doi:10.1111/j.1365-2575.2010.00354.x

Client–vendor knowledge transfer in IS offshore outsourcing: insights from a survey of Indian software engineers

Christopher Williams

Richard Ivey School of Business, The University of Western Ontario, 1151 Richmond Street North, London, Ontario N6A 3K7, Canada, email: cwilliams@ivey.uwo.ca

Abstract. *We use knowledge-based theory to develop and test a model of client–vendor knowledge transfer at the level of the individual offshore information systems engineer. We define knowledge transfer in this context in terms of mechanisms by which an offshore engineer employed by a vendor can (a) gain understanding of their onshore client; and (b) utilize their knowledge for the benefit of the client. Over large geographic, cultural and institutional distances, effective knowledge transfer is difficult to achieve, although it is central to the success of many offshore outsourcing contracts. Our empirical test consists of a survey of vendor software engineers physically located in India but working on development projects for clients in Europe and the United States. The findings support predictions regarding engineer exposure to explicit and tacit knowledge: We find client–vendor knowledge transfer to the offshore vendor engineer to be positively associated with formal training and client embedment. We also test whether an offshore vendor engineer's inappropriate reliance on informal discussions in the offshore location hinders effective client–vendor knowledge transfer. Our result for this is mixed. Finally, we show differences between offshore engineers who have had previous onshore experience and those who have not. Client embedment is a potent driver of knowledge transfer when the offshore engineer has had previous onshore placement, while it acts to reduce inappropriate reliance on informal discussions for those that have not had an onshore placement.*

Keywords: IS offshore outsourcing, client–vendor knowledge transfer

INTRODUCTION

Recent studies have emphasized a growing maturity of information systems (IS) offshore outsourcing vendors working with Western clients, offering services with ever-growing sophistication (Henley, 2006; Parkhe, 2007; Ramasubbu *et al.*, 2008). There has also been an increase in the overseas relocation of innovative activities such as product design, engineering and R&D (Lewin & Couto, 2006). Despite this, there is evidence that client firms experience difficulties in transitioning projects from onshore in-house locations to offshore non-captive locations (e.g. Levina & Vaast, 2008). Individual employees of vendor firms, typically young IS engineers, are hindered by different forms of distance, and by communication problems and a lack of understanding of the client (Armstrong & Cole, 2002; Grote & Täube, 2007). Overcoming these distances is crucial for client firms that seek to benefit from IS offshore outsourcing.

An emerging literature on task-level collaboration within offshoring puts a strong emphasis on the need for effective knowledge transfer, in particular, the transfer of client-specific knowledge from onshore locations to vendor engineers located offshore (Beulen *et al.*, 2005; Henley, 2006; Chua & Pan, 2008; Leornardi & Bailey, 2008; Youngdahl & Ramaswamy, 2008). There remains, however, a gap in our understanding of the effectiveness of knowledge transfer mechanisms. In addition, relatively little research has been done to examine the perceptions of remote vendor engineers themselves on this issue. As non-captive knowledge workers, the experience and opinions of vendor staff allow deeper insight into the determinants of successful IS offshore outsourcing.

We address this gap by using knowledge-based theory (KBT) (Kogut & Zander, 1992; Hedlund, 1994; Nonaka, 1994; Grant, 1996) to develop a model of client–vendor knowledge transfer at the level of the individual offshore vendor engineer. While the placement of vendor engineers to onshore client locations may assist them in internalizing client knowledge, this can be costly and impractical. KBT suggests ways in which knowledge transfer to offshore locations can take place, i.e. through explicit (codified) and tacit (socialized) mechanisms. In this study, we test the importance of these mechanisms from the viewpoint of the remote vendor engineer. We draw on the principle of absorptive capacity (Cohen & Levinthal, 1990) to define knowledge transfer in this setting in terms of both (a) understanding of the client; and (b) utilizing knowledge for the benefit of the client. Our primary data consist of a questionnaire survey of 140 vendor engineers located in India.

The findings suggest that the offshore vendor engineer's understanding of the client is positively influenced by exposure to codified knowledge through formal training, as well as by exposure to tacit knowledge through embedment within the client. Client embedment refers to the extent to which the offshore vendor engineer is incorporated tightly within the client organization. We also test whether inappropriate reliance on informal discussions negatively affects the offshore vendor engineer's understanding of the client, but this relationship was not supported in our results. The contribution of this paper is to show how IS engineers of offshore vendor firms perceive mechanisms for gaining and utilizing knowledge of their clients. Importantly, we highlight a contingency among prior onshore placement, opportunities for knowledge transfer and effectiveness of transfer.

THEORETICAL BACKGROUND

The problem of distance in IS offshore outsourcing

Different forms of distance (geographic, cultural, temporal, linguistic, historical, institutional) between client and vendor countries present barriers that can hinder the transfer of client-specific knowledge to individual engineers within vendor firms (Carmel & Abbott, 2007; Levina & Vaast, 2008). First, the offshore vendor engineer may not have access to new information as readily as a client employee does because of geographical location and limited opportunity to interact in close physical proximity with various stakeholders within a client firm over time. Furthermore, the chain needed to supply information to offshore engineers is likely to be longer than to onshore client staff. This presents a problem for effective knowledge transfer as distance between team members in geographically distributed groups can cause misunderstandings in communication (Armstrong & Cole, 2002) and can even bring into question the feasibility of offshoring (Grote & Täube, 2007). Second, cultural and institutional distances matter. Differences in national cultures act as a barrier to knowledge sharing in international teams, particularly those where adaptation to changes in requirements, membership and leadership is necessary (Harrison *et al.*, 2000; Grote & Täube, 2007; Walsham *et al.*, 2007). Furthermore, as institutional distances increase, so do the problems of knowledge stickiness (Jensen & Szulanski, 2004).

The usefulness of KBT

KBT is an appropriate theoretical platform for understanding how distance can be overcome in IS offshore outsourcing and for guiding the study of how remote non-captive engineers may gain and utilize knowledge of their client, despite problems of distance. KBT treats the firm as a social community and set of knowledge repositories that are more efficient at internal knowledge transfer than markets (Kogut & Zander, 1992; Kogut, 2000). In this theory, a firm's knowledge stock and its relative efficiency in internal knowledge flows compared with competitors combine to act as principal sources of competitive advantage (Nonaka, 1994; Grant, 1996). The stock of knowledge developed by a firm and the efficiency by which firm knowledge is created and transferred can determine the success of the firm vis-à-vis competitors (Gupta & Govindarajan, 1991; 2000; Kogut & Zander, 1992; Hedlund, 1994; Kostova, 1999; Kogut, 2000).

Knowledge is a complex concept for which researchers have provided various definitions and typologies over the years. Foremost among these is the distinguishing between forms of knowledge, i.e. articulated (or codified) and tacit (difficult to express, gained through experience) knowledge (Polanyi, 1966; Kogut & Zander, 1992; Nonaka, 1994; Grant, 1996; Lane & Lubatkin, 1998; Hansen, 1999; Lagerström & Andersson, 2003). Thus, knowledge has been categorized as information vs. know-how (Kogut & Zander, 1992) and declarative (operational data, such as management reports) vs. procedural (know-how, such as product designs) (Gupta & Govindarajan, 2000). Birkinshaw *et al.* (2002) described firm-level knowledge in terms of information (such as firm patents) vs. know-how (such as organizational routines).

Thus, we have two fundamental knowledge types: declarative knowledge being codifiable and straightforward to transfer, and procedural know-how that is difficult to articulate and to transfer.

A central argument of KBT is that knowledge transfer involves both transmission of knowledge from sender to recipient as well as its integration and application by the recipient (Ensign, 1999; Hansen, 1999). According to Szulanski (1996), this transfer involves four stages: initiation, implementation, ramp up and integration. The initiation and implementation stages comprise antecedents leading to a transfer decision and actual knowledge flow to a recipient. Ramp up and integration relate to knowledge modification and exploitation. Similarly, Davenport & Prusak (1998) defined transfer in terms of transmission and use. In this view, knowledge has not been transferred unless it has been absorbed, i.e. knowledge transfer relates not only to the sending of knowledge from a source to a recipient unit, but also its understanding and application (Cohen & Levinthal, 1990; Szulanski, 1996; Hansen, 1999). The common notion in these definitions of knowledge transfer is that successful transfer has taken place once the knowledge is utilized by the recipient.

In terms of the transfer and utilization of tacit knowledge, KBT puts a strong emphasis on socialization. Socialization with repeated face-to-face interaction allows tacit knowledge to flow between individuals and for knowledge to be internalized by the recipient (Nonaka, 1994). Socialization also allows for tacit knowledge to be observed and acquired through practice (Grant, 1996). This is a central feature of the communities of practice view, a logic which emphasizes the role of tightly knit social structures that provide a basis for mutual learning and knowledge development (Brown & Duguid, 1991; Lave & Wenger, 1991; Wenger, 1998). Here, groups of individuals working on a specific activity over long periods of time are able to share and apply knowledge while building a collective identity and trust. The communities of practice view places a strong emphasis on apprenticeship and learning in a single location. In particular, the more interactions that are made between experienced members and apprentices, the more an apprentice may gain in-depth tacit knowledge of new opportunities, approaches and practices (Hedlund, 1994). Coordination of interaction through tacit communication when two or more parties have incentives to reach a mutually beneficial outcome has been termed a ‘focal point’ (Schelling, 1960).

Overall, KBT views the firm as a knowledge-creating entity (Nonaka *et al.*, 2000). Dynamic human beings are placed at centre stage, and the interaction of individuals within the environment of the firm acts as an important mechanism for creating and applying knowledge (Grant, 1996). From the point of view of a vendor firm providing IS offshore outsourcing, the client firm is a vital actor within the environment from which knowledge is sourced. Thus, KBT suggests important mechanisms by which knowledge can be transferred from sources within a client firm to individual vendor engineers within an IS offshore outsourcing arrangement. The first of these relates to formalized, codified objects that capture the declarative aspects of client knowledge (e.g. organization structure, infrastructure and application systems documents, project plans and status reports). The second relates to more complex, tacit knowledge, gained through participation within the social communities of the client organization (e.g. through repeated social interactions and observation of cause–effect relationships).

Client–vendor knowledge transfer at individual engineer level

Within this line of thinking, a stream of literature has emerged putting an emphasis on knowledge sharing between onshore staff and remote staff within lateral offshoring relationships (Beulen *et al.*, 2005; Henley, 2006; Chua & Pan, 2008; Leornardi & Bailey, 2008; Youngdahl & Ramaswamy, 2008). For example, Henley (2006) pointed to 'increased investment in training, flat hierarchies and team-based organizations to encourage knowledge sharing' in successful Indian outsourcing companies (Henley, 2006, p. 120). He also highlighted the building of trust between client and provider as a result of onshore face-to-face interaction. This knowledge sharing ultimately enables offshore knowledge workers such as IS engineers to become able to complete tasks for the benefit of their client. The offshore individual develops an understanding of the client's business, its organization, technology and structure, and is able to utilize knowledge acquired for the benefit of the client. In other words, an offshore vendor engineer's performance is a function of transfer, aggregation and appropriability of knowledge (Grant, 1996).

MODEL DEVELOPMENT

Drawing on KBT, we consider three mechanisms influencing effective client–vendor knowledge transfer in IS offshore outsourcing. In our model, and consistent with KBT, knowledge transfer consists of both knowledge acquisition and use. In other words, the utilization of client knowledge by the offshore vendor engineer is dependent on, first, gaining an understanding of the client.

Exposure to explicit knowledge

First, codified knowledge can be made available to a vendor engineer to enable the engineer to gain an understanding of the client. This type of knowledge exists in written form (e.g. system specifications, requirements documents, organizational structure diagrams, etc.). Such explicit knowledge is more easily shared than tacit knowledge (Kogut & Zander, 1992; Zander & Kogut, 1995; Inkpen, 1998) and may therefore be used to train new team members, not just in the technological domain of the client (e.g. programming languages, operating systems, databases, design tools) but also for client-specific applications of those technologies (Chua & Pan, 2008). Formal training of vendor staff may also involve a co-location of client and vendor staff. Such co-location has been shown to be important for knowledge dissemination in an international product innovation environment (Song *et al.*, 2007). Where co-location for training is not possible but where information technology (IT) use is high, Web-based training may be adopted. This offers benefits such as instructors and participants being able to interact effectively in real time (Chan & Ngai, 2007).

Important information about the industry setting and competitive challenges facing the client, as well as client internal organizational structure and strategy, can be articulated for dissemination among offshore vendor engineers. This type of explicit knowledge has been shown to be important for generating service improvements and for maintaining knowledge at a collective team level (Leiponen, 2006). Knowledge of demand-side dynamics (Adner & Levinthal, 2001), which is important if the offshore vendor engineer is to understand the market challenges facing the client, can be made available in articulated form. Furthermore, written manuals and documentation allow codified knowledge to be available to the wider project team in a consistent way. Hence,

Hypothesis 1a: Exposing the offshore engineer to codified knowledge of the client will increase the engineer's understanding of the client.

Exposure to tacit knowledge through embedment with the onshore client

Second, much client knowledge will also be tacit in nature and difficult to transfer (Polanyi, 1966; Kogut & Zander, 1992; Inkpen, 1998). While the computer-mediated forum may be used for accessing information about the client, as Huber (1991) noted, know-how (interpretations of information, e.g. regarding cause–effect relationships) represents a different problem. The transferability (how easily the knowledge can be transferred), aggregation (how easily the knowledge can be combined and recombined) and appropriability of knowledge (whether value can be extracted) all become more difficult when knowledge is tacit (Grant, 1996). According to Nonaka (1994), an important way of overcoming this difficulty is to allow individuals to accumulate tacit knowledge through shared experience, using socialization to create a strong basis for common understanding (Nonaka, 1994).

Consequently, personal experience and direct interaction with the client organization will allow engineers from the vendor firm to gain knowledge of the client. In our analysis, we refer to this as client embedment: the extent to which an offshore vendor engineer is incorporated tightly within the client organization. Following the community of practice logic (Brown & Duguid, 1991; Lave & Wenger, 1991; Wenger, 1998), the offshore engineer is more likely to gain tacit knowledge of the client organization when he/she becomes incorporated into the community of practice surrounding the client project. This entails direct exposure to – and interaction with – the client over time. Leornardi & Bailey, (2008) provide support for this argument. These authors studied knowledge transfer effectiveness in gatekeeping and direct interface models of offshoring, and were able to show how offshore engineers prefer direct interfacing with clients as it enables them to learn directly from onshore sources (Leornardi & Bailey, 2008). In addition, direct interfacing with clients can act as a source of motivation for offshore engineers. Given that motivational disposition is important for avoiding knowledge transfer failure (Osterloh & Frey, 2000; Minbaeva *et al.*, 2003), client embedment becomes an important stimulus for tacit knowledge exchange. Hence,

Hypothesis 1b: Embedment of the offshore engineer with the onshore client will increase the engineer's understanding of the client.

Inappropriate reliance on informal discussions

Third, we highlight a danger that has not been sufficiently dealt with in the literature on IS offshore outsourcing: A reliance on informal discussions in the offshore location can, under certain circumstances, act to undermine effective client–vendor knowledge transfer. This hinges on the argument within the knowledge transfer literature that different forms of knowledge flows are facilitated in different ways (Zander & Kogut, 1995; Bresman *et al.*, 1999). The use of informal interactions is appropriate when the individual receiving the knowledge needs to overcome sources of profound uncertainty (Lam, 1997), when tacit knowledge and 'know-how' are required (Bresman *et al.*, 1999), when there are complex interdependencies and participants are required to bring expertise to bear (Faraj & Sproull, 2000), and when team members need to integrate expertise in order to be creative (Tiwana & McLean, 2005). For these sorts of reasons, team members in software development teams seek knowledge through direct questioning of immediate peers (Walz *et al.*, 1993).

However, localized informal discussions in an offshore location may also hinder effective client–vendor knowledge transfer in IS offshore outsourcing. First, when the vendor engineer relies heavily on informal discussions for knowledge that could be – and should be – explicitly codified, their understanding will not be optimal. More basic and codifiable information (of the 'know-what' kind) can be accessed from IT-based knowledge management repositories and hard copy documentation, where it has been validated for accuracy. In this instance, codification possibilities are high. The use of mechanisms like these for transferring codified knowledge offers benefits of precision and reliability (Zack, 1999), as well as increases the speed of transfer (Zander & Kogut, 1995). Second, a reliance on informal linkages in the offshore location underscores a dependence on second-hand knowledge of the client on the part of the individual engineer. Knowledge of the client sought through local discussions is likely to be of poorer quality than knowledge obtained through direct client interface mechanisms (Leornardi & Bailey, 2008). The benefits of 'pure experience' (Nonaka, 1994, p. 22) that can be gained through direct client embedment are lost if the engineer constantly resorts to informal social interactions in the offshore location. Hence,

Hypothesis 1c: An inappropriate reliance on informal discussions in the offshore location will reduce the engineer's understanding of the client.

Knowledge utilization

KBT also suggests that understanding of the client is only one aspect of client–vendor knowledge transfer at the level of the individual offshore vendor engineer. The second important aspect is utilization of knowledge for the benefit of the client. This draws from the principle of absorptive capacity, defined by Cohen & Levinthal (1990) as the 'ability to recognize the value of new, external knowledge, assimilate it, and apply it to commercial ends' (Cohen & Levinthal, 1990, p. 128). In a review of KBT, Ensign (1999) drew specific attention to technological and product concept understanding as a precursor to successful task performance.

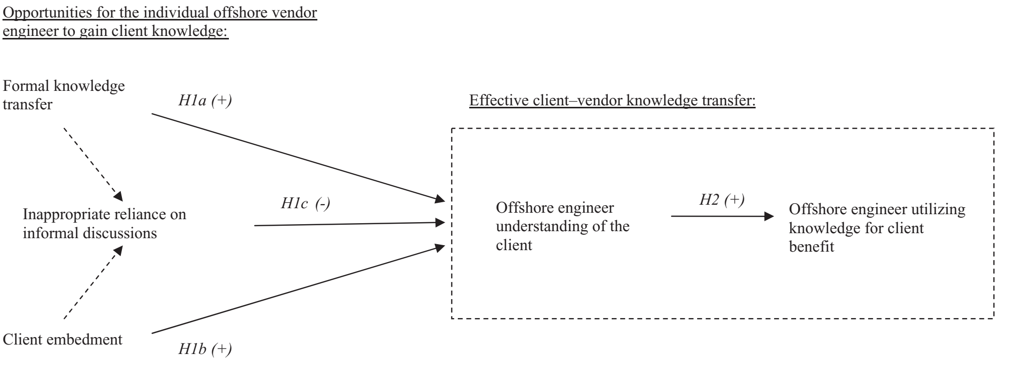

Figure 1. Conceptual model.

Thus, successful knowledge transfer incorporates an application of knowledge by the individual recipient, and this, in turn, is predicated on prior transmission and integration (Szulanski, 1996; Davenport & Prusak, 1998). Hence,

Hypothesis 2: The greater the offshore engineer's understanding of the client, the more likely the engineer will utilize knowledge for the benefit of the client.

The resulting conceptual model is shown in Figure 1. The independent variables are predicted to have a direct effect on client–vendor knowledge transfer. One might also expect formal knowledge transfer and client embedment to reduce inappropriate informal discussions in the offshore location. In the empirical test that follows, we also investigate these paths.

METHOD

The model was tested empirically using a questionnaire survey of 140 Indian software engineers. All respondents were assigned to IS development projects, the majority for clients based in Europe and the United States (in one exception, the client was based in Singapore). All respondents were assigned to projects for a single, principal client. We conducted the data collection in three steps and, thus, have three subsets to the data set. First, we developed and pre-tested the survey questionnaire with five vendor engineers on temporary assignment at an onshore location inside a client firm in London, UK. The engineers informed us of the benefits of clear, concise English questions in order to obtain accurate responses from offshore Indian engineers and of restricting the questions to one side of A4. In their view, busy engineers and team leaders would be more willing to participate in the survey if the instrument was easy to understand, concise and relevant. This was then followed by a pilot of the survey face to face during a workshop within a vendor firm in Chennai. This enabled questionnaire wording and format to be validated such that we were confident that the Indian respondents interpreted the items in a consistent, unambiguous way. In this round, all respondents were employed by a single vendor and were assigned to a contract with the same client (an information services company) ($n = 25$).

Second, with senior management support, the survey questionnaire was distributed to five further team leaders within the same vendor, who then distributed it among offshore engineers. These respondents were assigned to one of two clients, the original client or the one in the pharmaceutical industry ($n = 85$). Third, in order to offset possible bias caused by engineers being mandated to respond by senior management in this single vendor, we collected an additional round of data ($n = 30$) using professional networks and contacts in India. None of these additional respondents worked for the original vendor or clients. The final sample of $n = 140$ contained engineers from various locations in India and from among the largest and most well-known Indian firms providing IS offshore outsourcing. The mean tenure of respondents within their vendor was 2.71 years. Importantly, 65 of the respondents (46.43%) had experienced a prior onshore placement. The mean tenure for those that had never had an onshore placement ($n = 75$) was 1.65 years. The mean tenure for those that had had an onshore placement ($n = 65$) was 3.94 years. Table 1 shows the characteristics of the sample.

The survey contained open items to capture details of respondent experience (tenure) with the vendor, their current client and their current development project. The survey also contained original Likert style statements against which engineers were asked to indicate agreement on a five-point scale (1 = disagree strongly, 5 = agree strongly). A scale for *formal knowledge transfer* was produced from two five-point items relating to the transfer of explicit knowledge to the offshore engineer (Kogut & Zander, 1992; Inkpen, 1998; Leiponen, 2006). These were whether the respondent had been given formal training on the client's business and whether the respondent had been given formal training on the current project and system. A scale for *client embedment* was constructed from two items capturing the extent that the engineer was incorporated tightly within the onshore client organization. First, we used the responding engineer's overall experience with the client on any project. This was self-reported in years and months. Second, we used an item capturing the extent to which the respondent has daily communication with the client. A scale for *inappropriate reliance on informal discus-*

Table 1. Characteristics of the sample

	Subset 1	Subset 2	Subset 3
Description	Entry point: development team #1 in vendor V1	Five further development teams within vendor V1	30 additional offshore engineers not in vendor V1
Vendor offshore locations	Chennai	Chennai, Mumbai	Pune, Chennai, Bangalore
Client	C1 (information services)	C1 (information services) C2 (pharmaceuticals)	Not assigned to clients C1/C2
Client onshore locations	UK, Germany	United States, UK, Germany	United States, UK, Singapore, Germany, the Netherlands
Mean tenure of engineers within vendor	2.78 years	2.21 years	4.08 years
n respondents	25	85	30

sions was produced from two items capturing the engineer's use of informal discussions in order to gain information that has a high codifiability potential in IS development projects. We used items that relate to information on (1) the current project and system; and (2) the business priorities of the client.

A scale for *understanding of the client* was produced from three items relating to the degree to which the vendor engineer perceived himself/herself to understand (1) the client's core business; (2) how their work actually contributes to the client's business; and (3) the organizational structure of the client. A scale for *knowledge utilization* was derived from three items based on the principle of knowledge application to commercial ends (Cohen & Levinthal, 1990): use of knowledge to influence client requirements, use of knowledge to recommend new opportunities to the client and use of knowledge to influence the design of solutions for the client.

We ran a number of tests to examine the quality of the data collected. First, we used a Harman's single-factor test to check for common method variance (Podsakoff & Organ, 1986). This would be an issue if one main factor emerged from a factor analysis of all questionnaire items used. The first factor accounted for 33.685% of variance, less than half of total variance. It is therefore not expected that common method variance presents a problem in interpreting the results. Second, we examined the distribution of the scales using histograms and descriptive information. This indicated that the scales were normally distributed (Table 2). Third, we compared the means between the engineers working for vendor V1 (subsets 1 and 2, $n = 110$) and those not employed by V1 (subset 3, $n = 30$). This revealed no significant differences for inappropriate reliance on informal discussions, client embedment and understanding of the client. The mean for formal knowledge transfer was slightly lower for subset 3 vs. subsets 1 + 2 (3.12 compared with 3.50, $P < 0.10$). The mean for knowledge utilization was slightly higher for subset 3 vs. subsets 1 + 2 (3.68 compared with 3.17, $P < 0.01$). One possible explanation for these differences is the maturity of vendor V1 in terms of internal knowledge management systems, coupled with the slightly longer tenure of the engineers in subset 3. These differences are not large and do not impact our interpretation of the final results.

The model was tested using a partial least squares (PLS) algorithm within the SmartPLS software package (University of Hamburg (Germany), School of Business) (Ringle *et al.*, 2005). PLS is suitable for testing complex path models in which path coefficients verify

Table 2. Descriptive statistics

Variable	*n*	Range	Minimum	Maximum	Mean	Standard deviation
Formal knowledge transfer	140	4.00	1.00	5.00	3.28	0.92
Client embedment	140	4.45	0.55	5.00	2.42	1.24
Inappropriate reliance on informal discussions	140	4.00	1.00	5.00	2.93	0.96
Understanding of the client	140	2.67	2.33	5.00	3.73	0.74
Knowledge utilization	140	4.00	1.00	5.00	3.28	0.92

hypothesized relationships between latent variables (Lohmöller, 1989). PLS enables testing of both the psychometric properties of the measurement model (the items used to create variables) as well as the structural model (direction and strength of relationships between variables) (Wixom & Watson, 2001). A major strength of the PLS approach is its ability to handle different types of constructs and small sample sizes (Chin, 1998; Chin & Newsted, 1999). Latent variables were built from indicators (single questionnaire items) in a reflective manner: Questionnaire items linked to constructs were, as expected, positively intercorrelated (Diamantopoulos *et al.*, 2008). Four single items were applied as control variables to account for the possibility that respondent experience with the vendor and the current project (in each case, overall tenure and onshore experience) may determine the respondent's perceived understanding of the client. Thus, we included paths between these four items as latent variables and the construct *understanding of the client*.

PLS enables us to test for internal consistency, convergent validity and discriminant validity of the measurement model (Wixom & Watson, 2001; Gefen & Straub, 2005; Meso *et al.*, 2005). Table 3 shows internal consistency reliability and convergent validity for the scales. All reliabilities were greater than the recommended level of 0.7 (Hair *et al.*, 1995; Wixom & Watson, 2001). Convergent validity is supported when items load highly on their reflective constructs (Wixom & Watson, 2001; Meso *et al.*, 2005) and with a significant *t*-value at least at $P < 0.05$ (Gefen & Straub, 2005, p. 93). As shown in Table 3, all item loadings were greater than 0.7 and with significant *t*-values ($P < 0.001$). As noted below, all average variance extracted (AVE) values were also greater than 0.5, an indication of adequate convergent validity (Wixom & Watson, 2001; Gefen & Straub, 2005; Meso *et al.*, 2005). Table 4 shows the cross-loadings for all items and constructs. We note that items load much more strongly on their own constructs than on any other constructs in the model (Gefen & Straub, 2005, p. 93).

Table 5 shows the correlations between the latent variables and the square root of AVE scores for each latent variable. AVE scores are all above the 0.5 threshold recommended by Hair *et al.* (1995) and Gefen & Straub (2005). A test for satisfactory discriminant validity is when the square root of the AVE score for each reflective variable is greater than the variance shared between the variable and the other variables in the model (Wixom & Watson, 2001; Gefen & Straub, 2005). We note from Table 5 that this is the case for all variables. The measurement properties provide confidence in the use of these scales as internally consistent and valid.

We ran three models. The first model included all respondent data (engineers that had experienced an onshore placement as well as those that had not) ($n = 140$). The second model only contained those engineers that had experienced a prior onshore placement ($n = 65$). The third model only contained those engineers that had not experienced a prior onshore placement ($n = 75$). The second and third models were run to examine differences in client–vendor knowledge transfer in the presence (absence) of first-hand knowledge of the onshore environment. For the third model, items with reference to onshore placement (vendor and project) were removed as these both had a value of 0 for all 75 observations. These items were: 'How much onshore experience do you have with your current employer?' and 'How much onshore experience do you have with the current project?' (Table 4).

Table 3. Measurement properties of the scales (n = 140)

Latent variable	Composite reliability	Indicator	Item loading: Loading	Mean of subsamples	Standard error	*t*-statistic
Formal knowledge transfer	0.84	I have been given formal training on the client's business	0.92	0.92	0.03	27.84
		I have been given formal training on the current system/project	0.77	0.77	0.08	10.04
Client embedment	0.79	How long have you worked for your current client (on any project)?	0.75	0.75	0.08	9.92
		I have daily communication with staff from my client's business	0.86	0.85	0.05	17.00
Inappropriate reliance on informal discussions	0.89	I rely on informal discussions for information on the client's business priorities	0.85	0.84	0.09	9.59
		I rely on informal discussions for information on the system/project I am working on	0.94	0.94	0.03	35.66
Understanding of the client	0.86	I understand how my work contributes to the client's business	0.79	0.79	0.04	17.98
		I understand the organizational structure of the client	0.82	0.82	0.03	26.45
		I understand the client's business	0.84	0.85	0.03	29.67
Knowledge utilization	0.93	I am able to use my knowledge to influence client requirements	0.92	0.91	0.02	41.83
		I am able to use my knowledge to recommend new opportunities for the client	0.89	0.89	0.03	30.47
		I am able to use my knowledge to influence the design of solutions for the client	0.91	0.91	0.02	47.02

Table 4. Cross-loadings between items and latent variables (n = 140)

Questionnaire item	Formal knowledge transfer	Client embedment	Inappropriate reliance on informal discussions	Understanding of the client	Knowledge utilization	Vendor service	Vendor onshore experience	Project service	Project onshore experience
I have been given formal training on the client's business	**0.92**	0.10	–0.12	0.46	0.22	–0.02	–0.05	–0.02	–0.13
I have been given formal training on the current system/project	**0.77**	0.06	–0.11	0.27	0.09	–0.05	–0.14	–0.09	–0.06
How long have you worked for your current client (on any project)?	–0.01	**0.75**	–0.21	0.37	0.13	0.69	0.48	0.71	0.33
I have daily communication with staff from my client's business	0.16	**0.86**	–0.28	0.47	0.31	0.31	0.14	0.30	0.12
I rely on informal discussions for information on the client's business priorities	–0.12	–0.17	**0.85**	–0.20	–0.07	–0.06	–0.00	–0.21	–0.05
I rely on informal discussions for information on the system/project I am working on	–0.13	–0.34	**0.94**	–0.26	–0.06	–0.23	–0.10	–0.28	–0.09
I understand how my work contributes to the client's business	0.36	0.27	–0.19	**0.79**	0.35	0.16	0.07	0.13	0.06
I understand the organizational structure of the client	0.38	0.54	–0.31	**0.82**	0.34	0.46	0.29	0.38	0.21
I understand the client's business	0.36	0.44	–0.14	**0.84**	0.45	0.41	0.20	0.16	–0.02
I am able to use my knowledge to influence client requirements	0.20	0.24	–0.09	0.43	**0.92**	0.19	0.11	0.24	0.13
I am able to use my knowledge to recommend new opportunities for the client	0.22	0.17	–0.02	0.39	**0.89**	0.20	0.12	0.12	0.13
I am able to use my knowledge to influence the design of solutions for the client	0.12	0.36	–0.08	0.43	**0.91**	0.24	0.13	0.19	0.01
How long have you worked for your current employer?	–0.04	0.59	–0.18	0.44	0.23	1.00	0.72	0.47	0.23
How much onshore experience do you have with your current employer?	–0.10	0.36	–0.07	0.25	0.13	0.72	1.00	0.29	0.48
How long have you worked on the current project?	–0.06	0.59	–0.28	0.28	0.21	0.47	0.29	1.00	0.54
How much onshore experience do you have with the current project?	–0.12	0.26	–0.08	0.10	0.10	0.23	0.48	0.54	1.00

Bold values are the relevant cross-loadings for each latent variable.

Table 5. Intercorrelations between latent variables with square root of average variance extracted (n = 140)

	1	2	3	4	5	6	7	8	9
Primary variables of interest									
1 Formal knowledge transfer	**0.85**								
2 Client embedment	0.10	**0.81**							
3 Inappropriate reliance . . .	–0.14	–0.30	**0.90**						
4 Understanding of the client	0.45	0.53	–0.26	**0.82**					
5 Knowledge utilization	0.20	0.29	–0.07	0.46	**0.90**				
Offshore engineer experience									
6 Vendor service	–0.04	0.59	–0.18	0.44	0.23	**1.00**			
7 Vendor onshore experience	–0.10	0.36	–0.07	0.25	0.13	0.72	**1.00**		
8 Project service	–0.06	0.59	–0.28	0.28	0.21	0.47	0.29	**1.00**	
9 Project onshore experience	–0.12	0.26	–0.08	0.10	0.10	0.23	0.48	0.54	**1.00**

Bold values are the AVE scores.

FINDINGS

Table 6 shows the results of the PLS analysis. First, we consider the full model (model 1). In terms of vendor engineer understanding of the client, formal knowledge transfer (*H1a*) has the strongest effect. We also see a positive and significant effect for client embedment (*H1b*), although this is not as strong as formal knowledge transfer. Engineer inappropriate reliance on informal discussions has a slight negative impact on understanding of the client, but this is not significant. The R^2 for understanding of the client is 0.49. As expected, understanding of the client has a positive influence on utilizing knowledge for the benefit of the client (*H2*). The R^2 for utilizing knowledge for the benefit of the client is 0.21. In terms of paths between the independent variables, we see that formal knowledge transfer and client embedment act to reduce inappropriate reliance on informal discussions, but this is only significant for client embedment. Vendor service has a positive and significant impact on understanding of the client. Overall, the results provide support to *H1a*, *H1b* and *H2*.

Second, we observe interesting results when we contrast the subsamples of engineers with and without prior onshore experience (models 2 and 3). Understanding of the client is strongly influenced by formal knowledge transfer for both sets of engineers. Likewise, understanding of the client has a positive bearing on being able to utilize knowledge for client benefit in both subsamples. In both of these relationships, the path coefficients are stronger for the subsample with prior onshore experience. In both subsamples, an inappropriate reliance on informal discussions has a negative but insignificant impact on understanding of the client.

In contrast, we note that the path coefficient for client embedment is positive and significant for those engineers with onshore experience but insignificant for those engineers with no onshore experience. We also note a more pronounced negative impact of formal knowledge transfer and client embedment on inappropriate reliance on informal discussions for those engineers that have never had an onshore placement compared with those that have had an onshore placement.

Table 6. Summary of results

Hypothesis	Description	Model 1: Full sample (n = 140) Path coefficient (t-value)	Model 2: Subsample *with* prior onshore experience (n = 65) Path coefficient (t-value)	Model 3: Subsample *without* prior onshore experience (n = 75) Path coefficient (t-value)
H1a	Formal knowledge transfer: Exposing the offshore engineer to codified knowledge of the client will increase the engineer's understanding of the client.	0.42** (5.21)	0.51** (7.60)	0.36** (4.40)
H1b	Client embedment: Embedment of the offshore engineer with the onshore client will increase the engineer's understanding of the client.	0.33** (3.34)	0.36** (3.82)	0.15 (1.05)
H1c	Inappropriate reliance on informal discussions: An inappropriate reliance on informal discussions in the offshore location will reduce the engineer's understanding of the client.	–0.07 (0.73)	–0.14 (1.36)	–0.15 (1.50)
H2	Knowledge utilization: The greater the offshore engineer's understanding of the client, the more likely the engineer will utilize knowledge for the benefit of the client.	0.46** (5.69)	0.55** (8.06)	0.32** (3.34)
Additional paths	Formal knowledge transfer → inappropriate reliance on informal discussions	–0.11 (1.06)	–0.06 (0.44)	–0.21* (1.95)
	Client embedment → inappropriate reliance on informal discussions	–0.29** (3.01)	0.19 (0.98)	–0.47** (5.09)
	Effects of respondent experience on understanding of the client			
	Vendor service	0.33** (2.62)	0.34** (3.00)	0.22 (1.63)
	Vendor onshore experience	–0.09 (0.72)	–0.12 (1.06)	–
	Project service	–0.07 (0.67)	–0.03 (0.35)	0.00 (0.03)
	Project onshore experience	0.07 (0.65)	0.04 (0.43)	–

*$P < 0.05$; **$P < 0.01$.

DISCUSSION

The contribution of the current study is to show, from the perspective of the recipients of knowledge, how explicit and tacit mechanisms impact client–vendor knowledge transfer within IS offshore outsourcing. This is an important angle that has received little prior academic attention. Importantly, our approach stresses client–vendor knowledge transfer as more than simply gaining an understanding of client structure and organization; it also extends to offshore engineers' influencing of client requirements and confidence in making recommendations to the client. A key motivation for this study was that much recent offshore outsourcing literature focuses on client perceptions of the outsourcing arrangement. It is a contribution of this study to take a different viewpoint and focus on vendor engineer perceptions.

Implications for theory

The results of the present analysis provide broad support for KBT (Kogut & Zander, 1992; Nonaka, 1994; Zander & Kogut, 1995; Grant, 1996; Nonaka *et al.*, 2000) as applied in an IS offshore outsourcing setting. However, we also identify important nuances arising in this particular empirical context. These nuances help to shed light on how offshore outsourcing vendors have been able to deliver high-quality services to their clients in spite of the fact that not all of their software engineers are able to receive an onshore placement with their client.

First, the results support the importance of explicit knowledge of the client for dissemination within offshore vendor staff. We find that codified knowledge dissemination through formal training is beneficial for an offshore engineer's understanding of their client, regardless of whether the engineer has had a prior onshore placement. Second, the results lend support to the view that knowledge is efficiently developed within tightly knit co-located social communities that surround a focal point (Brown & Duguid, 1991; Lave & Wenger, 1991; Nonaka, 1994; Wenger, 1998). This is evidenced in our study by the relationship between client embedment and understanding of the client: This relationship becomes significantly stronger for offshore engineers who have had first-hand experience in an onshore location. When engineers only have offshore experience of their client (length of assignment to – and frequency of interactions with ?– the client but from an offshore location), the effect of client embedment on understanding of the client becomes insignificant. For these individuals, a lack of personal socialization with members from the client firm hinders their ability to internalize knowledge of the client through first-hand contact over time and distance.

Third, in terms of the argument that inappropriate reliance on informal discussions acts to hinder effective client–vendor knowledge transfer, we find no support for our hypothesis in either the full model or in the subsample models. The sign of the coefficient in these models is indeed negative, but the path is not statistically significant. One possible explanation for this is that the issue of what is and is not appropriate in terms of informal discussions in an offshore location is much more subtle than our hypothesis or operationalization anticipated. The extent to which informal discussions are appropriate vs. inappropriate may also depend on a range of other factors not captured here, such as whether those discussions are held in isolation from the client or whether the discussions act to confuse newcomers, rather than inform them.

Interestingly, for the subsample without onshore experience, we find formal knowledge transfer and client embedment act to reduce inappropriate reliance on informal discussions. This suggests that if the natural tendency to use informal discussions to gain information that should ideally be available in explicit form presents a hazard for effective knowledge transfer, increasing both formal training and client embedment will act to compensate. Thus, client embedment is not only meaningful for those engineers who have had onshore placements. For engineers who have never been onshore, client embedment has an indirect effect on knowledge transfer by reducing a dependence on localized informal discussions in circumstances where such discussions act to obfuscate knowledge flows. Given the constraint that not all offshore engineers can be placed onshore with the client, it appears that Indian offshore outsourcing firms are able to facilitate the transfer of knowledge of their clients in order to offer long-term value-adding services. Formal training is one way of achieving knowledge transfer to individuals without onshore placement experience, and client embedment from the offshore location is a viable mechanism, which is important because it reduces the hazard of unnecessary informal discussions.

One explanation for the result in model 3 relating to client embedment is that engineers with no onshore placement experience are yet to develop accurate knowledge frames (Kusunoki *et al.*, 1998) that reflect the business reality facing the client. Their experience has been limited to the immediate physical reality and task concerns of the setting within the vendor firm. According to Kusunoki *et al.* (1998), knowledge frames refer to the linkages between discrete units of knowledge. Having these frames will allow tacit knowledge flows to be effective. In this sense, the engineer who has not had an onshore placement is more likely to be at the boundary of the development function, less able to interpret the objects conveyed through informal mechanisms (Carlile, 2002). The individual will have a greater appreciation of the meanings placed on boundary objects (Carlile, 2002) and therefore develop knowledge frames (Kusunoki *et al.*, 1998) once they have experienced an onshore placement. In this sense, the onshore placement may be seen as an important phase of interaction and dialogue that enables the recipient offshore engineer to access otherwise hidden tacit knowledge (Nonaka, 1994). This enables the engineer to penetrate what Bettis & Prahalad (1995) referred to as the 'dominant logic' of the (client) firm.

We also find support for the central argument of KBT that effective knowledge transfer relates to both receipt and application of knowledge (Cohen & Levinthal, 1990; Szulanski, 1996; Davenport & Prusak, 1998). Overall, we find a strong link between understanding of the client and utilizing knowledge for client benefit. This adds justification to our definition of client–vendor knowledge transfer in IS offshore outsourcing as comprising both the individual's knowledge acquisition and their knowledge application (Figure 1). The findings suggest that this relationship becomes slightly weaker for offshore engineers who have never had an onshore placement; these engineers are less able to turn knowledge of the client received at an offshore location into actions that add value to the client. This underlines the usefulness of KBT in this research setting as KBT places a strong emphasis on the effectiveness of transfer.

Implications for practice

First and foremost, the current findings suggest that a client firm undertaking IS offshore outsourcing should take steps to transfer client knowledge to offshore vendor engineers in order to exploit the offshore outsourcing contract fully, i.e. to enable offshore vendor engineers to apply knowledge for client benefit. This means providing opportunities for offshore vendor engineers to gain knowledge of both the client's external environment (industry dynamics, consumer trends and tastes, competitors, drivers for growth, etc.) and the client's internal organizational structure, processes and technologies. In practical terms, the current research suggests that this is most likely to be achieved through formal training and communication of written documentation on the one hand, and by enabling client embedment on the other hand.

In terms of formal training, the ability of the client to transform complex tacit knowledge into an explicit form for consumption by vendor engineers becomes crucial. This transformation should be done on an ongoing basis if relevant client knowledge is rapidly changing; client trainers should update training materials and repeat training sessions in order to keep offshore engineers up to date. Vendor managers can seek formal client-specific training from client representatives in order to facilitate their employees' access to codified knowledge of the client. Vendor managers can make regular assessments of the knowledge gaps within their offshore teams and, if necessary, request training and documentation from client representatives. This amounts to a proactive approach of 'pulling' codified knowledge from the client.

In terms of client embedment, our findings suggest that vendor engineers should be provided with opportunities to become tightly knitted within the client organization. Whether this embedment is with end-users and marketing representatives, or with development and technology staff is likely to depend on the specific project circumstances. Our results indicate that client embedment can be achieved from an offshore location and that this is important both for engineers with and without prior onshore experience, albeit for different reasons. Given that onshore placements are not likely to be possible for all vendor staff, managers should note the effect that client embedment has on reducing inappropriate reliance on informal discussions, especially for those without onshore experience.

Finally, our model highlights the potential danger of offshore vendor engineers relying on informal discussions in the offshore location for information that has high codifiability. However, we urge caution here: Although the coefficient for this path had the correctly hypothesized sign, its significance was just outside the 10% level. Thus, managers should be sensitive to facilitating transfer of different forms of knowledge in different ways. Managers situated in the offshore location can monitor the extent of informal discussions within the offshore team. If informal discussions are not being used for the right reasons (integrating tacit knowledge and expertise, being creative, solving complex problems), managers may encourage engineers to use knowledge management repositories or documentation as appropriate. In this way, informal discussions may be preserved as a vehicle for solving complex problems while also allowing vendor engineers to gain knowledge of their client.

Limitations and avenues for future research

First, the present research is limited in terms of its sampling strategy, drawing the majority of respondents from one vendor firm and focusing on the perceptions of IS engineers in vendor firms, rather than both client and vendor respondents. The sampling strategy used does not allow the results to be generalized to a wider population of vendor firms or offshore activity. Second, the survey operationalization in the present study has been developmental. Attempts have been made to demonstrate robustness of the scales through consistency and validity tests. However, a major limitation is the operationalization of inappropriate reliance on informal discussions. There are likely to be better ways of bringing out the subtle nature of this construct and for evaluating whether informal discussions in the offshore location are appropriate or not. Third, as a cross-sectional study, the present research does not show how client–vendor knowledge transfer develops over time (e.g. Chua & Pan, 2008). Fourth, variables not considered here may be salient to the explanation of how offshore vendor engineers gain and utilize knowledge of their clients, such as corporate culture and commitment (e.g. de Brentani & Kleinschmidt, 2004) and the degree of trust between the parties (e.g. Aulakh *et al.*, 1996). In addition, team effects may also be important to knowledge transfer at the individual engineer level. Where an individual is physically co-located in a high-performing team, it is perhaps more likely that he/she will internalize task-specific knowledge that is useful.

Future work should build on the present research to address these limitations and develop our understanding of KBT within IS offshore outsourcing. IS offshore outsourcing represents a unique and interesting context in which to develop KBT. The sampling could be improved by considering different types of projects and a wider selection of vendors. The measure for inappropriate reliance on informal discussions should be enhanced by capturing aspects of informal discussions that discriminate between what is appropriate and what is inappropriate in this particular setting. For example, a more refined measure of this construct would be one that taps into the extent of isolation from the client while informal discussions in the offshore location take place. The operationalization of knowledge transfer could also be improved, for example, by measuring knowledge application relative to a client employee or to a co-worker. A comparative study could be undertaken to examine differences between near-shoring and far-shoring. A comparison could also be made between the consequences of client–vendor knowledge transfer arising through offshore outsourcing, with that arising through in-sourced or onshore alternatives. Finally, a deeper investigation into the potential detrimental effects of informal modes of knowledge transfer for younger, less tenured vendor engineers should be carried out.

CONCLUSION

Distances between client and vendor in IS offshore outsourcing limit the extent to which offshore vendor engineers are able to gain and apply knowledge for the benefit of their client. Overcoming these distances is necessary in order to create and maintain an understanding of client context by vendor engineers. Drawing on KBT, we find that this may be achieved, in part, through explicit knowledge transfer using formal training and by creating opportunities for tacit knowledge transfer through client embedment. Our analysis suggests that an inappropriate reliance on informal discussions among offshore vendor engineers may be detrimental to instilling client knowledge offshore, particularly for those with no prior onshore exposure. This may be reduced through formal training and client embedment from the offshore location. Onshore placements are a restricted but potent source of knowledge, amplifying the effects of future client embedment from an onshore location. Future research may develop this concept and further expand our understanding of IS offshore outsourcing through a knowledge-based lens.

REFERENCES

Adner, R. & Levinthal, D. (2001) Demand heterogeneity and technology evolution: implications for product and process innovation. *Management Science*, **47**, 611–628.

Armstrong, D.J. & Cole, P. (2002) Managing distances and differences in geographically distributed work groups. In: *Distributed Work*, Hinds, P. & Kiesler, S. (eds), pp. 167–189. MIT Press, Cambridge, MA, USA.

Aulakh, P.S., Kotabe, M. & Sahay, A. (1996) Trust and performance in cross-border marketing partnerships: a behavioral approach. *Journal of International Business Studies*, **27**, 1005–1032.

Bettis, R.A. & Prahalad, C.K. (1995) The dominant logic: retrospective and extension. *Strategic Management Journal*, **16**, 5–14.

Beulen, E., Van Fenema, P. & Currie, W. (2005) From application outsourcing to infrastructure management: extending the offshore outsourcing service portfolio. *European Management Journal*, **23**, 133–144.

Birkinshaw, J., Nobel, R. & Ridderstråle, J. (2002) Knowledge as a contingency variable: do the characteristics of knowledge predict organization structure? *Organization Science*, **13**, 274–289.

Bresman, H., Birkinshaw, J. & Nobel, R. (1999) Knowledge transfer in international acquisitions. *Journal of International Business Studies*, **30**, 439–462.

Brown, J.S. & Duguid, P. (1991) Organizational learning and communities-of-practice: toward a unified view of working, learning and innovation. *Organization Science*, **2**, 40–57.

Carlile, P.R. (2002) A pragmatic view of knowledge and boundaries: boundary objects in new product development. *Organization Science*, **13**, 442–455.

Carmel, E. & Abbott, P. (2007) Why 'nearshore' means that distance matters. *Communications of the ACM*, **50**, 40–46.

Chan, S.C.H. & Ngai, E.W.T. (2007) A qualitative study of information technology adoption: how ten organizations adopted Web-based training. *Information Systems Journal*, **17**, 289–315.

Chin, W.W. (1998) The partial least squares approach to structural equation modeling. In: *Modern Methods for Business Research*, Marcoulides, G.A. (ed.), pp. 295–336. Lawrence Erlbaum Associates, Mahwah, NJ, USA.

Chin, W.W. & Newsted, P.R. (1999) Structural equation modeling analysis with small samples using partial least squares. In: *Statistical Strategies for Small Sample Research*, Hoyle, R.H. (ed.), pp. 307–341. Sage Publications, Thousand Oaks, CA, USA.

Chua, A.L. & Pan, S.L. (2008) Knowledge transfer and organizational learning in IS offshore sourcing. *Omega*, **36**, 267–281.

Cohen, W.M. & Levinthal, D.A. (1990) Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, **35**, 128–152.

Davenport, T.H. & Prusak, L. (1998) *Working Knowledge: How Organizations Manage What They Know*. Harvard Business School Press, Boston, MA, USA.

de Brentani, U. & Kleinschmidt, E.J. (2004) Corporate culture and commitment: impact on performance of international new product development programs. *Journal of Product Innovation Management*, **21**, 309–333.

Diamantopoulos, A., Riefler, P. & Roth, K.P. (2008) Advancing formative measurement models. *Journal of Business Research*, **61**, 1203–1218.

Ensign, P.C. (1999) Innovation in the multinational firm with globally dispersed R&D: technological knowledge utilization and accumulation. *Journal of High Technology Management Research*, **10**, 203–221.

Faraj, S. & Sproull, L. (2000) Coordinating expertise in software development teams. *Management Science*, **46**, 1554–1568.

Gefen, D. & Straub, D. (2005) A practical guide to factorial validity using PLS-GRAPH: tutorial and annotated example. *Communications of the Association for Information Systems*, **16**, 91–109.

Grant, R.M. (1996) Toward a knowledge-based theory of the firm. *Strategic Management Journal*, **17** (Winter Special Issue: Knowledge and the Firm),109–122.

Grote, M.H. & Täube, F.A. (2007) When outsourcing is not an option: international relocation of investment back research – or isn't it? *Journal of International Management*, **13**, 57–77.

Gupta, A.K. & Govindarajan, V. (1991) Knowledge flows and the structure of control within multinational corporations. *Academy of Management Review*, **16**, 768–792.

Gupta, A.K. & Govindarajan, V. (2000) Knowledge flows within multinational corporations. *Strategic Management Journal*, **21**, 473–496.

Hair, J.F., Anderson, R.E., Tatham, R.L. & Black, W.C. (1995) *Multivariate Data Analysis*. Prentice-Hall, New York, NY, USA.

Hansen, M.T. (1999) The search-transfer problem: the role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly*, **44**, 82–111.

Harrison, G.L., McKinnon, J.L., Wu, A. & Chow, C.W. (2000) Cultural influences on adaptation to fluid workgroups and teams. *Journal of International Business Studies*, **31**, 489–505.

Hedlund, G. (1994) A model of knowledge management and the N-form corporation. *Strategic Management Journal*, **15**, 73–90.

Henley, J. (2006) Outsourcing the provision of software and IT-enabled services to India: emerging strategies. *International Studies of Management and Organization*, **36**, 111–131.

Huber, G.P. (1991) Organizational learning: the contributing processes and the literatures. *Organization Science*, **2**, 88–115.

Inkpen, A. (1998) Learning, knowledge acquisition, and strategic alliances. *European Management Journal*, **16**, 223–229.

Jensen, R. & Szulanski, G. (2004) Stickiness and the adaptation of organizational practices in cross-border knowledge transfers. *Journal of International Business Studies*, **35**, 508–523.

Kogut, B. (2000) The network as knowledge: generative rules and the emergence of structure. *Strategic Management Journal*, **21**, 405–425.

Kogut, B. & Zander, U. (1992) Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, **3**, 383–397.

Kostova, T. (1999) Transnational transfer of strategic organizational practices: a contextual perspective. *Academy of Management Review*, **24**, 308–324.

Kusunoki, K., Nonaka, I. & Nagata, A. (1998) Organizational capabilities in product development of Japanese firms: a conceptual framework and empirical findings. *Organization Science*, **9**, 699–718.

Lagerström, K. & Andersson, M. (2003) Creating and sharing knowledge within a transnational team: the development of a global business system. *Journal of World Business*, **38**, 84–95.

Lam, A. (1997) Embedded firms, embedded knowledge: problems of collaboration and knowledge transfer in global cooperative ventures. *Organization Studies*, **18**, 973–996.

Lane, P.J. & Lubatkin, M. (1998) Relative absorptive capacity and interorganizational learning. *Strategic Management Journal*, **19**, 461–477.

Lave, J. & Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press, Cambridge, MA, USA.

Leiponen, A. (2006) Managing knowledge for innovation: the case of business-to-business services. *Journal of Product Innovation Management*, **23**, 238–258.

Leornardi, P.M. & Bailey, D.E. (2008) Transformational technologies and the creation of new work practices: making implicit knowledge explicit in task-based offshoring. *MIS Quarterly*, **32**, 411–436.

Levina, N. & Vaast, E. (2008) Innovating or doing as told? Status differences and overlapping boundaries in offshore collaboration. *MIS Quarterly*, **32**, 307–332.

Lewin, A.Y. & Couto, V. (2006) *Next generation offshoring: the globalization of innovation*. *2006 Offshoring Research Network Report*, Cary Printing Company, Duke University/Booz Allen Hamilton, NC, USA.

Lohmöller, J-B. (1989) *Latent Variable Path Modelling with Partial Least Squares*. Physica-Verlag, Heidelberg, Germany.

Meso, P., Musa, P. & Mbarika, V. (2005) Towards a model of consumer use of mobile information and communication technology in LDCs: the case of sub-Saharan Africa. *Information Systems Journal*, **15**, 119–146.

Minbaeva, D., Pedersen, T., Björkman, I., Fey, C.F. & Park, H.J. (2003) MNC knowledge transfer, subsidiary absorptive capacity, and HRM. *Journal of International Business Studies*, **34**, 586–599.

Nonaka, I. (1994) A dynamic theory of organizational knowledge creation. *Organization Science*, **5**, 14–37.

Nonaka, I., Toyama, R. & Nagata, A. (2000) A firm as a knowledge-creating entity: a new perspective on the theory of the firm. *Industrial and Corporate Change*, **9**, 1–20.

Osterloh, M. & Frey, B.S. (2000) Motivation, knowledge transfer, and organizational forms. *Organization Science*, **11**, 538–550.

Parkhe, A. (2007) International outsourcing of services: introduction to the special issue. *Journal of International Management*, **13**, 3–6.

Podsakoff, P.M. & Organ, D.W. (1986) Self-reports in organizational research: problems and prospects. *Journal of Management*, **12**, 531–544.

Polanyi, M. (1966) *The Tacit Dimension*. Doubleday, New York, NY, USA.

Ramasubbu, N., Mithas, S., Krishnan, M.S. & Kemerer, C.F. (2008) Work dispersion, process-based learning, and offshore software development performance. *MIS Quarterly*, **32**, 437–458.

Ringle, C.M., Wende, S. & Will, S. (2005) SmartPLS 2.0 (M3) Beta, Hamburg. [WWW document]. URL http://www.smartpls.de

Schelling, T.C. (1960) *The Strategy of Conflict*. Harvard University Press, Cambridge, MA, USA.

Song, M., Berends, H., van der Bij, H. & Weggeman, M. (2007) The effect of IT and co-location on knowledge dissemination. *Journal of Product Innovation Management*, **24**, 52–68.

Szulanski, G. (1996) Exploring internal stickiness: impediments to the transfer of best practice within the firm. *Strategic Management Journal*, **17**, 27–43.

Tiwana, A. & McLean, E.R. (2005) Expertise integration and creativity in information systems development. *Journal of Management Information Systems*, **22**, 13–43.

Walsham, G., Robey, D. & Sahay, S. (2007) Foreword: special issue on information systems in developing countries. *MIS Quarterly*, **31**, 317–326.

Walz, D.B., Elam, J.J. & Curtis, B. (1993) Inside a software design team: knowledge acquisition, sharing, and integration. *Communications of the ACM*, **36**, 63–77.

Wenger, E. (1998) *Communities of Practice: Learning, Meaning and Identity*. Cambridge University Press, Cambridge, MA, USA.

Wixom, B.H. & Watson, H.J. (2001) An empirical investigation of the factors affecting data warehousing success. *MIS Quarterly*, **25**, 17–41.

Youngdahl, W. & Ramaswamy, K. (2008) Offshoring knowledge and service work: a conceptual model and research agenda. *Journal of Operations Management*, **26**, 212–221.

Zack, M.H. (1999) Managing codified knowledge. *Sloan Management Review*, **40**, 45–58.

Zander, U. & Kogut, B. (1995) Knowledge and the speed of the transfer and imitation of organizational capabilities: an empirical test. *Organization Science*, **6**, 76–92.

Biography

Christopher Williams, PhD, is Assistant Professor of International Business at the Richard Ivey School of Business, University of Western Ontario. His research interests include: entrepreneurship in international firms; knowledge creation and transfer in international firms; and offshore outsourcing of knowledge-intensive work. His work is published in academic journals such as Research Policy, Journal of World Business, International Business Review, R&D Management, Journal of International Management and Journal of Interdisciplinary Economics. Dr. Williams has over two decades industry experience in information systems and product development.