Moderating Effects of MNCs’ Size in the Relationship between Knowledge Characteristics and Degree of Inter-Firm Technology Transfer in International Joint Ventures

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Abstract

The main objective of this paper is to empirically examine the moderating effect of size of MNCs on the relationships between knowledge characteristics: tacitness, complexity and specificity and two distinct dimensions of degrees of technology transfer: degrees of tacit and explicit knowledge in inter-firm technology transfer within IJVs. Using the moderated multiple regression, the theoretical models and hypotheses in this study were tested based on empirical data gathered from 128 joint venture companies registered with the Registrar of Companies of Malaysia (ROC). The results revealed that size of MNCs has significantly affected the relationships between knowledge characteristics (tacitness, complexity and specificity) and both degrees of tacit and explicit knowledge; where the relationships were found stronger for medium/small MNCs than large MNCs. The study has bridged the literature gaps in such that it offers empirical evidence on the moderating effect of size of MNCs on the relationships between knowledge characteristics and two distinct degrees of technology transfer: degrees of tacit and explicit knowledge using the Malaysian sample.

Keywords: Technology Transfer, International Joint Ventures, Multinationals, Malaysia.

1. Introduction

The current issue on inter-firm technology transfer (TT) in the developing countries is centered on the efficiency and effectiveness of the transfer process by the multinational corporations (MNCs); which is
often measured by degrees of technologies that are transferred to the recipient partners. Knowledge as the critical element underlying technology has become one of the main factors that affects the success and failure of inter-firm technology transfer within IJVs. 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 (Szlanski, 1996, 2000, 2003; Gupta and Govindarajan, 2000; Minbaeva, 2007). Based on a literature review on inter-firm knowledge transfer (KT), knowledge characteristics (KCHAR) that have been identified, among others, include tacitness, complexity, specificity (Kogut and Zander, 1993; Inkpen and Dinur, 1998, Simonin, 1999a, 1999b, 2004; Pak and Park, 2004; Inkpen, 2000; Minbaeva, 2007; Makhija and Ganesh, 1997; Lei et al., 1997; Inkpen, 1998a, 1998b, 2000; Parise and Handerson, 2001; Mohr and Sengupta, 2002), knowledge relatedness (Inkpen, 2000; Lyles et al., 2003), desirability (Pak and Park, 2004) and availability (Minbaeva, 2007). Knowledge tacitness, specificity and complexity have contributed significantly to knowledge ambiguity in imitation (Reed and DeFillippi, 1990), and knowledge migration (Szlanski, 1996).

Many empirical studies on knowledge transfer and acquisition in strategic alliance have seldom tested the impact (strength) of moderating variables on the linear (direct) relationships between knowledge characteristics and technology or knowledge transfer (for example Szulanski, 1996; Gupta and Govindarajan, 2000; Minbaeva, 2007; Pak and Park, 2004; Lin, 2005; Wang and Nicholas, 2005; Liao and Hu, 2007; Bresman et al., 1999; Mowery et al., 1996; Lyles and Salk, 1996; Kogut and Zander, 1993; Grosse, 1996; Dhanaraj et al., 2004; Hau and Evangelista, 2007). Nonetheless, few studies on inter-firm KT in strategic alliance have acknowledged the important role of moderating variables such as: 1) collaborative know-how, learning capacity and alliance duration (Simonin, 1999a), 2) collaborative experience and firm size (Simonin, 1999b), 3) organizational culture, firm size, alliance form, and competitive regime (Simonin, 2004), 4) age of JV (Mohr and Sengupta, 2002), and 5) alliance origin and alliance experience (Yin and Bao, 2006). In two knowledge acquisition studies through IJVs, Tsang et al. (2004) and Hau and Evangelista (2007) tested age of JV and environmental challenge as moderating variables in the relationship between knowledge acquisition and JV’s performance, and marketing knowledge acquisition and its antecedents.

Although previous studies have acknowledged the significant effect of knowledge transfer determinants on knowledge transfer outcomes, nevertheless, the effects of KCHAR on TTDEG in inter-firm TT could have 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 could have been significantly influenced or moderated by these variables. Therefore, following the recent approach in the strategic alliance literature (Simonin, 1999a, 1999b, 2004; Yin and Bao, 2006; Tsang et al., 2004), this study expects to fill the literature gaps by specifically examining the effect of size of MNCs (large vs. medium/small MNCs) as a moderating variable in the relationships between the KCHAR and two distinct dimensions of degree of technology transfer: degrees of tacit (TCTDEG) and explicit (EXPDEG) knowledge based on the underlying knowledge-based view (KBV) and organizational learning (OL) perspectives. The primary objective is to provide new insights and information on the boundary conditions for KCHAR-TTDEG relationship (Aguinis, 2004).

2. Theory and Hypotheses

2.1. Knowledge Characteristics, Degree of Technology Transfer and Moderating Effect of Size of MNCs

This study focuses on three critical attributes of KCHAR: tacitness (TCT), complexity (COMPLX), and specificity (SPEC); which have significantly contributed to knowledge ambiguity (Reed and
Knowledge has been classified using many different dimensions and the dimension that appears to be particularly relevant to TT is tacit vs. explicit dimension (Marcotte and Niosi, 2000; Grant, 1996a, 1996b, 1997). The concept of tacit knowledge (TCT) is derived from the famous work of Polanyi (1967) who asserts that “we can know more than what we can tell”. Tacit knowledge is knowledge that is non-verbalizable, intuitive and unarticulated, developed through the transfer of context-specific knowledge, embedded in non-standardized and tailored process, and is difficult to acquire and exploit (Polanyi, 1967). Tacit knowledge derives from the accumulated experience, and is reflected in the expertise, skills and routines acquired by organizational members over time (Winter, 1987). Past studies have established that tacit knowledge, which includes insights, intuitions and hunches, rule of thumb, gut feeling, personal and organizational skills (Nonaka, 1994), managerial and marketing expertise (Lane et al., 2001), is difficult to codify: where it can only be observed through its application and acquired through practice. Thus, tacit knowledge transfer between individuals is slow, costly and uncertain (Kogut and Zander, 1992). Acquiring 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 efforts or resources are invested to acquire them within a short period of time (Dierickx and Cool, 1989; Lin, 2003) because tacit knowledge is unique to the knowledge owner and not codifiable in formulas or manuals and cannot be reverse-engineered easily (Zander and Kogut, 1995). Tacit knowledge which is hard to formalize, often sticky and not easily visible, is difficult to communicate, transfer and share between the alliance partners as it involves 1) intangible factors embedded in the personal beliefs, experiences, and values in an organization (Inkpen, 1998a, 2000), 2) internal individual processes like experience, reflection, internalization or individual talents (Nonaka, 1994), and 3) high incremental cost of transferring the knowledge to a specified location in a form usable by a given party (von Hippel, 1994).

On the other hand, explicit knowledge such as product technologies, physical distribution methods, and promotion techniques, lies in the organization’s policies, systems, guidelines and standardized procedures, and could be acquired, exploited and transferred inter-organizationally in a formal and systematic language (Polanyi, 1967; Nelson and Winter, 1982; Martin and Solomon, 2003). Explicit knowledge is referred to as “knowledge that could be articulated, codified, shared and transferred in the form of data, formulae and principles, accessed using verbal communication and written documents through words and numbers, and is less likely to act as a firm’s competitive advantage” (Kogut and Zander, 1992; Winter, 1987).

A number of literature has described complexity (COMPLX) from many dimensions for example: 1) COMPLX is closely associated with the amount of information required to characterize the item of knowledge in question (Winter, 1987), 2) COMPLX is “a result of the interdependent skills and assets: which arises from large numbers of technologies, organization routines and individual or team-based experience” (Reed and DeFillippi, 1990), 3) COMPLX as “the number of interdependent technologies, routines, individuals and resources linked to a particular knowledge or assets” (Simonin, 1999a), 4) COMPLX as “the number of critical and interacting elements embraced by an entity or activity” (Kogut and Zander, 1993), and 5) COMPLX as “an applied system whose components have multiple interactions and constitutes a non-decomposable whole” (Singh, 1997). COMPLX of human and technological systems produce higher levels of ambiguity which restrains imitation and impedes transferability (Reed and DeFillippi, 1990). It is argued that the higher the degree of COMPLX of the manufacturing technology, the more difficult for knowledge to be transferred or imitated (Kogut and Zander, 1993).

Specificity (SPEC) originally refers to transaction costs asset specificity as popularized by Williamson (1985). Asset SPEC which includes site, physical, dedicated and human assets refer to durable investments that are undertaken in support of particular transaction (Williamson, 1985). Building on Williamson (1985), Reed and DeFillippi (1990) define SPEC as “transaction-specific skills and assets that are utilized in production processes and provision of services for particular customers”. Through firm-customer relationship, the business actions resulting from the resource and skill deployment (competencies) are highly specific and inter-dependent with the firm’s internal or
external transaction partners (Reed and DeFillippi, 1990). Although sites or physical assets create limited ambiguity to imitation by rivals, dedicated assets such as the plants specifically designed for the production of goods and services for a specific customer, and human asset SPEC is linearly and significantly related to ambiguity as these types of asset SPEC create barriers to imitation and are protected by the security and exclusivity of the firm-customer relationship (Reed and DeFillippi, 1990). Simonin (1999a, 1999b) narrowly views SPEC as “durable investments in specialized equipment, facilities and skilled human resources”. Asset SPEC is not only acted as a source of causal ambiguity and barrier to imitation, where technology is difficult to be explicitly articulated (Lippman and Rumelt, 1982), but also as a barrier to knowledge transferability (Simonin, 1999a). The firms’ resources and competencies, which are highly specific, are difficult to imitate and transfer as they are embedded in context and idiosyncrasy to the firm (Kogut and Zander, 1993). Firms create sustainable competitive advantage by developing firms’ assets and competencies that are firm-specific, produce complex social relationships i.e. firm-customer relationship, embedded in a firm’s history and culture, generate organizational tacit knowledge and time consuming to develop (Lado and Wilson, 1994; Dierickx and Cool, 1989; Kogut and Zander, 1993).

The current TT issue in IJVs revolves around the extent of degree of technologies that are transferred (TTDEG) by the suppliers to recipient partners (Pak and Park, 2004; Minbaeva, 2007). The question is no longer whether or not the MNCs are transferring technology to local firms instead the focus in the literature has shifted to questions on 1) the level (sophistication) of the transferred technology, and 2) the stage where the transfer process has reached (Lai and Narayanan, 1997; Narayanan and Lai, 2000). Except for Pak and Park (2004) and Minbaeva (2007), not many studies in both intra and inter-firm TT have focused on TTDEG as independent or dependent variable. In general, bulk of the studies has focused more on technological knowledge and knowledge acquisition ‘per se’ as the outcomes (dependant variables). Past studies have acknowledged the effect of size of MNCs (MNC_SIZE) on both intra and inter-firm knowledge transfer due to asymmetries in the availability of the firms’ resources (Kogut and Zander, 1992, 1993; Simonin, 1997, 1999a, 2004; Bresman et al., 1999; Minbaeva et al., 2003). Large firms, because of the availability of high number of resources and expertise, are capable to transfer more/higher technology and knowledge than medium/small firms. Hagedoorn and Schakenraad (1994) find a strong positive effect of MNC_SIZE on the intensity of strategic partnering and technological cooperation because large firms have substantial administrative, organizational and monitoring supports to form an alliance. Generally, small firms do not have adequate resources and are likely to transfer knowledge and technology through arm’s length licensing agreements (Stobaugh, 1988). MNC_SIZE affects the propensity of the firm to develop competitive advantage and achieves the above-average performance (Porter, 1980). The strategy literatures also regard MNC_SIZE as the important contingency variable with respect to governance, levels of diversification and resistance to organizational change (Hoskisson et al., 1994), influence intra-firm knowledge transfer, and as an impediment to organizational learning (Marquardt and Reynolds, 1994). In the context of strategic alliance, MNC_SIZE has been considered as: 1) a determinant of alliance participation, intensity of strategic partnering and technological cooperation (Berg et al., 1982; Hagedoorn and Schkenraad, 1994), 2) a differentiating factor in the motives for alliance formation (Glaister and Buckley, 1996), and 3) a source of asymmetric bargaining power between partners in the alliance relationship (Khanna et al., 1998).

H1: The relationship between knowledge characteristics and degree of tacit knowledge in inter-firm technology transfer is moderated by size of MNCs.

H2: The relationship between knowledge characteristics and degree of explicit knowledge in inter-firm technology transfer is moderated by size of MNCs.
3. Methods
3.1. Sample
The sample frame was taken from the IJV companies registered with the Registrar of Companies (ROC). As at 1st January 2008, the number of IJVs operating in Malaysia was 1038. Out of this, 850 IJVs were considered as active IJVs and 103 IJVs were either dormant or had ceased operation. Since the focus of this study is on inter-firm TT from foreign MNCs to local companies, 85 IJVs were further eliminated from the population frame because only IJVs that have operated more than 2 years and have at least twenty percent (20%) of foreign equity are eligible to participate in the survey. Therefore, based on the list provided by ROC, which is considered as the most official and original source of information on foreign investment in Malaysia, it was decided that all IJVs (850) be included in the survey. Data collection was conducted in the period from July 2008 to December 2008 using a self-administered questionnaire. The questionnaires were mailed to 850 active JV companies as listed with ROC using a cover letter. After one month from the posting date the response was found not encouraging. By mid July 2008 there were only 70 responses received from the respondents. Thus, in order to increase the response rate the researcher followed-up through numerous phone calls, e-mails, reminders via letters and personal visits to seek the respondents’ cooperation in the survey. After intensive efforts were made, by mid November 2008 a total of 145 responses (17.05%) were received. Based on literature review, the response rates for mailed questionnaires are usually not encouraging and low (Newman, 2003; Sakaran, 2003). In the Malaysian context, however, a response rate of 15% to 25% is still being considered appropriate and acceptable (Mohammed, 1998; Rozhan, Rohayu and Rasidah, 2001). From 145 responses only 128 questionnaires were usable and 17 questionnaires were returned blank, returned incomplete, or replied but unable to participate in the study.

3.2. Instrument and Measurement
The main research instrument in this study is the questionnaire. Building on the previous TT and KT studies, the questionnaire adopts a multi-item scales which have been modified accordingly to suit the context of the study: inter-firm TT. Except for degree of technology transfer (TTDEG), all the variables are measured using ten-point Likert Scale (1 = strongly disagree to 10 = strongly agree). For TTDEG, this variable is measured using ten-point Likert Scale (1 = very low transfer to 10 = substantial transfer). The ten-point Likert Scale was selected because 1) the wider distribution of scores around the mean provides more discriminating power, 2) it is easy to establish covariance between two variables with greater dispersion around their means, 3) it has been well established in academic and industry research, and 4) from a model development perspective, a ten-point scale is more preferred (Allen and Rao, 2000).

3.3. Dependent Variable
3.3.1. Degree of Technology Transfer (TTDEG)
Following Lyles and Salk (1996), Lane et al. (2001), Gupta and Govindarajan (2000), Dhanaraj et al. (2004), Pak and Park (2004), Yin and Boa (2006) and Minbaeva (2007), this study adopts “a multi-dimensional operationalization approach” in measuring this construct. This study operationalizes TTDEG as the transfer of technological knowledge in terms of two dimensions: 1) tacit knowledge (TCTDEG) in terms of new product/service development, managerial systems and practice, process designs and new marketing expertise, and 2) explicit knowledge (EXPDEG) in terms of manufacturing/service techniques/skills, promotion techniques/skills, distribution know-how, and purchasing know-how. The respondents were asked to evaluate TTDEG from MNCs to local firms in terms of tacit and explicit dimensions of technological knowledge. The Cronbach Alphas for TCTDEG and EXPDEG were 0.96 and 0.97 respectively. The results of Cronbach Alpha were quite similar to that of Hau and Evangelista (2007) and Yin and Bao (2006).
3.4. Independent Variables

3.4.1. Knowledge Characteristics (KCHAR)
This study focuses on three critical attributes of KCHAR: tacitness (TCT), complexity (COMPLX), and specificity (SPEC); which have significantly contributed to knowledge ambiguity (Reed and DeFillippi, 1991; Simonin, 1999a). This study captures the taxonomic dimension of knowledge (tacit vs. explicit dimension) (Winter, 1987) and knowledge ambiguity (Kogut and Zander, 1993; Zander and Kogut; 1995).

3.4.2. Tacitness (TCT)
This study measures TCT in terms of its two constructs: codifiability and teachability (Kogut and Zander, 1993; Simonin, 1999a, 1999b, 2004). For codifiability, multi-item scales are designed to capture the extent to which the technology has been articulated in documents. Two (2) items are adopted from Kogut and Zander (1993) and modified accordingly to suit the context of this study which includes statements as to whether 1) the foreign JV partner’s manual describing the technology can be written, and 2) large parts of the foreign JV partner’s technology are embodied in standard software. Two (2) items are adopted from Simonin (1999a, 1999b, 2004) which include statements whether 1) the foreign JV partner’s technology is easily codified, and 2) the foreign JV partner’s technology is more explicit than tacit. One (1) item is adopted from Pak and Park (2004) inquiring whether the partner’s technology is hard to verbally transfer. For teachability, the scales are designed to capture the ease by which technology can be learned by the local JV partner. Three (3) items are adapted from Kogut and Zander (1993) and modified accordingly to suit the context of the study which include statements whether 1) the local JV firm’s personnel can easily learn the technology by communicating with the foreign JV partner’s skilled personnel, 2) the local JV local firm’s personnel can easily learn the technology by studying a complete set of blue prints, and 3) educating and training the JV local firms’ personnel is a quick and easy process. The Cronbach Alpha for TCT was slightly higher (0.86) than Simonin’s (1999a) Cronbach Alpha (0.72).

3.4.3. Complexity (COMPLX)
Following Simonin (1999a, 1999b, 2004) and Kogut and Zander (1992, 1993), this study adopts a five (5) items scale in measuring COMPLX which include statements whether the JV partner’s technology is the product of many interdependent techniques, routines, individuals, resources, and processes. The Cronbach Alpha for COMPLX was slightly higher (0.84) than Pak and Park’s (2004) Cronbach Alpha (0.74).

3.4.4. Specificity (SPEC)
To capture SPEC this study adopts a two (2) items scale from Simonin (1999a, 1999b) in terms of whether 1) the foreign JV partner has invested significantly in specialized equipment and facilities in developing their technology, and 2) the foreign JV partner has invested significantly in skilled human resources in developing their technology. Following Pak and Park (2004), this study also adopts one (1) item scale which includes a statement on whether the technology is difficult to access from the other company. For SPEC the Cronbach Alpha was slightly lower (0.72) as compared to Pak and Park’s (2004) Cronbach Alpha (0.87).

3.5. Moderating Variable of Size of MNCs (MNC_SIZE)
Following the previous studies (Simonin, 1999a; Tsang et al., 2004; Dhanaraj et al., 2004), MNC_SIZE is measured by the total employees of the foreign JV partner based on items coded: 0 = Large MNCs (employees > 1000) and 1 = small/medium MNCs (employees < 1000) (Yin and Bao, 2006).
3.6 Model and Analysis

The moderated multiple regression (MMR) analysis is described as an inferential procedure which consists of comparing two different least-squares regression equations (Aguinis, 2004; Aiken and West, 1991; Cohen and Cohen, 1983; Jaccard et al., 1990). Using the MMR analysis, the moderating effect of the variable (product term) was analyzed by interpreting 1) the $R^2$ change in the models obtained from the model summaries, and 2) the regressions coefficients for the product term obtained from the coefficients tables. Prior to conducting the MMR analysis, preliminary analyses were conducted to ensure that there was no violation of the assumptions of normality, linearity, homoscedasticity, and homogeneity of error variance. The population data was carefully examined to avoid the occurrence of 1) Type 1 error; which is the error of rejecting the true null hypotheses at a specified $\alpha$, and 2) Type 2 error ($\beta$); which is the error of failing to reject a false null hypotheses at a specified power (Aguinis, 2004). In this study, Equation 1 below was used to represent the variables in the ordinary least-squares (OLS) model:

\[
(\text{OLS model}): Y = \beta_0 + \beta_1X + \beta_2Z + e
\]  

(1)

To determine the presence of moderating effect, the OLS model was then compared with the MMR model which was represented by Equation 2 below:

\[
(\text{MMR model}): Y = \beta_0 + \beta_1X + \beta_2Z + \beta_3X*Z + e
\]  

(2)

where, $Y =$ degree of technology of transfer (TCTDEG and EXPDEG as the dependent variables), $X =$ knowledge characteristics (tacitness, complexity and specificity), $Z =$ a hypothesized binary grouping moderator (MNC$_{\text{SIZE}}$: large vs. medium/small), $X*Z =$ the product between the predictors (KCHAR*MNC$_{\text{SIZE}}$), $\beta_0 =$ the intercept of the line-of-best-of-fit which represents the value of $Y$ when $X = 0$, $\beta_1 =$ the least-squares estimate of the population regression coefficient for $X$, $\beta_2 =$ the least-squares estimate of the population regression coefficient for $Z$, $\beta_3 =$ the sample-base least-squares estimates of the population regression coefficient for the product term, and $e =$ the error term. The moderating variable (product term) is a binary grouping moderator; where the moderating variable MNC$_{\text{SIZE}}$ was coded using the dummy coding system; 0 = large MNCs, and 1 = medium/small MNCs. This is because of its simplicity and ease of interpretation of results when making comparisons between different groups (Aguinis, 2004).

4. Results

Table 1 and Table 2 show the model summary for both degrees of tacit (TCTDEG) and explicit (EXPDEG) knowledge. The coefficients for all variables for Model 1 and Model 2 (for both TCTDEG and EXPDEG) were presented in Table 3 and Table 4 below.

Table 1: Model Summary$^c$ - Degree of Tacit Knowledge

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>R Square Change</th>
<th>F Change</th>
<th>df1</th>
<th>df2</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.347$^a$</td>
<td>.121</td>
<td>.106</td>
<td>5.486</td>
<td>.121</td>
<td>8.564</td>
<td>2</td>
<td>125</td>
<td>.000</td>
</tr>
<tr>
<td>2</td>
<td>.439$^b$</td>
<td>.193</td>
<td>.173</td>
<td>5.276</td>
<td>.072</td>
<td>11.126</td>
<td>1</td>
<td>124</td>
<td>.001</td>
</tr>
</tbody>
</table>

| a. Predictors: (Constant), MNC$_{\text{SIZE}}$, KCHAR. |
| b. Predictors: (Constant), MNC$_{\text{SIZE}}$, KCHAR, KCHAR*MNC$_{\text{SIZE}}$. |
| c. Dependent Variable: TCTDEG. |

Table 1 above shows that for Model 1, $R = .347$, $R^2 = .121$ and $[F(2, 125) = 8.564, p = .0001]$. This $R^2$ means that 34.7% of the variance in the TCTDEG is explained by KCHAR scores and MNC$_{\text{SIZE}}$. Model 2 shows the results after the product term (KCHAR*MNC$_{\text{SIZE}}$) was included in the
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equation. Table 1 also indicates that the inclusion of the product term resulted in an $R^2$ change of .072, $[F (1, 124) = 27.401, p < 0.001]$. The results support the presence of a moderating effect. To put it differently, the moderating effect of MNC SIZE explains 7.2% variance in the TCTDEG above and beyond the variance by KCHAR scores and MNC SIZE. Thus, it can reasonably be concluded that hypothesis $H1$ was supported.

Table 2: Model Summary $^c$ - Degree of Explicit Knowledge

Table 2 above shows that for Model 1, $R = .274$, $R^2 = .075$ and $[F (2, 125) = 5.061, p = .001]$. This $R^2$ means that 27.4% of the variance in the EXPDEG is explained by KCHAR scores and MNC SIZE. Model 2 also shows the results after the product term (KCHAR*MNC SIZE) was included in the equation. Table 2 above indicates that the inclusion of the product term resulted in an $R^2$ change of .034, $[F (1, 124) = 4.752, p < 0.05]$. The results support the presence of a small significant moderating effect. To put it differently, the moderating effect of MNC SIZE explains 3.4% variance in the EXPDEG above and beyond the variance by KCHAR scores and MNC SIZE. Thus, it can safely be concluded that hypothesis $H2$ was supported. The coefficients table for TCTDEG as shown in Table 3 below depicts the results of the regressions equation for Model 1 and Model 2.

Table 3: Coefficients$^a$ - Degree of Tacit Knowledge

Model 1 indicates that KCHAR was not statistically significant ($p > 0.001$); however MNC SIZE was statistically significant ($p < 0.001$; Beta -0.316). Equation 3 below shows that for a 1-point increase in KCHAR, the TCTDEG is predicted to have a difference by -.043, given that the MNC SIZE is held constant. The regression coefficient associated with MNC SIZE means that the difference in TCTDEG between large and medium/small MNCs is -3.715, given that KCHAR is held constant.

$$TCTDEG = 21.848 - .043KCHAR - 3.715MNC SIZE$$

The high-order of interaction effects of the MMR test was conducted to differentiate the degree of technology transferred by large and medium/small MNCs. Model 2 shows the results after the product term (KCHAR*MNC SIZE) was included in the equation. As indicated in Table 1 the inclusion
of product term resulted in an $R^2$ change of .072, $[F (1, 124) = 27.401, p < 0.001]$. Model 2 shows KCHAR are highly significant ($p < 0.001$; Beta -0.482). Both MNC\_SIZE and KCHAR*MNC\_SIZE were also found to be significant ($p < 0.05$; Beta 1.123 and $p < 0.001$; Beta -1.491 respectively). The results support the presence of a moderating effect. Table 3 also reveals information on the regression coefficients after the inclusion of product term in the equation. The equation for Model 2 is as follows:

$$TCTDEG = 11.151 - .159KCHAR + 13.216MNCSIZE - .184KCHAR.MNCSIZE$$

As indicated above, the interpretation of the regression coefficients is based on the fact that the binary moderator was coded using the dummy code system. The result for Model 2 indicates that for a 1-point increase in the KCHAR, the TCTDEG is predicted to have a difference by -.159, given that MNC\_SIZE is held constant. The interpretation of the regression coefficients for the product term in Equation 4 is that there was a -.184 difference between the slope of TCTDEG on KCHAR between large and medium/small MNCs. In other words, the slope regressing TCTDEG on KCHAR is steeper for medium/small MNCs as compared to large MNCs. The KCHAR and TCTDEG relationship for large and medium/small MNCs is shown in Figure 1 below by creating a graft displaying the relationships for each of the groups (Aguinis, 2004). From the result of descriptive statistics, the value of the mean score for KCHAR is 6.56; and for the standard deviation ($SD$) is 1.25. Following Aguinis (2004), the value 1 $SD$ above the mean is 7.81, and the value 1 SD below the mean is 5.31. Thus, using the value of 1 ($SD$) above and 1 ($SD$) below mean in Equation 4 yields the graph shown in Figure 1. Results based on Equation 4 led to the conclusion that there was a moderating effect of MNC\_SIZE. Figure 1 below shows that the KCHAR-TCTDEG relationship is stronger (i.e. steeper slope) for medium/small MNCs as compared to large MNCs. The coefficients table for EXPDEG as shown in Table 4 below depicts the results of the regressions equation for Model 1 and Model 2.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>95% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>24.882</td>
<td>2.545</td>
<td></td>
<td>9.778</td>
<td>.000</td>
</tr>
<tr>
<td>KCHAR</td>
<td>-0.29</td>
<td>0.26</td>
<td>-0.95</td>
<td>1.105</td>
<td>.271</td>
</tr>
<tr>
<td>MNCSIZE</td>
<td>-2.758</td>
<td>0.93</td>
<td>-2.53</td>
<td>-2.935</td>
<td>.004</td>
</tr>
<tr>
<td>2 (Constant)</td>
<td>18.073</td>
<td>4.005</td>
<td></td>
<td>4.513</td>
<td>.000</td>
</tr>
<tr>
<td>KCHAR</td>
<td>-1.02</td>
<td>0.42</td>
<td>-3.35</td>
<td>2.411</td>
<td>.017</td>
</tr>
<tr>
<td>MNCSIZE</td>
<td>8.020</td>
<td>5.030</td>
<td>.735</td>
<td>1.594</td>
<td>.113</td>
</tr>
<tr>
<td>KCHAR*MNCSIZE</td>
<td>-0.117</td>
<td>0.554</td>
<td>-1.024</td>
<td>-2.180</td>
<td>.031</td>
</tr>
</tbody>
</table>

Table 4: Coefficients\(^a\) - Degree of Explicit Knowledge

Model 1 indicates that KCHAR was also not statistically significant ($p > 0.001$); however MNC\_SIZE was statistically significant ($p < 0.05$; Beta -0.253). Equation 5 below shows that for a 1-point increase in KCHAR, the EXPDEG is predicted to have a difference by -.029, given that the MNC\_SIZE is held constant. The regression coefficient associated with MNC\_SIZE means that the difference in EXPDEG between large and medium/small MNCs is -2.758, given that KCHAR is held constant.

$$EXPDEG = 24.882 - .029KCHAR - 2.758MNCSIZE$$

Model 2 shows the results after the product term (KCHAR*MNC\_SIZE) was included in the equation. As indicated in Table 2 the inclusion of product term resulted in an $R^2$ change of .034, $[F (1, 124) = 4.752, p < 0.05]$. Both KCHAR and KCHAR*MNC\_SIZE are significant (both at $p < 0.05$ level; Beta -0.335 and -1.024 respectively); however MNC\_SIZE is not statistically significant ($p > 0.05$). The results support the presence of a small significant moderating effect. Table 4 also reveals information on the regression coefficients after the inclusion of product term in the equation. The equation for Model 2 is as follows:

$$EXPDEG = 18.073 - .102KCHAR + 8.020MNCSIZE - .117KCHAR.MNCSIZE$$
The result for Model 2 indicates that for a 1-point increase in the KCHAR, the EXPDEG is predicted to have a difference by -.102, given that MNC_SIZE is held constant. The interpretation of the regression coefficients for the product term in Equation 6 is that there was a -.117 difference between the slope of EXPDEG on KCHAR between large MNCs and medium/small MNCs. The slope regressing EXPDEG on KCHAR is steeper for medium/small MNCs as compared to large MNCs. The KCHAR and EXPDEG relationship for large and medium/small MNCs is also shown in Figure 1 below. The value of the mean score for KCHAR is 6.47 and for the standard deviation (SD) is 1.34. The value 1 SD above the mean is 7.81, and the value 1 SD below the mean is 5.31. Thus, using the value of 1 (SD) above and 1 (SD) below mean in Equation 6 yields the graph shown in Figure 1. Results based on Equation 6 led to the conclusion that there was a small moderating effect of MNC_SIZE. Figure 1 below shows that the KCHAR-EXPDEG relationship is stronger (i.e. steeper slope) for medium/small MNCs as compared to large MNCs.

**Figure 1:** Slopes for both TCTDEG and EXPDEG on KCHAR for MNC_SIZE

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**5. Discussion and Conclusion**

Building on the underlying KBV and OL perspectives, this study has bridged the literature gaps by providing empirical evidence on the significant moderating effect of size of MNCs on the relationships between knowledge characteristics (tacitness, complexity and specificity) and two dimensions of degree of technology transfer: degrees of tacit and explicit knowledge using the Malaysia sample. The results suggest that the inclusion of MNC_SIZE (large vs. medium/small MNCs) in KCHAR-TCTDEG and KCHAR-EXPDEG relationships has a significant moderating effect in changing the degree (volume) of technology transfer for both degrees of tacit ($p < 0.001$; $R^2$-squared change of 0.72) and explicit ($p < 0.05$; $R^2$-squared change of 0.34) knowledge. The moderating effect of MNC_SIZE is shown to be capable of changing the nature of both relationships and explains under what condition KCHAR causes TCTDEG and EXPDEG. The presence of MNC_SIZE (large and medium/small MNCs) has a significant moderating effect in changing the volume/degree of technology transfer thus exceeding the
linear relationships between $K_{CHAR}$ and both $TCT_{DEG}$ and $EXP_{DEG}$. This is not surprising given the fact that $MNC_{SIZE}$ received strong theoretical support in the literature (Hagedoorn and Schakenraad, 1994; Glaister and Buckley, 1996; Hoskisson et al., 1994).

As the key finding in this study, the results suggest that $MNC_{SIZE}$; whether large or medium/small MNCs, has been established to provide a moderating impact on the degree of TT in the JVs. The slopes for both $TCT_{DEG}$ and $EXP_{DEG}$ on $K_{CHAR}$ for large and medium/small MNCs (Figure 1) indicated that the presence of a significant moderating effect of $MNC_{SIZE}$. Interestingly, the relationships appeared to be stronger for medium/small MNCs as compared to large MNCs. The results further suggest that between the two degrees of knowledge, the moderating effect of $MNC_{SIZE}$ particularly by medium/small MNCs on $K_{CHAR}$-$TCT_{DEG}$ relationship was stronger than its moderating effect on $K_{CHAR}$-$EXP_{DEG}$ relationship. The results provide critical information in such that due to the nature of knowledge which is highly tacit, complex and firm-specific both large and medium and small MNCs are unlikely to transfer higher degrees of both tacit and explicit technologies in IJVs. Even though large MNCs are known for having abundant supply of resources, expertise and more experience to undertake technology transfer in IJVs, nevertheless, due to their inherent advantage, a higher bargaining power and less dependent on local partners they are unlikely to transfer a higher degree or technology to local partners. Large MNCs have the tendency to treat their JV as one-way learning processes thus having little to share with local partners (Liu and Vince, 1999; Danis and Park, 2002). As learning in IJVs is asymmetrical, large MNCs consider learning as mainly the task of the knowledge-disadvantaged local partners (Lin, 2005). The MNCs from the developed countries would frequently request for a bigger equity ownership to increase their bargaining power and have full control of the systems, methods and decisions in the JVs (Makhija and Ganesh, 1997). Large MNCs typically choose JVs as the vehicle towards gaining knowledge and information on local business, economics, and political stability (Sinha, 2001). In this sense, large MNCs possibly will limit the transfer of technology to local partners by protecting their proprietary technologies and competencies in order to maintain their dominance (Taylor, 1995).

On the other hand, as compared to large MNCs, although medium/small MNCs in JVs are more likely to compromise with local partners on the equity ownership issue in order to have a balanced bargaining power in IJVs, nevertheless, due to their limited resources, expertise and lack of IJVs experience they are most unlikely to undertake technology transfer of both tacit and explicit knowledge than large MNCs particularly if the transfer involves technologies which form the strategic valuable resources, competencies and source of sustainable competitive advantage of the MNCs (Porter, 1985; Barney, 1991; Peteraf, 1993; Wernerfelt, 1984; Prahalad and Hamel, 1990). Another plausible argument is that the IJVs in the developing countries have always been construed as having high instability rate (Beamish, 1985). Both medium/small and large MNCs usually have the upper advantage of bringing their superior technology into the foreign markets and this has frequently affected the bargaining power of their counterpart from the developing countries. Because of their technology superiority, the foreign MNCs have always perceived themselves as having strong bargaining power in IJVs (Kogut and Zander, 2003). The results further support and extend the empirical findings by Simonin (1997, 1999a, 2004) where $MNC_{SIZE}$ was found to have moderated the relationships between 1) tacitness and knowledge transfer, and 2) learning intent, learning capacity, knowledge ambiguity and knowledge transfer. The findings also extend technology transfer literature by establishing that $MNC_{SIZE}$ moderates the relationship between $K_{CHAR}$ and $TT_{DEG}$ for both tacit and explicit knowledge.

6. Limitations, Implications and Recommendation for Further Research
One of the major limitations encountered by this study was the resource constraints; where this study has mainly relied on responses obtained from the top management level of the JVs. Thus, the scope of respondents could have been extended to include the response from middle and lower management levels in the JVs. Secondly, consistent with the literature, the subjectivity of nature of relationship is
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difficult to capture. Thus, the nature of relationship between IJV partners could have tremendously affected the results if the respondents perceived that the IJVs were competitive in nature rather than collaborative. Thirdly, due to lack of awareness on academic research the response rate in terms of the number of usable questionnaires, though sufficient, was not encouraging. This has become a major challenge to many researchers who conduct organization studies in Malaysia. Finally, due to time constraints, the types of technology under investigation in this study were limited to tacit vs. explicit knowledge dimension.

This empirical study is a response to the need for statistical evidence that has typically been lacking in inter-firm TT literature. Since this study focuses on degree of inter-firm TT, future studies could be conducted to further examine the moderating effect of size of MNCs in the relationships between other technology transfer characteristics such the recipient, supplier and relationship characteristics and degree of technology transfer. Secondly, the above relationship could also be extended to cover other formal and externalized inter-firm TT agents such as FDIs and licensing. Thirdly, it is worthwhile to extend the tacit and explicit dimension of technology to cover other dimensions of supply chain activities such as production, marketing, management, and distribution. Fourthly, since the IJV literature has highlighted the high instability rate of IJVs in developing countries, future studies could be directed to empirically examine the moderating effect of size of MNCs on the relationships between degree of inter-firm TT and conflicts, learning outcomes, asymmetric bargaining power, stability of JV, and equity ownership. Finally, future studies could further investigate the effects of few other established moderating variables such as organizational culture, collaborative know-how, prior JV experience, and learning capacity on the relationship to provide new insights and information on the boundary condition of knowledge characteristics-degree of technology transfer relationship.
References


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