Processes, characteristics, and effectiveness

An integrative framework for successful knowledge transfer within organizations

Hao Shen, Ziye Li and Xiuyun Yang
School of Economics and Finance, Xi'an Jiaotong University, Xi'an, China

Abstract

Purpose – The purpose of this paper is to address important but unresolved questions regarding how different knowledge transfer processes and characteristics affect knowledge transfer effectiveness (KTE). This study, which draws on an integrative knowledge management framework, forces us to reconsider successful knowledge transfer within organizations.

Design/methodology/approach – The data for this study were obtained through an interview survey of 117 firms in China. The questionnaire was adapted from several previous studies on processes, characteristics, and effectiveness of knowledge transfer. A regression method was conducted to test all hypotheses.

Findings – The findings show that both structured and unstructured knowledge processes has positive effects on KTE. Furthermore, knowledge embeddedness and articulability differently moderate the relationship between transfer processes and effectiveness.

Originality/value – The paper contributes to knowledge management theory by providing an integrative framework on how organizations can facilitate KTE by conducting appropriate transfer processes aligned with differentiated knowledge characteristics. Further, this study investigates the "fit" between knowledge transfer processes and characteristics.

Keywords Knowledge management, Knowledge transfer, Knowledge articulability, Knowledge embeddedness

Paper type Research paper

Introduction

For more than two decades, organizational knowledge has been the source of competitive advantages for firms in an increasingly dynamic business environment (Grant, 1996). Indeed, many firms find managing organizational knowledge to be challenging, although success is often critical in organizational change-related activities, such as technological innovation, strategic renewal, and business model development (Huber, 1991; Nonaka and Takeuchi, 1995; Argote *et al.*, 2000; Cummings and Teng, 2003; Goh, 2002; Kwan and Cheung, 2006). Previous studies on knowledge management have argued that effective knowledge transfer is the key determinant for the successful improvement of organizational knowledge management outcomes (Argote *et al.*, 2000). Although most organizations can achieve remarkable performance benefits by effectively transferring knowledge from one unit to another, improved knowledge transfer effectiveness (KTE) can be difficult to achieve (Argote, 1999). This raises a serious question: why can some firms achieve better KTE within their organization but others cannot?

An organization must conduct proper transfer processes to successfully transfer knowledge and thus achieve superior KTE. Transfer processes serve as efficient

This paper is supported by National Natural Science Foundation of China (No. 71302144 and No. 71302143) and Postdoctor Fundation of China (No. 2012M520082 and No. 2014T520929).

Journal of Organizational Change Management
Vol. 28 No. 3, 2015
pp. 486-503

0953-4814
DOI 10.1108/JOCM-12-2013-0251

paths or approaches for the transfer of knowledge embedded in individuals into an organization's rules, routines, structures, and technologies. The knowledge management literature has contributed to the introduction of knowledge transfer processes for superior knowledge management outcomes (Sun and Scott, 2005; Kwan and Cheung, 2006). It has highlighted the many knowledge transfer processes within organizations that benefit knowledge transfer performance, such as discussions, meetings, the sharing of training experiences, and presentations (Goh, 2002; Roberts, 2000; Ermine *et al.*, 2006). Chen *et al.* (2010) suggested that structured knowledge transfer (SKT) and unstructured knowledge transfer (UKT) can leverage searching, learning, practice, and integration to help organizations win better KTE. SKT shapes the way that organizations transfer explicit knowledge through formal and planned processes, whereas UKT shapes the way that organizations transfer tacit knowledge through informal and unplanned processes (Szulanski, 1996). Thus, SKT and UKT may offer good ideas for the effective transfer of knowledge within organizations. Although some studies (Szulanski, 1996; Nonaka *et al.*, 2000; Chen *et al.*, 2010) have implied that SKT plays an important role in effectively transferring knowledge inside firms, few studies have focussed on UKT, and the effects of the two processes on KTE has not been critically examined, which is a significant research gap.

Knowledge transfer does not occur in a vacuum. The characteristics of the particular knowledge to be transferred are important because different transfer processes are not generally adapted to all types of knowledge. The literature has identified embedded knowledge and articulated knowledge as the key elements for improving KTE (Walker *et al.*, 1987; Bresman *et al.*, 1999; Cummings and Teng, 2003; Wagner and Buko, 2005; Hong and Nguyen, 2009). The different characteristics of knowledge are viewed as distinguishable managerial objects that result in different contexts affecting the efficiency of knowledge transfer processes (Nonaka *et al.*, 2000; Katila and Ahuja, 2002; Chen, 2004). As the context affects knowledge transfer, the knowledge characteristics add complexity to the knowledge transfer process and must therefore be taken into account (Lee and Choi, 2003). The knowledge characteristics, such as knowledge embeddedness (KE) and knowledge articulability (KA), may thus have significant, different effects on the relationship between transfer processes and the EKT. The moderating effects of KE and KA will therefore be discussed here. Unfortunately, few studies have integrated knowledge transfer processes and characteristics into a framework. We therefore poorly understand the result of an organization undertaking many kinds of activities when attempting to facilitate knowledge transfer and what the appropriate transfer process for a particular knowledge characteristic is. Therefore, it is critical to investigate the proper "fit" between different characteristics of knowledge and different processes of knowledge transfer for effective knowledge transfer in organizations (Argote *et al.*, 2003).

This study addresses the above theoretical gaps by using an integrative knowledge management framework to systematically reconsider knowledge transfer. We explore two important but unresolved questions: how different transfer processes affect KTE and how different knowledge characteristics moderate the relationship between transfer processes and KTE. This study makes a number of significant contributions. We integrate transfer processes and knowledge characteristics into a knowledge management framework and empirically examine the direct and indirect relationships between processes, characteristics, and KTE, thus filling theoretical gaps and enriching the literature. We explore how knowledge transfer processes rely on particular knowledge

characteristics to facilitate KTE and discover how different knowledge transfer processes and knowledge characteristics best "fit" together, thus contributing to the knowledge management literature.

Theoretical model and hypotheses

Knowledge transfer processes

The term knowledge transfer process is interpreted broadly here and refers to the approaches, rules, and principles used to regulate knowledge transfer activities, as knowledge transfer is a complex task for organizations (Argote *et al.*, 2003). Knowledge transfer processes are divided into SKT and UKT in the literature. SKT refers to calculative design and control, which is defined as "regulating the transfer activities within an organization so that they are in accord with the expectations established in policies, plans, and targets" (Child, 1974). SKT involves direct knowledge transfer, which is a formal, planned process and leads to codification informed by rules, procedures, and formal structures (Davenport *et al.*, 1998; Simonin, 1999; Chen *et al.*, 2010). In a structured transfer process, control is primarily bureaucratic and normative (Baliga and Jaeger, 1984), monitoring individuals' behavior and performance to preclude opportunistic behavior. SKT may, however, inhibit free, active learning. UKT is an informal, unplanned process that entails creating opportunities, options, and channels for knowledge transfer and keeping knowledge systems open (Chen *et al.*, 2010). UKT uses a system of primarily social or cultural connections, in which people can hold multiple and sometimes conflicting interpretations (Katila and Ahuja, 2002) and still subscribe to their organization's values and goals, allowing them to act in accordance with one another (Hedlund, 1994). UKT often operates at a low level of codification and is more casual and loosely coupled than SKT, but it may prevent wide dissemination.

As the knowledge for transfer can have multiple, complementary types and/or characteristics, it is clear that multiple knowledge transfer processes must be used flexibly and simultaneously. The richness and diversity of transfer approaches and corporate settings that are available within firms are important because certain organizational arrangements may be more appropriate to specific knowledge properties than others (Argote *et al.*, 2003). In the literature, SKT and UKT have been considered the key determinants for ensuring a greater distribution of knowledge, the legitimacy of knowledge transfer, and the promotion of knowledge socialization. The transfer processes that are focussed on structural arrangement, normalization, and control, and the processes that are focussed on the social process of knowledge transfer, have become more and more important in developing organizational KTE. A comparison of SKT and UKT is provided in Table I.

SKT. SKT is typically designed to ensure that knowledge transfer takes place between those who need it most. Organizations, we argue, can transfer knowledge by using structured processes, such as document exchanges, problem-solving meetings, joint technical training, and frequent cultural training. We can therefore restate the fundamental law of SKT in this way: the most thorough method of transferring knowledge is controlling human behavior through rational planning. A greater ability to control, and a greater power over, a course of events helps to achieve the expectation of knowledge sharing and transfer. SKT is thus characterized by formalization, specialization, standardization, and predisposition toward a structured, stable, predictable order. These methods require rational conduct from the outset, and thus require organizations with good management, for example, leadership professionalization and administrative structure rationalization. SKT creates more stable, codified, structured

	SKT processes	UST processes
Strength	Lower information costs; large systems design capability through complex articulation and tightly controlled complex	Rapid infusion and diffusion of drastically new perspectives through people in social communities; allowing people to act autonomously; may introduce unexpected opportunities to increase employees' willingness to transfer knowledge; more likely to maintain greater flexibility in transferring, relating, and interpreting knowledge
Weakness	"Competence traps" through a too constrained development path; biased toward the institutional arrangements; strategic vulnerability through strong focus; high dependency on the top management	Long time to acquire new knowledge due to restrictions on the process of socialization; difficult to transfer knowledge on a large scale due to reliance on small communities; human exhaustion; lack of overall control by the organization; time consuming; difficult to coordinate individuals
Specific contents	Management policies and systems; direction; organization structure; organizational design; IT support	Community of practice; center of excellence; social interactions; corporate socialization
Management processes	The top management acts as a monitor and allocator; leaders are commanders, dependent on information processing; chaos is not allowed; emphasis on division and permanent structures	The top management acts as a catalyst, architect, and protector; leaders are catalysts and sponsors; emphasis on combination and temporary constellations
Transferred knowledge	The knowledge resides in various forms, such as written documentation, structured information stored in electronic databases, codified human knowledge stored in expert systems, documented organizational procedures and processes, and tacit knowledge acquired by individuals and networks of individuals (Tan *et al.*, 1999). Explicit, computerized or otherwise documented knowledge	Organizational culture; transformations (production processes and work procedures) Tacit knowledge in diverse forms

Table I.
A comparison of SKT and UKT

knowledge diffusion routines, which may provide a "relatively brief window of opportunity to rectify unexpected problems." SKT thus avoids the future occurrence of intra-organizational transaction costs from unexpected troubles or events, helping organizations to gain better effectiveness from successful knowledge transfers. We can therefore state the following hypothesis:

H1. SKT is positively related to KTE.

UKT. Knowledge transfer is often characterized as having both a structured component and a complex social component, which is "interactive and embedded in the existing capabilities on both sides and in the social relationships between both sides of the transaction" (Grandori and Kogut, 2002). Unstructured transfer is therefore important for the diffusion of knowledge through these social processes. UKT entails the development of social interactions, values, and socialization processes that encourage knowledge transfer, which are all required for a management system

in which employees' willingness to share and transfer knowledge is high. Further, UKT can promote informal communications and interactions between internal organization units, which play a very important role in promoting knowledge flows within organizations (Gupta and Govindarajan, 2000). Thus, the distant, informal, unstructured contacts between different organizational sub-units and individuals can facilitate knowledge diffusion and exchange, and effectively improve KTE. We can therefore formulate our second hypothesis:

H2. UKT is positively related to knowledge transfer effectiveness.

Knowledge characteristics

Knowledge is an elusive concept that has been classified and defined in a variety of ways (e.g. see Hedlund, 1994; Huber, 1991; Nonaka, 1994; Nonaka and Takeuchi, 1995; Spender, 1996) and its characteristics have emerged as an important predictor of its transfer (Cummings and Teng, 2003; Argote *et al.*, 2003; Simonin, 2004). As dynamic knowledge transfer processes are contingent on the knowledge's context, we must pay attention to the importance of knowledge characteristics (Chen, 2004; Lee and Choi, 2003). Drawing on previous research that captures the key properties of knowledge (e.g. Winter, 1987), we can single out two kinds of knowledge characteristics that are directly related to transfer performance, KA and KE. These knowledge characteristics are posited because they are relevant, complementary measures that reflect the intrinsic nature of transferred knowledge assets. They affect the rate at which knowledge is accumulated, how much of it is retained, and where it is retained, and characterize how easily it transfers within and/or across organizational boundaries in different transfer processes. As the literature indicates, knowledge characteristics provide good contexts to analyze knowledge management performance, whereas transfer processes contribute to different tactics or routines to improve the KTE (Katila and Ahuja, 2002). Therefore, we argue that knowledge contexts and transfer processes probably jointly affect how firms achieve effective knowledge transfer. The characteristics of the knowledge being transferred are likely to influence the KTE according to different transfer processes.

KE. KE refers to the extent to which knowledge is a function of the system or context in which it is embedded (Birkinshaw *et al.*, 2002). It is recognized as an important factor associated with the resources, networks, and systems that affect knowledge transfer by emphasizing the embedded context and social system (e.g. Cummings and Teng, 2003; Birkinshaw *et al.*, 2002; Dhanaraj *et al.*, 2004). Knowledge can be embedded in shared values, procedures, and systems, and in people, tools, routines, and related sub-networking in which a common identity and collective interpretation of reality and values are formed (Dyer and Nobeoka, 2000; Argote and Ingram, 2000; Hong and Nguyen, 2009). When the knowledge being transferred is highly embedded, it can be transferred, understood, and used by systematic, comprehensive, formal routines in accordance with SKT. The success of knowledge transfer depends on the transferability of the meaning and value of the knowledge, not just the transferability of the knowledge itself. In this sense, knowledge cannot be transferred into an organization or team without the transfer of clusters of individuals with established patterns of working together (Kostova, 1999). Therefore, we argue that formal, systematic knowledge transfer processes like SKT work well for the transfer of highly embedded knowledge, because they can provide the institutions, systems, and training required to develop the resources needed for successful knowledge transfer, such as organizational culture, structure, network, and rules. SKT can formally help knowledge exchange by assisting

in greater understanding, assimilation, and socialization, as highly embedded knowledge is often associated with close connections, strong ties, shared values, trust, and shared common tools, processes, and tactics.

Conversely, UKT is much more informal and optional. If the knowledge being transferred by UKT is highly embedded, the result will be disappointing because UKT is not able to provide the environment, institution, and opportunities needed for organizational members to learn and exchange the tools, procedures, and other resources related to knowledge transfer. In that sense, UKT cannot achieve better KTE when knowledge is highly embedded. We can therefore state the following hypotheses:

H3a. KE has a positive moderating effect on the relationship between SKT and KTE.

H3b. KE has a negative moderating effect on the relationship between UKT and KTE.

KA. According to Bresman *et al.* (1999), KA refers to the extent to which knowledge can be verbalized, written, drawn, or otherwise articulated, which can facilitate recipients identifying where the desired knowledge is and developing an intimate understanding of it (Dixon, 1994). Previous research on knowledge transfer has indicated that KA plays a very important role in knowledge transfer processes (Zander and Kogut, 1995; Bresman *et al.*, 1999). However, when the KA is high, it is easy to identify related elements and resources to support knowledge transfer and too much effort may be expended for knowledge transfer, leading to extra costs incurred by the firm. If the knowledge being transferred by SKT is highly articulated, then the cost will be high and articulated knowledge will have a negative effect on SKT's ability to improve the KTE. We therefore argue that SKT is not costless and that it will spend too much time and energy (e.g. formally organizing plans, institutions, and procedures, and/or using systematic tools, methods, and people) transferring articulated knowledge that appears to be easy. As pointed out by Bresman *et al.* (1999), redundant efforts are not necessary when KA acts as a significant facilitator of knowledge transfer.

UKT will have better KTE when transferring highly articulated knowledge, because the essence of UKT is to facilitate direct communication and interactions between people. UKT offers a unique, loosely coupled system or environment to facilitate effective transfer of articulated knowledge by quick, simple, casual experience sharing (e.g. oral communication, consulting other people) and expertise learning (e.g. job experience learning, team cooperation) between organizational members and units. Therefore, UKT typically involves considerable informal inter-personal networks and face-to-face interactions between the two parties in a knowledge transfer process, allowing articulated knowledge to be transferred easily and efficiently with low transaction costs by specific unstructured methods. UKT is therefore very effective in the transfer of highly articulated knowledge, helping organizations to achieve better knowledge management outcomes. We therefore formulate the following hypotheses:

H4a. KA has a negative moderating effect on the relationship between SKT and KTE.

H4b. KA has a positive moderating effect on the relationship between UKT and KTE.

As stated above, we construct a research model framework integrating transfer processes, knowledge characteristics, and effectiveness, which is shown in Figure 1.

Methodology

Sample and data collection

This paper used survey data from Chinese firms to empirically test the stated hypotheses. There is a high variation in knowledge management among Chinese firms and the majority of Chinese firms have relatively less sophisticated capabilities and knowledge (Hitt *et al.*, 2000). This high variation in knowledge management provides an ideal context to test our hypotheses. As the research horizon of knowledge management expands to include China, it is critical to know more about "what is going on there" (Meyer, 2006). The integrated knowledge management framework developed here has enormous implications for Chinese firms and Western firms collaborating with Chinese firms aiming to improve their knowledge transfer and organizational effectiveness for long-term competitive advantage.

We tested our hypotheses by using a questionnaire survey to collect responses from firms in the Shaanxi, Zhejiang, Fujian, Shanghai, Guangdong, Shandong, Sichuan, Jiangsu, Tianjin, and Yunnan provinces of China. We obtained 300 firms at random from local governmental departments that are closely connected to those firms. We organized telephone conversations with representatives from each firm to outline the study briefly and encourage their participation, using customized reports for the respondents as an incentive. In all, 134 firms were willing to participate in our survey. Face-to-face interviews were conducted with the respondents from the identified firms. We ensured that the survey data were complete and usable by using the face-to-face method, which allowed the interviewers to address any doubts or questions immediately. Our interviewers were mainly faculty members and graduate students, with some professional consultants, who all received extensive advanced training on the background to the survey, the precise meaning of the questionnaires, and interview skills. We designed the questionnaire to collect information about the conditions faced by Chinese firms, using existing questionnaires on similar problems from the literature (Hakanson and Nobel, 1998; Baughn *et al.*, 1997; Landaeta, 2008; Hoegl and Gemuenden, 2001). We conducted a pilot study with five firms from Shaanxi province using a preliminary questionnaire. These responses were excluded from the final analysis. The questionnaire was revised based on feedback from the pilot study. Of the 134 participating firms, 117 valid surveys were completed and returned. In total, 17 companies did not respond to the survey. The effective response rate for the survey was 87.3 percent (117/134), which is quite satisfactory.

We tested the validity of the collected samples by assessing the non-response bias of the total distributed samples, comparing the responding and non-responding

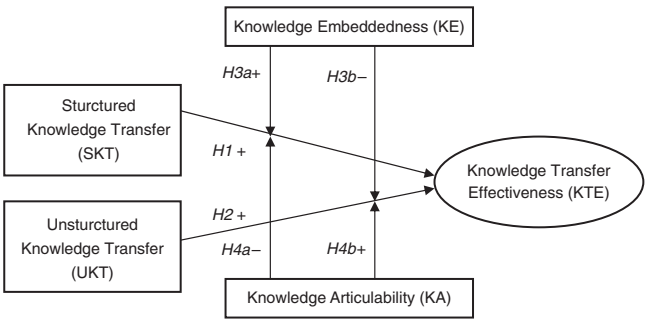

Figure 1.
A conceptual model of the formulated hypotheses

firms with respect to firm size, firm age, type of firm ownership, and type of industry. The non-response bias test revealed no statistically significant differences between the responding and non-responding firms at the 0.05 level, thereby indicating that the obtained responses were representative of all of the participating firms and were not biased (Armstrong and Overton, 1977). As our measurement items were all collected using the same survey instrument, we examined the potential for common method variance following the procedures recommended by Podsakoff and Organ (1986). We performed an unrotated principal components factor analysis on the 20 questionnaire items, extracting five factors with eigenvalues larger than 1. Factors with a value of 1 accounted for 28.54 percent of the variance. The test results therefore suggested that common method variance was not present in this study.

Measurements

All of the multi-item measures followed a five-point Likert-type scale, with responses ranging from "strongly disagree (1)" to "strongly agree (5)." Most of our measures were adapted from the literature by translating words and sentences into Chinese to ensure a better understanding of the questions in the Chinese context. Back-translation was used to ensure comparability between the original and translated versions of the questionnaire.

Independent variables. Based on Cummings and Teng (2003) and Chen *et al.* (2010), we designed four items to measure SKT, frequent presentation/report sessions, frequent problem-solving workshops, frequent general teaching of techniques, and cultural/institutional training. We also developed four items to measure UKT, frequent oral communication and information sharing with others, frequent consulting with others, frequent job experience learning, and frequent intra/inter-team cooperation. We used a five-item scale developed by Hakanson and Nobel (1998) to measure KA, including the degree of ease with which new personnel can obtain knowledge by studying a complete set of blueprints, documents, or plans; the degree of ease with which new personnel can obtain knowledge by talking to experienced personnel; and the degree of ease with which new personnel can be taught the knowledge. We designed four items to measure KE, according to Hong and Nguyen (2009) and Baughn *et al.* (1997), the degree of difficulty for the recipient to identify a source person to help them reconfigure and adapt knowledge; the degree of difficulty for the recipient to identify a source person to help them to obtain the necessary tools, equipment, and technologies; the degree of difficulty in identifying the necessary tools to perform each activity, task, and procedure; and the degree of difficulty in locating and extracting the information needed to understand the knowledge.

Dependent variable. Five items were adapted from Hoegl and Gemuenden (2001) and Szulanski (1996) to measure KTE, that is, the knowledge quality is satisfactory; the process of knowledge transfer is satisfactory; organizational members think that the knowledge transfer is successful; the results of the knowledge transfer activities are very good; and the results of the transfer activities satisfy organizational members.

Control variables. Organizational performance related to knowledge management may be affected by firm size, age, ownership status, and industry type. Four factors were used as dummy control variables. Firm size has long been recognized as a key factor in organizational design (Baligh *et al.*, 1996). We therefore controlled this variable by measuring it in terms of the number of full-time employees at the firm; that is,

a score of 0 if the firm was small or medium-sized (fewer than 500 employees) and a score of 1 if the firm was large. Firm age was identified as a control variable because the level of KE is likely to vary significantly over time. Firm age was calculated based on the number of years the firm had been established in 2008, with a score of 0 if the firm was a new venture and less than ten years old, and a score of 1 if the firm had been established for more than ten years. Ownership status has potential effects, because different ownership types will have different roles in knowledge transfer (focussing on local or international knowledge). Ownership scored 1 if the firm was state-owned and 0 if not state-owned. Industry type varies considerably and with it many important elements, such as the type of knowledge being transferred and the intellectual property regime, also vary (Birkinshaw *et al.*, 2002). Industry scored 0 if it belonged to a non-high technology category and 1 if high technology.

Analysis and results

The descriptive statistics in Table II show the basic information on each construct and the correlations between these variables. We used the statistical software SPSS 13.0 and followed the two-stage procedure recommended by Anderson and Gerbing (1988) to estimate our conceptual model. We estimated the model's reliability and validity, which ensures that the constructs used in this study are reliable and valid. We then tested our conceptual model using a regression method.

Reliability and validity

Composite reliability is indicated and estimated using Cronbach's α, which refers to inter-item consistency. Reliability coefficients are usually considered adequate at values of 0.70 or higher (Fornell and Larcker, 1981), but Nunnally (1978) suggested that permissible α values can be slightly lower (> 0.60) when using relatively new scales. As the constructs developed in this study were based on previously validated items in the literature and adapted to a Chinese context, the reliability can be accepted at slightly lower values. Table III shows that the α values of all of the constructs except UKT were above 0.60, and that the α of UKT was above 0.50. As these constructs were used in a new context, we can accept the composite reliability of these constructs, and we further suggest that all of the constructs in this study had good reliability and internal consistency.

We assessed the construct validity by examining the convergent validity (Fornell and Larcker, 1981) and discriminant validity (Bagozzi, 1980). A loading value of 0.7 or higher is the suggested level for the item loadings on an established scale (Fornell and Larcker, 1981), but Nunnally (1978) again stated that permissible loading values can be slightly lower (> 0.60) for some newer scales. As Table III shows, 17 of the 20 items were greater than the threshold value of 0.7 (Fornell and Larcker, 1981), one item was below 0.7 but above 0.6, and two items were below 0.6 but above 0.5. As these items are very new for the Chinese context, the loading values of the items were acceptable and further indicated a good definition of underlying factors and supported the convergent validity.

The discriminant validity was assessed using a test suggested by Fornell and Larcker (1981) that compares the variance shared between the constructs with the average (AVE) for each individual construct. Table II presents the square roots of the AVE for each construct along the diagonal (in italics) and the correlation coefficients between all of the theoretically related constructs in the off-diagonal elements. The discriminant validity

Table II.
Correlations and discriminant validity

Variables	1	2	3	4	5	6	7	8	Mean	Std.
1. SKT	*0.750*								3.830	1.091
2. UKT	0.422**	*0.662*							5.288	1.040
3. KE	0.244**	0.249**	*0.777*						5.379	0.792
4. KA	0.352**	0.270**	0.272**	*0.763*					4.841	1.154
5. Effectiveness	0.372**	0.224*	0.320**	0.617**	*0.822*				4.376	1.201
6. Firm type	−0.043	−0.002	−0.007	−0.054	0.010	1			0.368	0.484
7. Firm age	−0.073	−0.048	0.012	0.040	0.013	0.275**	1		0.641	0.482
8. Firm size	0.052	0.030	−0.019	0.095	0.044	0.188*	0.280**	1	0.675	0.470
9. Industry type	0.202	0.039	0.034	0.143	0.110	−0.134	−0.133	−0.163	0.436	0.498

Notes: $n = 117$. The diagonal elements in italics are the square roots of the average values. *,**Correlation is significant at the 0.05 and 0.01 levels, respectively (two-tailed)

Construct/indicators	Factor loadings	α
SKT (AVE = 0.563)		
1. Presentation/reports sessions	0.730	0.738
2. Problem-solving workshops	0.744	
3. General techniques teaching	0.692	
4. Cultural/institutional training	0.828	
UKT (AVE = 0.438)		
1. Oral communication and information sharing with others	0.764	0.515
2. Consulting from others	0.505	
3. Job experience learning	0.570	
4. Intra/inter-team cooperation	0.766	
KA (AVE = 0.582)		
1. Ease in learning the knowledge by studying a complete set of blueprint, documents or plants for new personnel	0.768	0.640
2. Ease in learning the knowledge by talking to experienced personnel for new personnel	0.750	
3. Ease in educating and training new personnel in the knowledge	0.770	
KE (AVE = 0.603)		
1. Difficulties in identifying source personnel who can help new personnel to reconfigure and adapt the knowledge they want	0.791	0.779
2. Difficulties in identifying source personnel who can help new personnel to get the tools, equipment and technologies related to the knowledge	0.796	
3. Difficulties in identifying which tools to use to perform each activity, task, and procedure	0.762	
4. Difficulties in locating and extracting the information needed to understand the knowledge	0.757	
KTE (AVE = 0.675)		
1. The knowledge quality is satisfactory	0.803	0.879
2. The process of knowledge transfer is satisfactory	0.768	
3. Organizational members thought that the knowledge transfer was successful	0.883	
4. The results of knowledge transfer activities are very good	0.848	
5. The results of the transfer activities satisfy the organizational members	0.800	

Table III.
Convergent reliability of the measurement models

of a construct is adequate when the diagonal element is greater than each of the off-diagonal elements in the corresponding rows and columns. There was strong evidence for discriminant validity between the five theoretical constructs in the present study. These findings together support the reliability and validity of the constructs and items and their use in testing the hypotheses.

Hypotheses testing

Table IV reports the results of the hierarchical multiple regression models used to test the hypotheses. In Model 1, only the control variables were entered. In Model 2, adding SKT and UKT achieved an $R^2 = 0.038$, revealing a significant positive influence on performance (SKT: $\beta = 0.270$, $p < 0.001$; UKT: $\beta = 0.330$, $p < 0.001$), and providing empirical support for *H1* and *H2*. In Model 3, adding KE and KA resulted in an $R^2 = 0.227$ and confirmed the moderating effects of KA and KE on the relationships between structured and unstructured transfer, and KTE. KE positively moderated the

Variables	KTE ($n = 117$) Model 1	Model 2	Model 3
Control variables			
Firm types	−0.096	0.014	0.071
Firm age	0.116	0.028	−0.025
Firm size	0.134	−0.046	0.092
Industry types	0.011	0.022	0.012
Independent variables			
SKT		0.270***	0.243**
UKT		0.330***	−0.034
KE			0.355***
KA			0.511***
SKT × KE			0.596***
SKT × KA			−0.392***
UKT × KE			−0.379***
UKT × KA			0.212***
R^2	0.038	0.227	0.661
F-value	0.612	1.973*	5.123***
R^2 change	–	0.189	0.434
F-value for R^2 change	–	13.570***	22.404***
df	4/113	2/111	6/105

Notes: *,**,***,****Significant at $p < 0.05$, $p < 0.01$, $p < 0.001$, $p < 0.1$ levels, respectively

Table IV. Results of the regression analysis

relationship between SKT and KTE ($\beta = 0.596$, $p < 0.001$) and negatively moderated the relationship between UKT and KTE ($\beta = -0.379$, $p < 0.001$). *H3a* and *H3b* were therefore supported. In contrast, KA negatively moderated the relationship between SKT and KTE ($\beta = -0.392$, $p < 0.001$) and positively moderated the relationship between UKT and KTE ($\beta = 0.212$, $p < 0.001$). *H4a* and *H4b* were therefore supported. An F-test was used to examine significant changes, to test for an increment in R^2. The change in R^2 from Model 1 to Model 2 was 0.189 and from Model 2 to Model 3 was 0.434. The increases in R^2 were obviously significant from the F-test, which indicated good improvement in the overall model fit.

Discussions and conclusions

The implications of knowledge transfer on firm-level performance have been an enduring research theme in the fields of knowledge management and organization theory. The literature has, however, paid limited empirical attention to the question of how to achieve better KTE within organizations and to the key variables proposed in this study. This study fills these gaps by developing a framework for studying the simultaneous relationships between knowledge transfer processes, knowledge characteristics, and KTE. Focussing on the specific characteristics of the knowledge transfer process rather than other factors, this study provides new empirical evidence for the key role played by knowledge transfer processes coupled with different knowledge characteristics in promoting intra-organizational knowledge management outcomes. Both SKT and UKT were found to have a positive effect on KTE. The two knowledge transfer processes must be significantly moderated by different knowledge characteristics for successful knowledge transfer within organizations.

Theoretical contributions

This study makes several contributions to the literature. Although many studies have investigated the effect of knowledge transfer activities on knowledge-based performance (e.g. Hansen *et al.*, 1999; Davenport and Prusak, 1998), few studies have examined the direct effect of knowledge transfer processes on KTE. Unlike previous research (e.g. Chen *et al.*, 2010) that focussed on the effects of SKT on organizational knowledge performance using qualitative analysis, this study defined the structured and unstructured transfer processes as the important determinants for effectively transferring knowledge within organizations, and empirically examined how different transfer processes facilitate KTE. This study therefore illustrates the different influencing mechanisms of SKT and UKT on knowledge management outcomes, filling theoretical gaps and enriching the knowledge management literature.

Existing studies have focussed on the effects of either knowledge characteristics or transfer activities on knowledge management outcomes. These partial considerations gave rise to a black box for analyzing knowledge transfer process. This study fills this theoretical gap by simultaneously integrating knowledge characteristics and transfer processes into one framework, and examining how the specific transfer processes affect KTE under the context of different knowledge characteristics. This study shows that the moderating effects of knowledge characteristics on transfer processes are significant, thus identifying important moderating interactions that occur when KTE is facilitated. Consequently, this study provides a more comprehensive perspective for organizational knowledge management processes.

The results also imply that SKT matches embedded knowledge and UKT matches articulated knowledge. Structured transfer processes "fit" embedded knowledge to win better KTE, whereas unstructured transfer processes "fit" articulated knowledge to gain successful knowledge transfer. The match perspective makes it clear that knowledge transfer processes are generally contingent on articulated and/or embedded knowledge characteristics. We therefore suggest that multiple structured/unstructured transfer arrangements should be exploited appropriately in accordance with specific, flexible knowledge contexts, and that different organizational knowledge can also exploit different transfer tactics to satisfy the knowledge demands from organizational units and members. The matched portfolios indicate the good fitting effects between knowledge contexts and transferring processes, and establish the existence of tight links between transfer processes, characteristics, and effectiveness for knowledge management to help us to unlock the dynamics of knowledge transfer. Thus, this study will enrich our understanding of the "fit" needed to properly transfer different knowledge, which was called for "more research is needed on the mechanism through which fit affects learning and knowledge management outcomes" by Argote *et al.* (2003), extending the relevant knowledge management literature.

Managerial implications

These findings also have some potentially important implications for managerial practice, especially regarding the organizational change activities in which knowledge transfer is critical, such as new project development, technological R&D, and strategic renewal. It is important to consider the characteristics of the knowledge being transferred and the different knowledge transfer processes. The design of knowledge transfer tactics or measurements should therefore be rooted in and guided by an understanding of the articulability and embeddedness of the knowledge being transferred. Practically, managers should develop a knowledge evaluation scheme or internal knowledge scanning

process (Garud and Nayyar, 1994) through which they can get to know the characteristics of the knowledge within their organization and use this information to guide their choice of appropriate knowledge transfer processes.

This study suggests that using the transfer process appropriate to the knowledge being transferred and combining the efficiency and stability of structured transfer with the flexibility of unstructured transfer will help managers to maximize the efficiency and effectiveness of knowledge transfer in, and enhance the capabilities of, their organizations. Executives who understand the dynamics between transfer processes and knowledge characteristics will be better able to determine how to effectively select and develop the organizational mechanisms for managing transfer processes. In practice, managers should choose appropriate measurements to transfer knowledge based on the characteristics of the knowledge being transferred. For example, when knowledge is highly simple, explicit, and independent (e.g. objectified technologies and processes, such as product development and production technologies), it is relatively easy to transfer and there is no need to organize an informal social community or spend time cultivating relationships with other people. Formal document exchanges, mentoring, online chats or database inquiry should be used instead.

Limitations and future research

There are several theoretical and empirical limitations to this study, which may, however, offer possible directions and avenues for future research. This paper focussed on KA and KE. Further research on more general knowledge characteristics or properties, such knowledge complexity, is likely to produce other results and a different understanding of the research issues.

This paper focussed on internal knowledge transfer and sharing within a firm and neglected knowledge protection, an important knowledge management practice highlighted in previous studies (e.g. Oxley and Sampson, 2004). Studies in transaction cost economics have suggested that an appropriate governance structure will simultaneously promote knowledge sharing and enhance knowledge protection (Sampson, 2004), but there is no single appropriate scope that can provide this a mechanism. More articulated and less embedded knowledge may facilitate knowledge transfer and sharing between organizational members but may also increase the risk of unintended knowledge leakage. The results presented in this study might have been different if we had considered the effects of knowledge loss. Future research must consider broader angles and more detail.

We tested the model solely in the Chinese context using a medium-sized sample. Although we believe that the findings will still hold when applied to firms originating from different countries, the moderate sample size and different sample sources limit theoretical generalization. Further research will need to introduce a cross-cultural dimension to the context and cross-validate the model in different national settings with a large sample.

Conclusions

We began with the perspective that effective knowledge transfer is crucial to organizations' competitive advantage. Organizations succeed at knowledge transfer by using appropriate transfer processes pertaining to transferring distinct knowledge. We presented a discussion of knowledge transfer processes, characteristics, and effectiveness. Two kinds of knowledge transfer processes coupled with different knowledge characteristics were identified for

achieving higher effective knowledge transfer. Both transfer processes facilitated effective knowledge transfer and the characteristics KE and KA differently moderated the relationship between transfer processes and effectiveness.

This study drew on an integrative knowledge management framework to empirically analyze the fit between transfer processes and knowledge characteristics for effective knowledge transfer, and extended theoretical research on organizational knowledge management. Thus, these results offer a comprehensive understanding of the issues mentioned above.

References

Anderson, J.C. and Gerbing, D.W. (1988), "Structural equation modeling in practice: a review and recommended two step approach", *Psychological Bulletin*, Vol. 103 No. 3, pp. 411-423.

Argote, L. (1999), *Organizational Learning: Creating, Retaining, and Transferring Knowledge*, Kluwer Academic Publishers, Boston, MA.

Argote, L. and Ingram, P. (2000), "Knowledge transfer: a basis for competitive advantage in firms", *Organizational Behavior and Human Decision Processes*, Vol. 82 No. 1, pp. 150-169.

Argote, L., McEvily, B. and Ray, R. (2003), "Managing knowledge in organizations: an integrative framework and review of emerging themes", *Management Science*, Vol. 49 No. 4, pp. 571-582.

Argote, L., Ingram, P., Levine, J.M. and Moreland, R.L. (2000), "Knowledge transfer: a basis for competitive advantage in firms", *Organizational Behavior and Human Decision Process*, Vol. 82 No. 1, pp. 150-169.

Armstrong, S. and Overton, T. (1977), "Estimating nonresponse bias in mail surveys", *Journal of Marketing Research*, Vol. 14 No. 3, pp. 396-402.

Bagozzi, R.P. (1980), *Causal Models in Marketing*, John Wiley & Sons, New York, NY.

Baliga, C.A. and Jaeger, A.M. (1984), "Multinational corporation: control systems and delegation issues", *Journal of International Business Studies*, Vol. 15 No. 2, pp. 25-39.

Baligh, H.H., Burton, R.M. and Obel, B. (1996), "Organizational consultant: creating a useable theory for organizational design", *Management Science*, Vol. 42 No. 12, pp. 1648-1662.

Baughn, C.C., Denekamp, J.G., Stevens, J.H. and Osborn, R.N. (1997), "Protecting intellectual capital in international alliances", *Journal of World Business*, Vol. 32 No. 2, pp. 103-117.

Birkinshaw, J., Nobel, R. and Ridderstrale, J. (2002), "Knowledge as a contingency variable: do the characteristics of knowledge predict organization structure?", *Organization Science*, Vol. 13 No. 3, pp. 274-289.

Bresman, H., Birkinshaw, J. and Nobel, R. (1999), "Knowledge transfer in international acquisitions", *Journal of International Business Studies*, Vol. 30 No. 4, pp. 439-462.

Chen, C.J. (2004), "The effects of knowledge attribute, alliance characteristics, and absorptive capacity on knowledge transfer performance", *R&D Management*, Vol. 34 No. 3, pp. 311-321.

Chen, J., Sun, P.Y.T. and McQueen, R.J. (2010), "The impact of national cultures on structured knowledge transfer", *Journal of Knowledge Management*, Vol. 14 No. 2, pp. 228-242.

Child, J. (1974), "Managerial and organizational factors associated with company performance-part I", *Journal of Management Studies*, Vol. 11 No. 3, pp. 175-189.

Cummings, J.L. and Teng, B.S. (2003), "Transferring R&D knowledge: the key factors affecting knowledge transfer success", *Journal of Engineering and Technology Management*, Vol. 20 Nos 1/2, pp. 39-68.

Davenport, T.H., De Long, D.W. and Beers, M.C. (1998), "Successful knowledge management projects", *Sloan Management Review*, Vol. 39 No. 2, pp. 43-57.

Davenport, T.H. and Prusak, L. (1998), *Working Knowledge*, Harvard Business School Press, Boston, MA.

Dhanaraj, C., Lyles, M.A., Steensma, H.K. and Tihanyi, L. (2004), "Managing tacit and explicit knowledge transfer in IJVs: the role of relational embeddedness and the impact on performance", *Journal of International Business Studies*, Vol. 35 No. 5, pp. 428-442.

Dixon, N.M. (1994), *The Organizational Learning Cycle: How We Can Learn Collectively*, McGraw-Hill, New York, NY.

Dyer, J.H. and Nobeoka, K. (2000), "Creating and managing a high-performance knowledge-sharing network: the Toyota case", *Strategic Management Journal*, Vol. 21 No. 3, pp. 345-367.

Ermine, J.L., Boughzala, I. and Tounkara, T. (2006), "Critical knowledge map as a decision tool for knowledge transfer actions", *Electronic Journal of Knowledge Management*, Vol. 4 No. 2, pp. 129-140.

Fornell, C. and Larcker, D. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Garud, R. and Nayyar, P.R. (1994), "Transformative capacity: continual structuring by intertemporal technology transfer", *Strategic Management Journal*, Vol. 15 No. 5, pp. 365-386.

Goh, S.C. (2002), "Managing effective knowledge transfer: an integrative framework and some practice implications", *Journal of Knowledge Management*, Vol. 6 No. 1, pp. 23-30.

Grandori, A. and Kogut, B. (2002), "Dialogue on knowledge and organization", *Organization Science*, Vol. 13 No. 3, pp. 224-231.

Grant, R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17 No. S2, pp. 109-122.

Gupta, A.K. and Govindarajan, V. (2000), "Knowledge flows within multinational corporations", *Strategic Management Journal*, Vol. 21 No. 4, pp. 473-496.

Hakanson, L. and Nobel, R. (1998), "Technology characteristics and reverse technology transfer", *Management International Review*, Vol. 40 No. 1, pp. 29-48.

Hansen, M., Nohria, N. and Tierney, T. (1999), "What is your strategy for managing knowledge?", *Harvard Business Review*, Vol. 77 No. 2, pp. 106-116.

Hedlund, G. (1994), "A model of knowledge management and the N-form corporation", *Strategic Management Journal*, Vol. 15 No. S2, pp. 73-90.

Hitt, M.A., Tina, D.M., Edward, L., Jean-Luc, A. and Anca, B. (2000), "Partner selection in emerging and developed market contexts: resource-based and organizational learning perspectives", *Academy of Management Journal*, Vol. 43 No. 3, pp. 449-467.

Hoegl, M. and Gemuenden, H.G. (2001), "Teamwork quality and the success of innovative projects: a theoretical concept and empirical evidence", *Organization Science*, Vol. 12 No. 4, pp. 435-449.

Hong, J.F.L. and Nguyen, T.V. (2009), "Knowledge embeddedness and the transfer mechanisms in multinational corporations", *Journal of World Business*, Vol. 44 No. 4, pp. 347-356.

Huber, G. (1991), "Organizational learning: the contributing processes and the literatures", *Organization Science*, Vol. 2 No. 10, pp. 88-115.

Katila, R. and Ahuja, G. (2002), "Something new: a longitudinal study of search behavior and new product introduction", *Academy of Management Journal*, Vol. 45 No. 6, pp. 1183-1194.

Kostova, T. (1999), "Transnational transfer of strategic organizational practices: a contextual perspective", *Academy of Management Review*, Vol. 24 No. 2, pp. 308-324.

Kwan, M.M. and Cheung, P.K. (2006), "The knowledge transfer process: from field studies to technology development", *Journal of Database Management*, Vol. 17 No. 1, pp. 16-33.

Landaeta, R.E. (2008), "Evaluating benefits and challenges of knowledge transfer across projects", *Engineering Management Journal*, Vol. 20 No. 1, pp. 29-38.

Lee, H. and Choi, B. (2003), "Knowledge management enablers, processes, and organizational performance: an integrative view and empirical examination", *Journal of Management Information Systems*, Vol. 20 No. 1, pp. 179-228.

Meyer, K.E. (2006), "Asian management research needs more self-confidence", *Asia Pacific Journal of Management*, Vol. 23 No. 2, pp. 119-137.

Nonaka, I. (1994), "A dynamic theory of organizational knowledge creation", *Organization Science*, Vol. 5 No. 1, pp. 14-37.

Nonaka, I. and Takeuchi, H. (1995), *The Knowledge-Creating Company*, Oxford University Press, New York, NY.

Nonaka, I., Toyama, R. and Komo, N. (2000), "SECI, ba and leadership: a unified model of dynamic knowledge creation", *Long Range Planning*, Vol. 33 No. 1, pp. 5-34.

Nunnally, J.C. (1978), *Psychometric Theory*, McGraw-Hill, New York, NY.

Oxley, J.E. and Sampson, R.C. (2004), "The scope and governance of international R&D alliances", *Strategic Management Journal*, Vol. 25 Nos 8/9, pp. 723-749.

Podsakoff, P.M. and Organ, D.W. (1986), "Self-reports in organizational research: problems and prospects", *Journal of Management*, Vol. 12 No. 4, pp. 531-544.

Roberts, J. (2000), "From know-how to show-how? Questioning the role of information and communication technologies in knowledge transfer", *Technology Analysis and Strategic Management*, Vol. 12 No. 4, pp. 429-443.

Sampson, R.C. (2004), "Organizational choice in R&D alliances: knowledge-based and transaction cost perspectives", *Managerial and Decision Economics*, Vol. 25 Nos 6/7, pp. 421-436.

Simonin, B.L. (1999), "Ambiguity and the transfer of knowledge in strategic alliances", *Strategic Management Journal*, Vol. 20, pp. 595-623.

Simonin, B.L. (2004), "An empirical investigation of the process of knowledge transfer in international strategic alliances", *Journal of International Business Studies*, Vol. 35 No. 5, pp. 407-427.

Spender, J.C. (1996), "Making knowledge the basis of a dynamic theory of the firm", *Strategic Management Journal*, Vol. 17 No. S2, pp. 45-62.

Sun, P.Y.T. and Scott, J.L. (2005), "An investigation of barriers to knowledge transfer", *Journal of Knowledge Management*, Vol. 9 No. 2, pp. 75-91.

Szulanski, G. (1996), "Exploring internal stickiness: impediments to the transfer of best practices within the firm", *Strategic Management Journal*, Vol. 17 No. S2, pp. 27-43.

Tan, S., Teo, H., Tan, B.C.Y. and Wi, K. (1999), "Developing a preliminary framework for knowledge management in organizations", *Proceedings of the Americas Conference of Information Systems (AIS), Baltimore, MD.*

Wagner, S.M. and Buko, C. (2005), "An empirical investigation of knowledge-sharing in networks", *Journal of Supply Chain Management*, Vol. 41 No. 4, pp. 17-31.

Walker, B., Celsi, R. and Olson, J. (1987), "Exploring the structural characteristics of consumers' knowledge", *Advances in Consumer Research*, Vol. 14 No. 1, pp. 17-21.

Winter, S.G. (1987), "Knowledge and competence as strategic assets", in Teece, D.J. (Ed.), *The Competitive Challenge: Strategies for Industrial Innovation and Renewal*, Ballinger, Cambridge, MA, pp. 159-184.

Zander, U. and Kogut, B. (1995), "Knowledge and the speed of the transfer and imitation of organizational capabilities: an empirical test", *Organization Science*, Vol. 6 No. 1, pp. 76-92.

About the authors

Dr Hao Shen is an Assistant Professor at the School of Finance and Economics, Xi'an Jiatong Univerisity. His research interests are innovation, knowledge, and strategic management. He has previously published his research in *Management and Organization Review*, *Chinese Management Studies*, *SAM Advanced Management Journal*, *System Research and Behavioral Science, and African Journal of Business Management.*

Dr Ziye Li is an Assistant Professor at the School of Finance and Economics, Xi'an Jiatong Univerisity. Her research interests knowledge management and firm growth. She has previously published research in *SAM Advanced Management Journal, Dynamics of Continuous, Discrete & Impulsive Systems.* Dr Ziye Li is the corresponding author and can be contacted at: zyli@mail.xjtu.edu.cn

Xiuyun Yang, a Professor at the School of Finance and Economics, Xi'an Jiatong Univerisity, focusses her research in corporate strategy and industry growth. She published research in *East Asian Policy, Journal of Air Transport Management,* and some international conferences.