whether MNCs are transferring their technology to the Malaysian industries; rather the issues are centered on the effectiveness, efficiency and success of implementation of TT (Lai and Narayanan, 1997). This is because TT's success heavily depends on interactive communications between the technology supplier and recipient which requires both parties involvement (Gibson and Slimor, 1991). Previous studies have also indicated that MNCs are said to be a reluctant technology supplier and have been slow in transferring technology and R&D expertise to local industries due to the risk of technology 'spillovers' (Narayanan and Lai, 2000; Ravenhill, 1999; Guyton, 1995; Muller and Schnitzer, 2006).

On the other hand, MNCs contend that it is not a question of their willingness to transfer technologies rather the transferring process is mainly hampered by low maturity level of the Malaysian industry which is largely due to insufficiency of skilled personnel and weak institutional support and business environment (Rasiah and Anuwar, 1998). As compared to the U.S MNCs, TT by the Japanese MNCs have been found to be less intensive and slower where technologies are normally transferred within their 'keiretsu' (Raduan, 2002; Yamashita, 1991). The Japanese MNCs for example, to some extent, have no intention to transfer key aspects of their technology in order to maintain their dominance in Southeast Asian economies (Taylor, 1995). The impressive record of economic progress in Malaysia has not gone hand in hand with the technological progress of proportionate magnitude due to weak relationship between the TT practice and the decision to innovate (Malairaja and Zawdie, 2004). In this aspect, the innovation capabilities greatly depend on the local firms' ability to understand, assimilate and apply new technology transferred to them (Cohen and Laventhal, 1990). Studies from KBV perspective have acknowledged that MNCs tend to be more protective of their advance technology, knowledge and competencies in products, processes and management because these strategic valuable resources and competencies are their main sources of competitive advantage (Porter, 1985; Barney, 1991; Peteraf, 1993; Wernerfelt, 1984; Pralahad and Hamel, 1990). OL perspective studies have suggested that technology and knowledge are protected by the supplier when the recipients are opportunistic in the collaborative relationship (Inkpen, 1998a; Inkpen and Dinur, 1998; Child and Faulkner, 1998). Thus, based on the above scenarios, four critical issues require serious attention.

First, in the context of TT through IJVs, the remaining question is on the extent of TT by foreign MNCs when transferring their advance technology to local recipient partner (Narayanan and Lai, 2000). While realizing that technologies, knowledge, and competencies are the supplier's main source of competitive advantage, the current TT issue in JV revolves around the extent of degree of technologies that are being transferred by the suppliers to recipient partners in terms of tacit knowledge (new product/service development, managerial systems and practice, process designs and new marketing expertise), and explicit knowledge (manufacturing/service techniques/skills, promotion techniques/skills, distribution know-how, and purchasing know-how) (Madanmohan et al., 2004). This is because from the recipient's perspective, TT success is not merely possessing the ability to operate, maintain or repair the machineries at the production level (transmission) but it also includes the ability to learn, acquire, absorb and apply new external technologies and knowledge embedded in product materials, physical assets, processes and production, and management capabilities (absorption) (Davenport and Prusak, 1998, 2000).

Second, previous studies on intra-firm knowledge transfer have acknowledged the significant influence of technology actors and facilitators/barriers such as the characteristics of knowledge transferred, source, recipient and contextual/relational in the knowledge transfer process (Szulanski, 1996, 2000, 2003; Gupta and Govindarajan, 2000; Minbaeva, 2007). Thus, in the context of inter-firm TT where technology transfer processes are more complex, difficult and involve the process of transferring technology across the organizational boundary to unaffiliated firms, the prevailing issue is on the extent of significant effects of TT characteristics (TTCHARS) in determining the degree or level of technology transfer (TTDEG). Specifically to what extents do TT characteristics influenced TTDEG? And whether all TTCHARS and their dimensions can predict and explain TTDEG?

Third, since JVs is one of the formal and externalized mechanisms of TT which could directly affect performance, therefore the next intriguing issue is on the extent of TTDEG in affecting the performance of local firms; specifically on how TTDEG could help to improve the corporate and human resource/competencies performance.

Finally, although previous studies have acknowledged the significant effects of knowledge transfer determinants on knowledge transfer outcomes, nevertheless, the effects of TTCHARS on TTDEG in inter-firm TT through JVs could possibly be moderated by other important factors such as size of MNCs, age of JV, MNCs' country of origin, and MNCs' types of industry. Thus, in other words the variations in TTDEG's

outcome could have been significantly influenced or moderated by these variables. Building on intra and inter-firm TT literature, this study proposes that the inter-firm TT between foreign MNCs and the local recipients' companies through JVs is contingent on the knowledge transferred (KCHAR), technology recipient (TRCHAR), technology supplier (TSCHAR), and relationship (RCHAR) characteristics (Szulanski, 1996; Leonard-Barton, 1990; Teece, 1977; Rogers, 1983).

Knowledge-Based View Perspective (KBV) and Technology Transfer (TT)

In the late 1980s and early 1990s, knowledge-based economies, which are based on the production, distribution and use of knowledge and information, have emerged as the dominant perspective in the management fields. Knowledge has been regarded as the catalyst of organizational competitiveness and economic growth. KBV perspective, which is originally developed from resource-based view of the firm (RBV) perspective (Wernerfelt, 1984; Barney, 1991), has been developed to response to the change in the environment; where in the information era knowledge, especially tacit knowledge, is acknowledged as one of the most important strategic resources (Grant and Baden-Fuller, 1995; Grant, 1996a, 1996b, 1997). These researchers explain the relationship between a firm's knowledge integration and its competitive advantage based on the resource and capability perspective. Knowledge integration in a firm will lead to the firm's organization capability which in turn determines its competitive advantage.

KBV perspective suggests that firms as a bundle of knowledge emphasize on firm-specific, intangible, non-tradable and inimitable knowledge as durable sources of sustainable competitive advantage of the firm (Spender, 1996; Barney, 1991). Past studies on KBV perspective have focused on knowledge as a key competitive asset. Many studies have emphasized on the capacity of firms to integrate tacit knowledge (Grant and Baden-Fuller, 1995; Conner and Pralahad, 1996). KBV perspective is primarily concerned with human resource than other physical resources of the firm since human resource plays an important role in the process of knowledge creation, knowledge transfer and acquisition within organizations (Conner and Pralahad, 1996; Kogut and Zander, 1996). KBV perspective is critical in explaining how firms gradually grow and achieve sustainable competitive advantage through knowledge creation and learning (Kogut and Zander, 1992, 1993; Spender, 1996). As repository of knowledge, firms build their firm-specific knowledge and accumulate it over time, which makes them specialize in specific product or service (Dierickx and Cool, 1989; Kogut and Zander, 1993). Firms expanding abroad transfer to their foreign subsidiaries firm-specific ownership advantages such as superior production, marketing and technical knowledge because of the inherent disadvantage of operating in the host country's environment (Hymer, 1970). The intra-firm knowledge transfer of superior knowledge is viewed as an effective means of replication and exploitation of the ownership advantage for economic rents (Kogut and Zander, 1993).

However, recent studies have argued that firms are no longer seen as repository of knowledge rather as an instrument to transfer knowledge across subsidiaries and contribute to knowledge development (Gupta and Govindarajan, 2000; Holm and Pedersen, 2000). As firm-specific knowledge is the important resource of the firm, tacit knowledge is more difficult to replicate and transfer than explicit knowledge (Mowery and Rosenberg, 1989). The firm's tacit knowledge is not easily communicated and shared as it is highly personal deeply rooted in action and in an individual's involvement within a specific context (Nonaka, 1994). The individual's insights and skills that form tacit knowledge in human resource, which are gained through personal experience, are hard or impossible to articulate or transfer (Kogut and Zander, 1993; Nelson and Winter, 1982; Nonaka, 1994; Polanyi, 1962, Simonin, 1999a). Tacit knowledge acts as "the glue that integrates mechanism in learning" (Dhanaraj et al., 2004). On the other hand, explicit knowledge, which is highly codifiable and transmittable in formal and systematic language, acts as "the building blocks" (Polanyi, 1967; Nonaka and Takeuchi, 1995). A number of researchers such as Kogut and Zander (1992, 1993, 1996), Nonaka (1994), Nonaka and Takeuchi (1995), Nonaka et al. (1996), Grant (1996a, 1996b, 1997), Spender (1996), and Szulanski (1996) are among the researchers who have developed KBV perspective as a theory of the firm and strategy. These researchers stress on knowledge as "the most important strategic resource which emphasizes the roles of knowledge acquisition, storage, replication, transfer, and creation in organizations".

Organizational Learning (OL) Perspective and Technology Transfer (TT)

Based on a review of literature, the term organizational learning (OL) has existed in the literature since 1960s through researchers such as Argris (1964), Cangelosi and Dill (1965), and Cyret and March (1963). Past studies have defined OL from three different views. The first view describes OL as a process. Researchers who hold this view describe learning as cognition or information processing. OL is defined as 1) a development of insights, knowledge and associations between past actions, the effectiveness of those actions, and the future actions (Appelbaum and Goransson, 1997), 2) the process by which the organizational knowledge base is developed and shaped (Tsang, 1999), and 3) an organizational process, both intentional and unintentional, enabling the acquisition of, access to, and revision of organizational memory (Robey et al., 2000). The second view emphasizes on the outcomes of OL such as change of behavior and improvement of organizational effectiveness. Proponents of this view describe OL as 1) a change in the behavior of individuals or groups within an organization leading to changes in the behavior of the organization itself (Reynolds and Ablett, 1998), 2) increasing an organizational capacity to take effective action (Kim, 1993), changes in the behavior of the organizations' knowledge and value base leading to improved problem solving ability and capacity for action (Probst et al., 1997), and 3) improving actions through better knowledge and understanding (Fiol and Lyles, 1985). The third view integrates both views that link the learning process and outcomes. Researchers who hold this view describe OL as 1) a process that result in changed behavior in ways that lead to improved performance (Buckler, 1998), and 2) the development or acquisition of new knowledge or skills in response to internal and external stimuli that leads to a more or less permanent change in collective behavior, enhancing organizational effectiveness (Sadler-Smith et al., 2001). Other researchers have described OL as 1) the environment adjustment process for achieving the specific goals of an organization and a common learning method of procedure of the organization (Lin, 2007), 2) the firm's ability of evolution and action in response to the stimulation from the internal and external environment (Meyers, 1990), 3) the process of promoting organizational activities with better knowledge and understanding (Grant, 1996), and 4) the process of acquiring or internalizing the skills or know-how of the partners (Khanna et al., 1998). An entity/organization learns if through its processing of information the range of its potential behaviors is changed, or if any of its unit acquires knowledge that it recognizes as potentially useful to the organization (Huber, 1991).

Building on Huber's (1991) seminal work on OL, Miner and Mezias (1996) suggest that OL involves three key questions or issues 1) what are the learning processes, 2) who or what is doing the learning, and 3) when is learning valuable. The first question is closely related to the four constructs and processes of OL developed by Huber (1991). The four constructs which integrally linked to explain the OL process are 1) Knowledge Acquisition: This construct refers to the process of how knowledge is acquired or obtained; 2) Information Distribution: This construct relates to the process by which information from different sources is shared and thereby leads to new information or understanding; 3) Information Interpretation: This construct refers to a process by which distributed information is given one or more commonly understood interpretations; and 4) Organizational Memory: This construct refers to the means by which knowledge is stored for future use (Huber, 1991).

On the second question, Miner and Mezias (1996) suggest three levels of learning 1) the individual level; where individuals acquire and interpret information based on their personal cognitive maps and frameworks, 2) the group level; where the group decision-making of the firm will respond to performance feed-back with shared understanding and coordinated behavior; and 3) the organization level; where groups in the organization acquire knowledge through sharing of experience. With regard to the third question, the factors affecting the learning impact include learning rate, level of noise in the feedback process, numbers of the independent learning sub-units and the timing of learning (Miner and Mezias, 1996). Huber's (1991) work on OL provides a useful framework in understanding how knowledge is acquired by organizations in the inter-firm relationship from outside the organizational boundary through grafting process (Inkpen, 2000). Through grafting, which is a sub process of knowledge acquisition; organizations increase their store of knowledge by acquiring new knowledge not previously available within the organization either by mergers, acquisition or alliance (Huber, 1991). Thus, the focus of the present study directly relates to the grafting process, which occurs at the OL level to explain how organizations (the partner firms) in the inter-firm relationship such as IJVs acquire and transfer knowledge between them (Huber, 1991; Inkpen, 2000; Tsang et al., 2004; Hau and Evangelista, 2007).

Knowledge acquisition through alliance may occur in various organizational arrangements of strategic alliance such as JVs, licensing agreements, distribution and supply agreements, research and

development partnerships and technical exchanges (Inkpen, 1998a). Knowledge acquisition by organization through JVs is a multi-stage process (Inkpen and Dinur, 1998). The first stage begins with the formation of the JV; where interactions between the individuals from two or more JV partners occur. The second stage is the grafting process; where the knowledge is transferred from the JV to the partners. In the final stage, for internalization to occur, the parent firms must first attempt to transfer the partner's skill-related knowledge from the JV to themselves (Inkpen and Dinur, 1998).

Past studies on learning through alliance have acknowledged two main factors which affect knowledge acquisition 1) the accessibility of knowledge, and 2) the firm's effectiveness at learning (Inkpen, 1998a, 2000). The accessibility to alliance's knowledge is mainly depending on knowledge tacitness and partner protectiveness (Inkpen, 1998a). Knowledge tacitness limits knowledge accessibility when knowledge, which is embedded in personal beliefs, experiences and values, is hard to formalize, not easily visible and difficult to communicate and share (Inkpen, 2000). Partner protectiveness inhibits alliance knowledge acquisition when a high competitive overlap exists between partners. The transferring firms will be reluctant to share or transfer knowledge due to risk of knowledge spillovers to the opportunist learning partner (Inkpen, 1998a). In addition, knowledge must be accessible before it can be acquired and even if knowledge is accessible, it does not ensure acquisition. Thus, an effective knowledge acquisition is determined by 1) the knowledge connections between the parent and its JV, and 2) the nature of alliance knowledge and its relatedness to the parent (Inkpen, 2000).

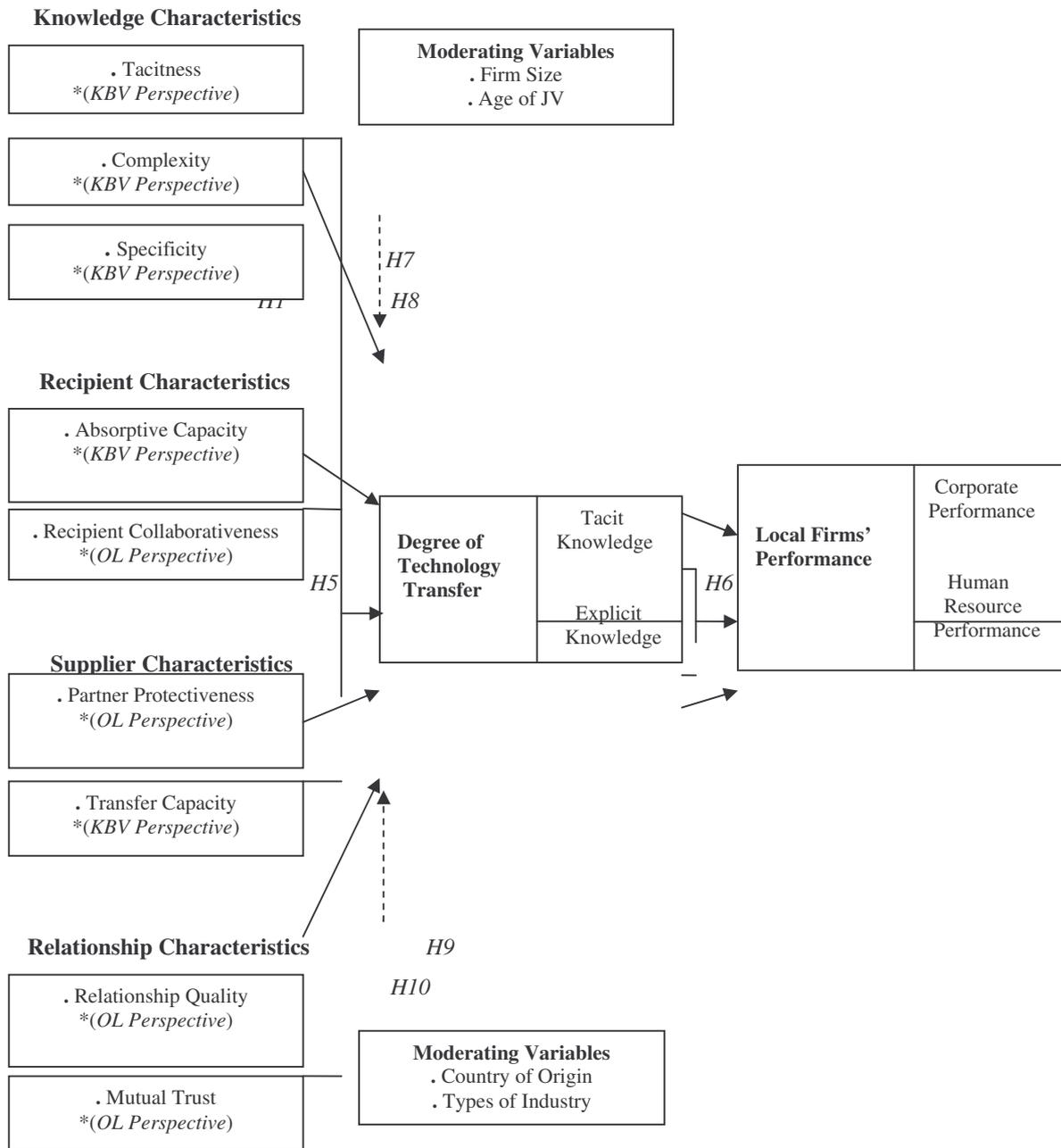
Bapuji and Crossan (2004), however, suggest that external learning by the organizations occurs in three forms: 1) congenital learning; where a new firm learns from the past experience of other firms in the industry, 2) vicarious learning; where firms learn from the experience of other firms, and 3) inter-organizational learning. In the inter-organizational learning, OL occurs through vicarious learning when organizations interact with each other in alliances or joint ventures (Bapuji and Crossan, 2004). Few TT studies have suggested that OL perspective provides much needed rigor in the conceptualization of the TT process in terms of its depth and breadth. Daghfous (2004) views OL literature as necessary and a complementary component of the complete view of 1) TT as a learning process; and 2) technology recipient organizations as learning system (Levin, 1993; Daghfous, 2004; Bapuji and Crossan, 2004). A review of literature reveals that the previous researchers have proposed several OL models which explain 1) how an organization learns (Argyris and Schon, 1978), 2) the sources of knowledge (Mills and Friesen, 1992), 3) the OL process (Nevis et al., 1995), 4) how organizational knowledge is created (Nonaka, 1994), 5) the links between individual learning and OL (Kim, 1993), and 6) the OL and KT in IJVs (Tiemessen et al., 1997).

The Inter-Firm Technology Transfer Model based on integrated KBV and OL perspectives

The main theories underpinning the relationships of variables in the conceptual framework (Figure 1) of this study are knowledge-based view (KBV) and organizational learning (OL) perspectives. The perspective of KBV underlies the relationships between KCHAR and their sub-variables: tacitness (TCT), complexity (COMPLX) and specificity (SPEC), and dependent variable TTDEG. Both KBV and OL perspectives underlie the relationships between the TRCHAR and their sub-variables: absorptive capacity (ACAP) and recipient collaborativeness (RCOL) and TTDEG. The relationships between the TSCHAR and sub-variables: partner protectiveness (PPROTEC), and transfer capacity (TRANSCAP), and TTDEG are governed by both KBV and OL perspectives. The OL perspective underlies the relationship between RCHAR and their sub-variables: relationship quality (RELQLTY) and mutual trust (MT). For the TTCHARS-TTDEG relationship, both KBV and OL perspectives are integrated to underlie the relationship.

As indicated in Figure 1 below, both KBV and OL perspectives have not only provided a strong foundation for the relationships between all TTCHARS and TTDEG in this framework but they also provide valuable arguments, theoretical insights, empirical findings, hypotheses development, testable constructs and reliable measurements (Simonin, 1999a; Minbaeva, 2007)

Figure 1: The Conceptual Framework of TTCHARS - TTDEG- LFP in IJV



Previous studies on knowledge transfer have acknowledged the significant effect of KCHAR (TCT, COMPLX and SPEC) on knowledge transfer (Kogut and Zander, 1992, 1993; Simonin, 1999a, 1999b, Pak and Park, 2004; Minbaeva, 2007). KBV perspective suggests that tacit knowledge/tacitness (TCT) is not easily replicable and transferable (Mowery and Rosenberg, 1989). A number of studies have established the role played by tacit knowledge as a barrier to knowledge and TT (Kogut and Zander, 1996; Choi and Lee, 1997; Simonin, 1999a). Tacit knowledge, which is context-specific, embedded in non-standardized and tailored process, is difficult to acquire and exploit (Polanyi, 1962). Tacit knowledge is the implicit and non-

codifiable accumulation of skills resulting from learning by doing, accumulated through experience and refined by practice (Reed and DeFillippi, 1990). Hence, tacit knowledge which is highly personal, deeply rooted in action, commitment, and involvement within a specific context, is hard to be formalized, communicated and shared (Nonaka, 1994). Tacit knowledge is subject to time-compression diseconomies which means to accelerate tacit knowledge learning is very difficult or perhaps not even possible no matter how much effort or resources are invested to acquire them (Dierickx and Cool, 1989). In the context of OL perspective, tacit knowledge, which is hard to formalize and not easily visible, is difficult to be communicated and shared with the other partners as it involves intangible factors that is embedded in the personal beliefs, experiences, and values of an organization (Inkpen, 1998a, Inkpen and Dinur, 1998). Empirical studies have found support that TCT has a significant negative impact which impedes inter-firm knowledge transfer (Simonin, 1999a, 1999b; Pak and Park, 2004; Minbaeva, 2007).

Past studies have also affirmed the significant effect of knowledge complexity (COMPLX) on knowledge transfer. COMPLX, as a result of the interdependent skills and assets, arises from large numbers of technologies, organization routines, individual and team-based experience (Reed and DeFillippi, 1990). COMPLX of human and technological systems produce a higher level of ambiguity that restrains imitation and impedes transferability. COMPLX as the number of interdependent technologies, routines, individuals and resources is linked to a particular knowledge or assets (Simonin, 1999a). As COMPLX increases, knowledge or technology becomes difficult to transfer or imitate (Kogut and Zander, 1993). Empirical studies have found support that COMPLX has a significant negative effect on both intra and inter-firm knowledge transfer (Simonin, 1999a, 1999b; Minbaeva, 2007).

Specificity (SPEC), as the third knowledge characteristic, refers to assets specificity that includes site, physical, dedicated and human assets which are durable investments undertaken in support of particular transaction (Williamson, 1985). Assets specificity as durable investments in specialized equipment, facilities and skilled human resources is not only acting as a source of ambiguity and barrier to imitation but also as a barrier to knowledge transferability (Simonin, 1999a; 1999b).

From the KBV perspective, a firm creates sustainable competitive advantage by developing valuable assets and competencies which are firm-specific, produce complex social relationships, embedded in the firm's history and culture thus generating organizational tacit knowledge (Lado and Wilson, 1994). As the firm's source of competitive advantage, knowledge or technology which is firm-specific is difficult to transfer (Kogut and Zander, 1993). Empirical studies have established that SPEC has a negative effect on knowledge transfer (Simonin, 1999a; Pak and Park, 2004; Minbaeva, 2007). Building on the theoretical and empirical studies, KCHAR which consists of TCT, COMPLX and SPEC are predicted to have a significant negative effect on TTDEG and its dimensions. This study advances the following hypotheses:

H1: Knowledge characteristics are negatively related to degree of technology transfer.

H1a: Knowledge characteristics are negatively related to degree of tacit knowledge.

H1b: Knowledge characteristics are negatively related to degree of explicit knowledge.

H1c: Tacitness is negatively related to degree of technology transfer.

H1d: Complexity is negatively related to degree of technology transfer.

H1e: Specificity is negatively related to degree of technology transfer.

Many theoretical and empirical studies have found support for the positive effect of absorptive capacity (ACAP) on knowledge transfer. A low degree of the technology recipient's ACAP impedes both intra and inter-firm knowledge transfer (Cohen and Lavinthal, 1990; Hamel, 1991; Lyles and Salk, 1996; Mowery et al., 1996; Lane and Lubatkin, 1998; Lane et al., 2001; Gupta and Govindarajan, 2000; Minbaeva et al., 2003, Minbaeva, 2007; Pak and Park, 2004; Simonin, 1999a, 1999b). ACAP is the firm's ability to recognize, assimilate, and apply to commercial ends the value of new external information (Cohen and Lavinthal, 1990). Prior related knowledge, as the important element of ACAP, is critical for organizations to assimilate and exploit new knowledge. By possessing sufficient prior related knowledge, organizations are able to have an adequate ability to absorb new external knowledge (Cohen and Lavinthal, 1990). OL literature suggests that another critical element of ACAP is the recipient's firm intensity of efforts. Intensity of effort is reflected on the amount of energy expended by organizational members to solve problems through organization members directing their considerable time and effort in learning how to solve problems before attempting to solve complex problems (Kim, 1998). Both intra and inter-firm knowledge transfer literature

have found positive effect of ACAP on knowledge transfer (Szulanski, 1996; Minbaeva, 2007; Lyles and Salk, 1996; Mowery et al., 1996; Simonin, 1999a; Pak and Park, 2004; Yin and Bao, 2006).

Another important dimension of TRCHAR is recipient collaborative (RCOL). RCOL is closely related to the recipient's learning intent (competitive vs. collaborative intent). The technology recipient firm's willingness to establish a mutually beneficial and collaborative relationship requires the recipient firm's honest intention to create common benefits for both JV partners (Yin and Bao, 2006). Studies on inter OL have suggested that cooperative/collective learning encourages the alliance partners to work together by sharing their knowledge, benefit each other's complementarities and provide mutual opportunities to extract potential synergies between their respective competencies (Doz, 1996; Geringer, 1991). Collaborative learning creates an access to the partner's knowledge and skills such as product and process technology, organizational skills, and knowledge about new environments (Inkpen, 1995a). In the collaborative learning environment where the recipient's learning intent is crucial, the transferring partner tends to be more open or transparent in terms of sharing and transferring knowledge to the acquiring firm as it involves mutual exchange of valuable knowledge (Inkpen, 2000). RCOL, which is reflected on the partner's learning intent (competitive vs. collaborative intent), determines the degree of openness or transparency in knowledge sharing and knowledge transfer (Inkpen, 2000). Few studies have found positive effect of RCOL on knowledge transfer (Yin and Bao, 2006; Hamel, 1991). Building on the theoretical and empirical studies, TRCHAR which consists of ACAP and recipient RCOL are expected to have a significant positive effect on TTDEG and its dimensions. Thus, this study advances the following hypotheses:

H2: Technology recipient characteristics are positively related to degree of technology transfer.

H2a: Technology recipient characteristics are positively related to degree of tacit knowledge.

H2b: Technology recipient characteristics are positively related to degree of explicit knowledge.

H2c: Absorptive capacity is positively related to degree of technology transfer.

H2d: Recipient collaborativeness is positively related to degree of technology transfer.

Partners in the collaborative relationship such as JV are expected to mutually exchange their valuable assets, resources, information, knowledge and technology between them in order to achieve mutual benefits (Inkpen, 2000; Khanna et al., 1998; Child and Faulkner, 1998). KBV perspective suggests that since the firm's competencies are the sources of technology-supplier's sustainable competitive advantage therefore for fear of losing ownership of their valuable assets they tend to protect their competencies from the opportunist recipient partner (Barney, 1991; Cohen and Lavinthal, 1990; Hamel, 1991). Partner protectiveness (PPROTEC) is closely related to partner's transparency or openness (Hamel, 1991). Relationship openness has been described as "the willingness and ability of JVs' partners to share information and communicate openly" (Inkpen, 2000). Most of the researchers are in consensus that the extent of willingness of the JV's partners to share and transfer knowledge depends on the degree of partner protectiveness and transparency (Hamel, 1991; Inkpen, 2000). Studies have suggested that if a situation of high competitive overlap exists, an alliance partner may be very reluctant to share knowledge due to risk of knowledge 'spillovers' to the other partner (Inkpen, 1998a; Inkpen, 2000; Yan and Luo, 2001). However, the theoretical and empirical studies have found inconsistent results of the impact of PPROTEC on both intra and inter-firm knowledge transfer (Szulanski, 1996; Simonin, 2004).

As for the technology-supplier's transfer capacity (TRANSCAP), many studies have suggested that while firms differ in their ability in creating knowledge, they also differ in their ability to transfer knowledge within or outside of the organization boundary (Kogut and Zander, 1992, 1993; Szulanski, 1996). The efficiency in transmitting knowledge by the technology supplier is important in both intra and inter-firm knowledge transfer (Martin and Solomon, 2003). Studies on inter-firm knowledge transfer suggest that the firm's ability to transfer knowledge facilitates the OL process as it justifies their commitments in the collaborative relationship (Inkpen, 1998a; Inkpen 2000; Khanna et al., 1998; Child and Faulkner, 1998). Empirical studies have shown that TRANSCAP has a significant positive impact on both intra and inter-firm knowledge transfer (Szulanski, 1996; Gupta and Govindarajan, 2000; Minbaeva, 2007; Yin and Bao, 2006). Thus, building on the theoretical and empirical studies, TSCHAR which consists of PROTEC and TRANSCAP are expected to have a significant effect on TTDEG and its dimensions. Thus, this study advances the following hypotheses:

- H3: Technology supplier characteristics are positively related to degree of technology transfer.*
H3a: Technology supplier characteristics are positively related to degree of tacit knowledge.
H3b: Technology supplier characteristics are positively related to degree of explicit knowledge.
H3c: Partner protectiveness is negatively related to degree of technology transfer.
H3d: Transfer capacity is positively related to degree of technology transfer.

OL literature suggests that acquiring and transferring technology require frequent and effective interactions between the supplier and recipient as knowledge is firm-specific, embedded in firm organizational context, personal quality in nature and idiosyncrasy (Nonaka, 1994; Kogut and Zander, 1992, 1993; Bresman et al., 1999). Studies have identified relationship quality (RELQLTY) as the critical element of relationship characteristic in both intra and inter-firm knowledge transfer (Szulanski, 1996; Gupta and Govindarajan, 2000; Lin, 2005; Gupta, 1987; Wang et al., 2004; Bresman et al., 1999). RELQLTY promotes intimacy of relationship between the source and recipient unit (Szulanski, 1996), informality, openness and density of communication (Gupta and Govindarajan, 2000), and increases openness of communication, spontaneous and open exchange of information between interacting parties (Gupta, 1987). In the context of strategic alliance, RELQLTY promotes greater opportunities to learn, share and access alliance partners' strategic knowledge and competencies. It also creates higher relationship openness which could directly affect the willingness of alliance partner to share information and communicate openly (Inkpen, 1998a, 2000). Consistent with the theoretical studies, empirical studies have established that RELQLTY has a significant positive effect on both intra and inter-firm knowledge transfer (Szulanski, 1996; Minbaeva, 2007; Hansen, 1999, 2002; Gupta and Govindarajan, 2000; Lin, 2005; Bresman et al., 1999).

With respect to mutual trust (MT) between partners, previous studies have suggested that MT creates opportunities for a mutual inter-organizational learning when partners become more open and committed in sharing their knowledge and competencies, less protective of their knowledge, and develop free exchange of information between partners (Inkpen, 2000). When the level of transparency or openness between the alliance partners is high, the propensity for inter-partner learning is also high as knowledge is more accessible due to free exchange of information (Hamel, 1991; Doz and Hamel, 1998; Inkpen, 2000). MT encourages partners to be more open and transparent in exchanging, sharing, and transferring knowledge and technology between them due to non-existence of opportunistic behaviors (Kale et al., 2000; Gulati, 1995; Uzzi, 1997; Child and Faulkner, 1998; Steensma and Lyles, 2000; Lane et al., 2001). MT is found to have reduced search cost, increased benefits and alliance's performance (Gulati, 1995), increased alliance's cooperation, improved flexibility, reduced the coordinating activities cost, and increased knowledge transfer and learning (Smith et al., 1995). Empirical studies have found positive impact of mutual trust on inter-firm knowledge transfer (Nielsen, 2007; Kale et al., 2000; Luo, 2001; Dhanaraj et al., 2004; Pak and Park, 2004). Building on the previous studies, RELQLTY and MT are predicted to have a significant positive effect on TTDEG and its dimensions. Thus, this study advances the following hypotheses:

- H4: Relationship characteristics are positively related to degree of technology transfer.*
H4a: Relationship characteristics are positively related to degree of tacit knowledge.
H4b: Relationship characteristics are positively related to degree of explicit knowledge.
H4c: Relationship quality has a positive effect on degree of technology transfer.
H4d: Mutual trust is positively related to degree of technology transfer.

Building on intra and inter-firm knowledge transfer literature, all technology transfer characteristics (TTCHARS) which formed the study's conceptual framework, are viewed as both the critical facilitators/determinants and barriers to TT (Szulanski, 1996). The TTCHARS are inter-dependent, co-existed and closely related to each other; where failure to manage any of TT characteristic will affect TT outcomes. Previous studies on intra and inter-knowledge transfer have acknowledged the significant influence of these facilitators/barriers on TT's success or failure (Szulanski, 1996, 2003; Gupta and Govindarajan, 2003; Minbaeva, 2007; Hamel, 1991; Inkpen, 1998, 2000). For technology acquisition to occur in IJVs, technology must first be accessible by the learning partner. In a collaborative/cooperative learning environment as opposed to competitive learning, the transferring partner is more transparent/open and willing to share and transfer their proprietary knowledge, competencies and skills although they are organizationally embedded in

the organization's routines and processes (Hamel, 1991; Inkpen, 2000; Child and Faulkner, 1998). As a result, this will reduce the degree of PPROTEC to allow for freer and greater flow of information to the learning partner particularly the accessibility to tacit knowledge (Inkpen, 2000; Yan and Luo, 2001; Hamel, 1991; Doz and Hamel, 1998). Relationship openness thus is influenced by the learning intent of the recipient partner and inter-partner MT (Inkpen, 2000; Inkpen and Beamish, 1997). If competitive overlap exists and for fear of losing their proprietary technology/knowledge and risk of spillovers, the transferring partner is likely to be less transparent, more protective of their technology either through explicit or active measures, and restrict the information flow to the opportunist partner who perceives JV as a low cost approach to internalize partner's competencies (Hamel, 1991; Simonin, 1999a, 2004; Steensma and Lyles, 2000). The recipient partner's learning intent also determines the TRANSCAP of the transferring partner in terms of increasing motivation to transfer technology.

MT between JV partners is important in reducing the fear of opportunistic behaviors of the recipient partner, promotes greater transparency which may contribute a higher degree of accessibility to partner's technological knowledge, and motivates the transferring partner to share and transfer higher technology (Inkpen, 1998; 2000). As a result of the collaborative learning intent (RCOL), RELQTY promotes a higher degree of MT and openness between partners resulting in a higher degree of knowledge sharing and transfer of tacit knowledge (Inkpen, 2000; von Hippel, 1998; Marsden, 1990; Kale et al., 2000). On the other aspect, learning capability (ACAP) promotes higher TTDEG if the learning partner has the capacity to recognize, absorb, assimilate and apply new technology/knowledge (Cohen and Lavinthal, 1990; Lane and Lubatkin, 1998). ACAP is closely related to knowledge connection and knowledge relatedness between JV partners (Inkpen and Dinur, 1998; Inkpen, 2000). Acquiring tacit knowledge involves various organizational levels and personal interactions between individuals and groups. Thus, knowledge connection and knowledge relatedness between JV partners are capable of creating potentials for the sharing of more personal observations and experiences (Von Krogh, 1994; Inkpen 2000).

Although TCT, COMPLX and SPEC have greatly contributed to technology ambiguity, these barriers to technological gap between JV partners may be reduced or eliminated if the learning partner has adequate prior related knowledge and intensity of learning efforts (Hamel, 1991; Inkpen, 2000; Szulanski, 1996; Kim, 1998). Building on previous theoretical and empirical studies, this study proposes the following hypotheses:

- H5: Technology transfer characteristics, which consist of knowledge, technology recipient, technology supplier, and relationship characteristics, are significant predictors of degree of technology transfer.*
- H5a: Technology transfer characteristics sub-variables, which consist of tacitness, complexity, specificity, absorptive capacity, recipient collaborativeness, partner protectiveness, transfer capacity, relationship quality, and mutual trust, are significant predictors of degree of technology transfer.*

Most of the studies on strategic alliance operationalize performance as either the JV or MNCs' subsidiary performance. Intra and inter-firm empirical studies on knowledge transfer and acquisition have established that knowledge transfer and acquisition have a significant positive effect on human resource, business and general performance (Lyles and Salk, 1996), operational cost, operational efficiency, employee productivity, business volume, market share, market penetration, product quality, customer service, and customer satisfaction (Lane et al., 2001; Tsang et al., 2004; Dhanaraj et al., 2004; Cui et al., 2006). On the local firms' performance (LFP), tacit knowledge acquisition is found to have a significant positive effect on the recipient firms' performance in terms of increasing their productivity, revenue and market share (Yin and Bao, 2006). Based on the empirical studies, this study proposes the following hypotheses:

- H6: Degree of technology transfer, which consists of degree of tacit and explicit knowledge, is positively related to local firms' performance.*
- H6a: Degree of technology transfer, which consists of degree of tacit and explicit knowledge, is positively related to local firms' corporate performance.*
- H6b: Degree of technology transfer, which consists of degree of tacit and explicit knowledge, is positively related to local firms' human resource performance.*

Past studies have affirmed that MNCSIZE has a significant effect on the intensity of strategic partnering and technological cooperation (Hagedoorn and Schakenraad, 1994), propensity of the firm to develop competitive advantage and achieve the above-average performance (Porter, 1980), organizational learning (Marquardt and Reynolds, 1994), motives for alliance formation (Glaister and Buckley, 1996), and asymmetric bargaining power between partners in the alliance relationship (Khanna et al., 1998). Generally, as compared to large firms, small firms do not have adequate resources and expertise to undertake inter-firm TT and are more likely to transfer technology through licensing agreements (Stobaugh, 1998). Empirical studies have found that MNCSIZE has a significant moderating effect on the relationships 1) between experience, know-how and collaborative relationship, and 2) between knowledge tacitness and ambiguity (Simonin, 1997; Simonin, 2004; Dhanaraj et al., 2004; Bresman et al. 1999). However, other studies have found MNCSIZE did not moderate 1) the knowledge-performance relationship, and absorptive capacity, and 2) learning and IJV performance relationship (Tsang et al., 2004; Lane et al., 2001). Building on the theoretical studies and empirical findings, MNCSIZE is predicted to have a significant moderating effect on the relationship between TTCHARS and TTDEG. Thus, this study advances the following hypothesis:

H7: The relationship between technology transfer characteristics and degree of technology transfer is moderated by the MNCs' firm size.

The IJV literature suggests that the longer the collaborative relationships the greater the opportunity for JV partners to share, learn and transfer technology and knowledge between them. This is because the duration of relationship is positively associated with frequency of communication and information exchange between partners (Kale et al., 2000; Hallen et al., 1991; Foss and Pedersen, 2002). Nevertheless, duration of JV could also increase the propensity of losing the valuable proprietary asset to the other JV partner (Kale et al., 2000). From the strategic alliance perspective, as an alliance sustains overtime, JVAGE provides several effects such as intensifying inter-partner trust, changing the bargaining power between partners, and developing partners' personal attachment (Gulati, 1995; Yan and Gray, 1994; Inkpen and Beamish, 1997). Empirical studies have found that the moderating effect of JVAGE has inconsistent results. Few empirical studies on inter-firm knowledge transfer in IJVs find JVAGE is insignificant in relationship between 1) knowledge acquisition-performance relationship, and 2) organizational characteristics, structural mechanisms, contextual factors, and knowledge acquisition relationship (Tsang et al., 2004; Lin, 2005; Lyles and Salk, 1996). Nevertheless, empirical studies have also recorded significant moderating effect of JVAGE on 1) ambiguity-knowledge transfer relationship, and 2) knowledge characteristics-marketing knowledge transfer relationship (Simonin, 1999a, 1999b). Building on the above theoretical studies and empirical findings, JVAGE is predicted to have a significant moderating effect on the relationship between TTCHARS and TTDEG. Therefore, this study hypothesizes as follows:

H8: The relationship between technology transfer characteristics and degree of technology transfer is moderated by age of JV.

Many theoretical and empirical studies have acknowledged the significant role of MNCCOO on the propensities of MNCs' choice of global strategies, organizational structures, control system, and internal corporate cultures (Bartlett and Ghoshal, 1990; Egelhoff, 1984; Franko, 1976; Porter, 1990; Yip et al., 1994). In the collaborative relationship such as JVs, partners tend to encounter various problems related to cultural differences, opinions, beliefs, and attitudes originated from the alliance partners' nationality (Kale et al., 2001). Studies have shown that nationality has a significant influence on the outcomes, performances, and inter-organizational learning in an alliance (Harrigan, 1988b; Parkhe, 1993; Mowery et al., 1996). Both theoretical and empirical studies have different views on the moderating effect of MNCCOO on knowledge transfer (Kale et al., 2000; Gupta and Govindarajan, 2000; Cho and Lee, 2004). However, the empirical findings suggest that MNCCOO has no moderating effect on the relationship between the supplier and recipient factors and tacit knowledge acquisition (Yin and Bao, 2006). Based on the theoretical and empirical studies, this study predicts that MNCCOO moderates the TTCHARS-TTDEG relationship. Thus, this study advances the following hypothesis:

H9: The relationship between technology transfer characteristics and degree of technology transfer is moderated by the MNCs' country of origin.

Economic theory has consistently found that industries characterized by greater degrees of knowledge intensities have the propensity to become more global than other industries (Goedde, 1978; Grueber et al., 1967; Horst, 1972). Asymmetries in industries characteristics show that certain industries are more global thus require a higher level of knowledge transfer than other industries (Minbaeva, 2007). Empirical studies on intra and inter-firm knowledge transfer have found support that MNCIND have a significant influence on knowledge transfer (Gupta and Govindarajan, 2000; Minbaeva, 2007; Cho and Lee, 2004; Lane and Lubatkin, 1998; Lane et al., 2001). However, few studies have also found MNCIND as insignificant (Luo, 2001; Dhanaraj et al., 2004; Nielsen, 2007). Thus, building on the previous theoretical and empirical studies, this study advances the following hypothesis:

H10: The relationship between technology transfer characteristics and degree of technology transfer is moderated by MNCs' types of industry.

CONCLUSION

Since many studies on inter-firm TT are theoretical (Hamel, 1991; Inkpen, 1998a; Inkpen and Dinur, 1998) and have exclusively focused on a single or few dimensions of TT determinants (Pak and Park, 2004; Yin and Bao, 2006; Hau and Evangelista, 2007) there is a need for more hypothesis development and testing (Huber, 1991; Fiol, 1994). The major contribution of this study to inter-firm TT literature is the development of "a holistic model of inter-firm TT in IJVs", which is based on the integrated perspectives of KBV and OL, in explaining the relative relationship (effects) of TT characteristics and degree of TT in a single model (Szulanski, 1996; Minbaeva, 2007).

In the context of inter-firm TT and knowledge transfer (KT), there are inadequate studies which examined all the four TT characteristics in a single model. For example, in the context of Korean's IJVs, Pak and Park (2004) examine two determinants of knowledge transfer: 1) relation-specific variables (equity ownership, conflict, and experience) and 2) knowledge-specific determinants (tacitness and absorptive capacity). Another study by Yin and Boa (2006) examines both supplier individual level and recipient's factors that affect tacit knowledge acquisition in China's JVs. In the context of marketing knowledge acquisition, Hau and Evangelista (2007) examine the effect of knowledge seekers, knowledge holders, and contextual factors on explicit and tacit knowledge acquisition through IJVs in Vietnam. Hence, the holistic model advanced by this study extends the theoretical scope of TT and KT literature. From a review of literature, the holistic model of inter-firm TT advanced by this study has never been conceptualized before by previous researchers.

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