Human Resources Integration Strategy for International Technology Entrepreneurship in the Chinese Small and Medium Companies

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Abstract

Technology cooperation has been an important approach to enhancing the capability of international technology entrepreneurship in developing countries. However, the knowledge transfer in distributive engineering context was more complicated than it was expected. The integration strategy and capability of technology receiver or tech-entrepreneurs are crucial for building up the integration strategies. This study was carried out in the Chinese small and medium companies such as local automobile components firms that were transferring core technology from the multinational partners to local companies through human resource integrated strategies. An in-depth case analysis was conducted to examine the technology entrepreneurship process in China and provide critical incidents in measuring transferring technology through partner interaction, joint project teams, and customer interaction. A three-level knowledge integration-based interactive strategy model was developed with vertical business-tech-supplier integration, vertical business-key customer integration and horizontal cross-functional team integration. An empirical testing by the technology-transfer entrepreneurship scale among managers and technicians involved in technology innovation and transferring showed that human resources integration strategies for the horizontal cross-functional teams had the most significant impact on the effectiveness of international high-tech entrepreneurship. Based on the results of the case study and empirical testing, the innovation integration model was modified. The implications of this study to building up innovation integration mechanism and technology entrepreneurship for small businesses are highlighted (NSF China grant No. 70232010).

Keywords: international technology entrepreneurship, innovation integration, Chinese small business

Introduction

Technology cooperation is an important approach to promoting high-tech transfer (Kogut,1988; Kogut & Zander,1993), facilitating international technology entrepreneurship (Zacharakis,1997; Bruton & Rubanik, 1997) and enhancing enterprise technology capability(Wang, 2000). However, the key to success lies upon the self-absorbing capability for technical competence in participation of technology cooperation and integrative innovation (Grant,1996). In general, the effectiveness of technology integration replies on not only the technical integration mechanism emphasizing interaction and communications between the cooperative partners (Kahn,1996, Kahn & McDonough 1997; Huang & Newell, 2003), but also technology integration strategy for project management and innovative entrepreneurship under the context of globally distributed engineering (Mills & Tanik 2000; Meil, 2004; Teece et al,1997).

While this area is among the active research fields (Kahn,1996, Kahn & McDonough 1997 Deeds, DeCarolis & Coombs ,1999; Cooper,2000; Yli-Renko, Autio & Sapienza,2001), they were generally studied either from a single level or department (e.g., Song, Montoya-Weiss & Schmidt ,1997; Huang & Newell, 2003), tech-supplier and customer interaction (Gupta & Govindarajan, 2000; Yli-Renko, Autio & Sapienza,2001) or using a qualitative analysis (De Boer,Van den Bosch & Volberda,1999; Huang &Newell,2003). Also, studies in the Chinese firms were still handful (e.g., Li, Gu and Li 1998; Chen J. 1994; Chen F. Q. 2001; Xu & Liu 2004).

Similar to Rebentisch and Marco's (1995) point of view, we consider technological cooperation across international organizations as the transfer of knowledge resources across boarders, which was largely relied upon the innovation integration between and within the organizations. As Grant (1996) pointed out, it was the integration process rather than the technical knowledge itself created technology advantages. This process emphasized three aspects of interaction and communication: tech-knowledge interaction between the local firms and tech-suppliers, among different international teams, and across firms and customers. In this process, the local firms needed to have competencies of understanding, utilizing and developing innovations by the organizations (Ritter & Gemunden, 2004; Malerba & Marengo, 1995). Tiwana (2001) studied e-commerce project teams and found that their integrative capability was mainly an ability of acquiring new knowledge from the team members and outside the teams. Such integration could even be built up to the organizational level of integration capability to fit with business and knowledge strategy (Grant, 1996 De Boer,Van den Bosch & Volberda,1999 Tiwana, 2001), though previous discussions of organizational integration capability and mechanism were still rather abstract and vagor (Kahn, 1996; Teece et al,1997; Eisenhardt & Martin, 2000; Boudreau,2002 Huang &Newell,2003).

In this study, we will focus on cross-cultural technology innovation and human resources strategies between the international partners for technology innovation and high-tech entrepreneurship. Specifically, the cross-cultural technical cooperation process and three-level of interaction strategies will be examined between local W firm and international D firm: (1) organizationally vertical integration, organizational horizontal integration and .

The Case Analysis and Hypotheses

Organizationally vertical integration: Interaction between local entrepreneurial firms with suppliers and among key customers in tech-entrepreneurship. From the in-depth interview analysis, it was found that the local W firm paid more attention to the two-level of interaction and integration: two-way participation and communication (e.g., Gupta & Govindarajan, 2000; Suzlansk, 1996, 2000). Previous studies indicated that high-level of interaction facilitated the transfer of more implicit technological knowledge and the sharing of technological data and documents (Simonin, 1999, 2004). A successful tech-transfer results in tech-commercialization through satisfaction among key customers (Cooper, 2000; Mitchell & Singh 1996). This could be mostly achieved through high social interaction between the local firms and their key customers. It would not only enhance organizational ability to recognize relevant knowledge (Cohen & Levinthal, 1990), but also stimulate business information exchange and processing (Zahra, Ireland & Hitt,2000). Zahra & Nielsen (2002) demonstrated the integrative ability for resources and information from within and outside of organizations by studying 119 manufacturing firms. Yli-Renko, Autio and Sapienza (2001) also showed from the results of a 180 British entrepreneurial high-tech firms that a social interaction with key customers increased the acquisition of knowledge about new product and technical advantages.

Organizationally horizontal integration: Interaction among cross-functional teams in tech-entrepreneurship. An effective integration means high-level of interaction (Griffin et al, 1992; Huang & Newell, 2003). Cross-functional departmental cooperation may improve new product development (Jassawalla & Sashittal, 1998; Kahn, 1996, 1997). Kahn and McDonough (1997) studied 514 managers of marketing, production and R & D in electronic industries and found that cross-functional cooperation had significant effects on performance but strangely the interaction had no effects. Meetings and data file exchange might even have negative effect on performance. Apparently, more research is needed to investigate on the theoretical models and effectiveness of tech-innovation integration strategies.

Based upon the in-depth case study among the Chinese entrepreneurial automobile components firms who are transferring innovative technology from multinationals and carrying out high-tech entrepreneurship, an empirical field study was conducted to examine the horizontal and vertical

integration strategies of innovative technology from overseas and investigate the effects of different integration strategies on high-tech integration mechanism and capability. The following hypothesized model is proposed as indicated in Figure 1.

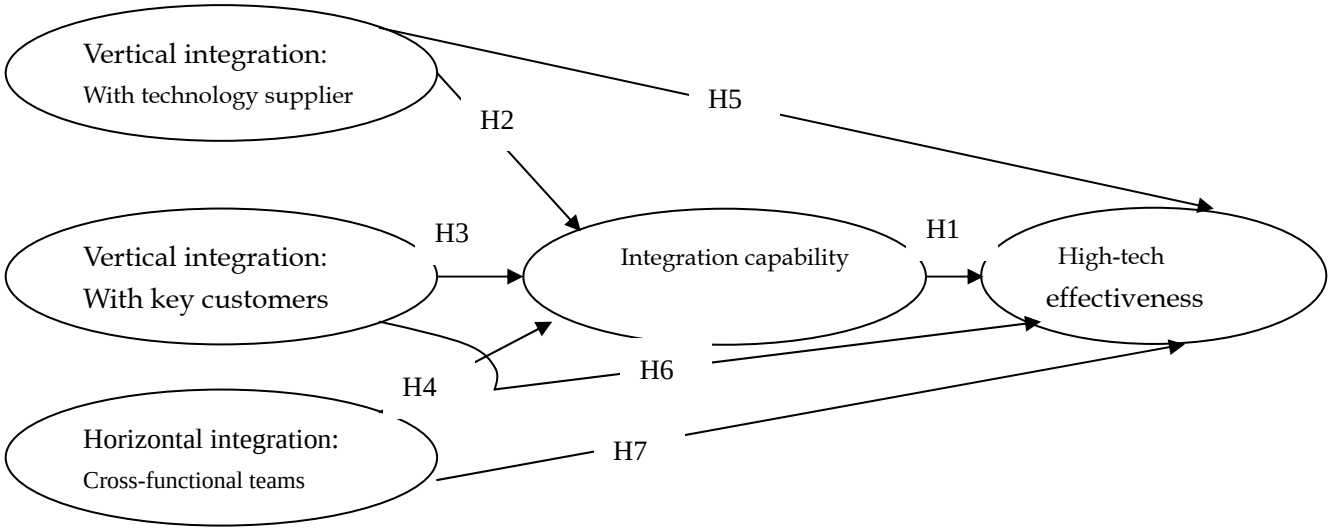

Figure 1: Knowledge integration-based high-tech cooperation:
A multilevel interactive integration model

The following hypotheses are proposed:

H1: The innovation integration capability of high-tech cooperative entrepreneurship has significant positive effects on high-tech cooperation effectiveness and is acting as an intervening variable in the knowledge integration-based high-tech cooperation model.

H2: The innovation integration mechanism of high-tech cooperative entrepreneurs and technology suppliers helps to enhance the innovation integration capability and has positive effects on tech-cooperation effectiveness (H5).

H3: The innovation integration mechanism of high-tech cooperative entrepreneurs and key customers will enhance the innovation integration capability and has positive effects on tech-cooperation effectiveness (H6).

H4: The innovation integration mechanism of different functional teams within the high-tech cooperative entrepreneurs will enhance the innovation integration capability and has positive effects on tech-cooperation effectiveness (H7).

Research Methods

Sampling. This study had the sample of managers and technicians from local Chinese key automobile firms and used the high-tech cooperative projects with the partner, well-known American automobile components firm. These projects included various teams such as top management, technical department, project engineering department and manufacturing department.

Altogether, two-hundred and five participants joined in this study, including twenty-five managers, technicians and supervisors were interviewed and one-hundred eighty employees (technicians, project team members, core employees) participated in this study. Eighty-two percent of participants completed scales, who were from the departments of technology development, technical quality, project management, marketing, technology design, investment development, manufacturing and production, and other departments.

Procedures. In order to obtain more comprehensive data, the procedure of this study had two parts: (1) a field interview was conducted among 25 people in charge of the international high-tech cooperative projects. Each was interviewed for about 120 minutes. (2) a tech-transfer entrepreneurship scale was developed and used to measure the key variables on the basis of interview results, company documents, literature and existing scales. The draft scale was first reviewed and revised by the top management people to ensure high face validity and content validity. Then this scale was distributed among 180 participants who had a average of 4.8 years of tenure were involved in international and cross-cultural cooperative activities with the American automobile components firm. A small souvenir was given to each participant who completed the scale.

Measures. The tech-transfer entrepreneurship scale was design using multiple-choice measures by 5-point Likert scale. A procedure of scale development was adopted through a literature review, key constructs pilot testing, in-depth interview verification and expert panel reviewing (Gerbing & Anderson, 1988; Wang 2000). The scale consists of three sub-scales: the innovation integration capability, the innovation integration mechanism, and the high-tech cooperation effectiveness. (1) the innovation integration capability sub-scale was built on the three features of integration capability defined by Grant (1996) to include items such as "internationally transferred technology and managerial experience extend our technical capability", "we can learn many technical skills and managerial skills from the international partners", "the current organizational competence can absorb and utilize the transferred technical and managerial experience from the American automobile components firm" and "we can re-group and/or innovate the transferred technical and managerial experience from the American automobile components firm". (2) the innovation integration mechanism sub-scale was based on a two dimensional construct of integration: interaction and cooperation (Kahn, 1996). The interaction dimension includes more structured coordinative behaviors of various participants such as regular meetings, telephone conference, and exchange of official documents, while the cooperation dimension represents more un-structured behaviors of various participants which emphasize intentional and affective interaction such as mutual understanding, resource sharing and common goal accomplishment

(Carlsson & Matts, 1991; Kahn, 1996). According to Kahn (1996), although both interaction and cooperation are specific dimensions of innovation integration mechanism in high-tech entrepreneurship, they should positively affected innovation performance. Three kinds of integration are considered in this study: integration across different functional teams, with technology suppliers, and with key customers. (3) the high-tech cooperation effectiveness scale was designed to measure organizational performance under technical cooperation including the accomplishment of organizational objectives, and the enhancement of technical capability.

Statistical analysis methods. In addition to the descriptive statistics and reliability testing, an explorative factor analysis was used to verify basic constructs and their variables. Then a LISREL 8.2 software was adopted to conduct confirmatory factor analysis to test the hypothesized model and constructs (Joreskog & Sorbom,1997; Joreskog et al, 2000).

Analysis and Main Results

Reliability of measures and inter-correlations. The reliability analysis indicated that the five main constructs had acceptable level of reliability (≤.70) as Nunnally (1978) suggested. In the LISREL modeling, all the observable variables had statistically significant standardized loadings ($p<0.01$), indicating good convergent validity. Table 1 presents the descriptive statistics and inter-correlations among the main constructs of this study.

Table 1: Descriptive statistics and inter-correlations among main constructs

constructs	M	SD	VITS	VIKC	HIFD	IIC	TCE
VITS	13.51	3.65	1.00				
VIKC	12.93	3.23	0.507**	1.00			
HIFD	16.46	2.75	0.447**	0.482**	1.00		
IIC	11.68	2.01	0.252*	0.399**	0.695**	1.00	
TCE	12.65	1.94	0.345**	0.437**	0.609**	0.735**	1.00

**$p<0.01$; *$p<0.05$

Structural equation modeling. The structural equation modeling (SEM) is adopted to test the paths and intervening variables of the hypothesized model (Joreskog et al, 2000; Jensen & Szulanski, 2004). LISREL8.2 software is conducted. Figure 2 presents the results of SEM analysis.

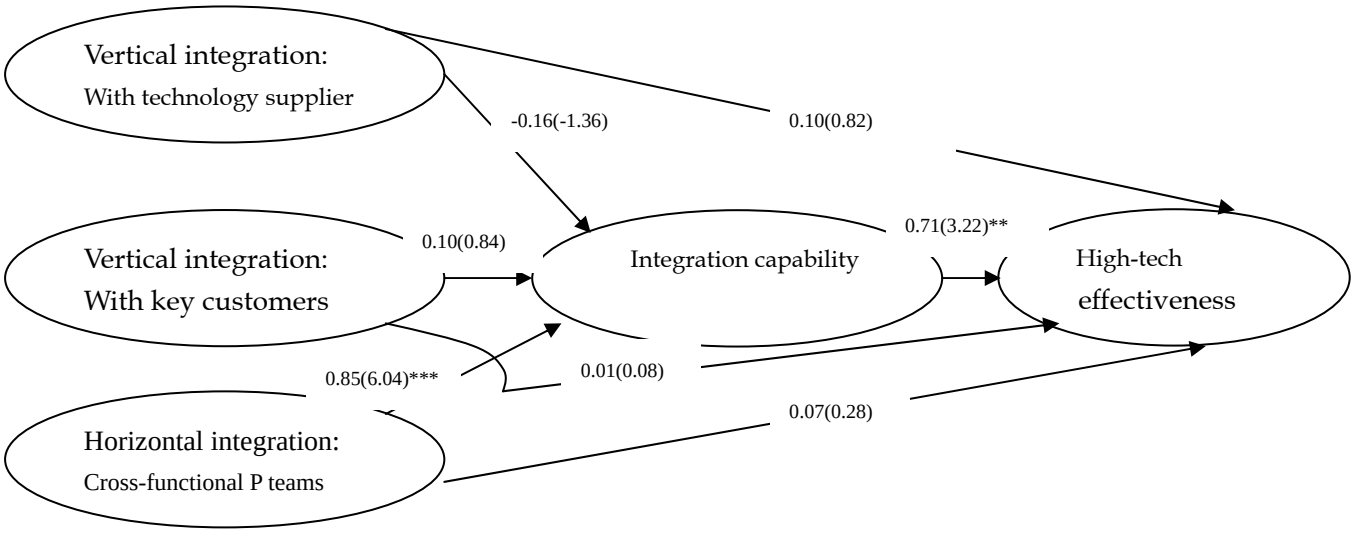

Figure 2: The multilevel interactive integration LISREL model
of Knowledge integration-based high-tech cooperation
(standardized co-efficients)

Chi-Square=318.28, Df=233, p-value=0.00017， RMSEA=0.070， CFI=0.90， IFI=0.90， Within the blanks are T values (***p<0.01).

The results of LISREL analysis in Figure 2 showed that the innovation capability of international technology entrepreneurship significantly affected the effectiveness of technology cooperation and knowledge transfer. So H 1 was strongly supported. In the meantime, H 4 was also significantly supported indicating that cross-functional integration was a very crucial mechanism to affect organizational high-tech knowledge integration and entrepreneurship. However, H 2, H3, H5, H6 and H7 were not evident from the LISREL modeling and analysis.

Discussion and Conclusions

The results of this study showed that innovation integration capability is a key factor in international technology entrepreneurship and the horizontal integration strategy with cross-functional teams is a significant predictor for IIC in this process of technology transfer, absorb and utilization. The innovation integration strategies, innovation integration capability and their effects on high-tech cooperation effectiveness formulate effective integration mechanism for technology entrepreneurship. The important implications of this study indicate that a knowledge integration-based interactive innovation

is more crucial in the cross-cultural technology transfer and that cross-functional team integration strategy is more effective in the Chinese setting than vertical task-oriented integration strategy for international technology entrepreneurship.

Also, this study used a quantitative and empirical approach to measure organizational integration capability and proved it as a key intervening variable in building up innovation integration mechanism. This has provided evidence for a strategy evaluation model of assessing the effectiveness of technology entrepreneurship. As a practical implication, enhancing the firm's innovation integration capability is an important method for strengthening technological competence and competitive advantages for many developing countries such as China. The new vision for international technology entrepreneurship should include HR and change strategies for promoting cross-functional integration with new organizational structure, distributed engineering, top management support and internal R & D investment (Cohen & Levinthal,1990; Grant,1996).

Further research should be carried out in different samples industries and various kinds of international high-tech partners for the generalisability of the knowledge integration-based interactive model of high-tech international entrepreneurship.

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