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Factors of stickiness in transfers of know-how between MNC units

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ABSTRACT

The effective sharing of organizational knowledge is particularly relevant for multinational corporations, where firm-specific tacit knowledge (know-how) is considered a source of competitive advantage for subsidiaries participating in a global strategy. To that end, multinational corporations (MNCs) are asking their IT departments to support both the exploitation of existing knowledge and the unit-to-unit transfer of new know-how derived in units from exploration. Nonetheless, new know-how derived from exploratory research, development and experience in one unit can be difficult to transfer to units that can exploit that know-how to commercial ends. The factors that impede the transfer of new know-how have been conceptualized as "factors of stickiness". In this paper, we present a theoretical model of organizational factors that can cause (or conversely mitigate) stickiness in the flow of new know-how between MNC units. To test the six hypotheses of the model, we used meta-analytic structural equation modeling (MASEM) of 31 empirical studies, representing 10,432 cases of new know-how transfer between units. The result of MASEM shows that the factors of receiving units' potential absorptive capacity and transmission channel in form of social capital that is enacted through its three dimensions (i.e., embedded social ties between units, institutional shared vision of units, and interorganizational trust of units) affect recipient subsidiaries' capability to exploit new know-how in practice (i.e., realized absorptive capacity), thus effectuating its transfer. Based on our findings, we propose research directions within the context of agile information systems development, distributed software projects, and management of information systems functions in MNCs.

1. Introduction

Organizations use codification and/or personalization knowledge management strategies to compete (Hansen et al., 1999). A codification strategy enables companies to store organizational explicit knowledge in databases for transfer to anyone in the organization. A codified body of knowledge typically has multiple indexes that allow users to efficiently localize and retrieve existing knowledge (e.g., via database queries). In contrast, a personalization strategy is based on person-to-person interaction embedded within a social context (i.e., social capital) to enable the transfer of tacit knowledge. It is tacit knowledge that enables companies to coordinate and combine their resources and capabilities in innovative ways (i.e., new know-how) (Earl, 2001). It develops from experience and is embedded in complex organizational routines (Earl, 2001; Hansen, 1999; Teece et al., 1997; Zack, 1999). Consequently, unlike many explicit knowledge resources such as databases, tacit knowledge is specific to the organizational context and cannot be simply purchased from the marketplace in a ready-to-use form. Because tacit knowledge is a firm-specific knowledge resource, it is an important source of competitive advantage for organizations (Teece et al., 1997). Management of tacit knowledge enables companies to coordinate and combine their traditional resources

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and capabilities in new and distinctive ways, providing more value for their customers than can their competitors (Earl, 2001). Our focus in this paper is on organizational factors that can cause difficulties or "stickiness" (Szulanski, 1996) in the transfer of tacit knowledge (i.e., new know-how) between multinational corporation (MNC) units. Transfer of new know-how is of particularly strategic importance for multinational corporations (Earl, 2001; Hansen et al., 1999) that constitute an intracorporate network (Inkpen and Tsang, 2005). An intracorporate network consists of a group of organizations operating under a unified corporate identity in which the headquarters (or "parent") of the network has ownership interest in subsidiary business units. Extant literature on the multinational corporation contends that a primary strategic advantage of MNCs compared to markets is the diverse knowledge resources of MNCs (Hansen et al., 1999; Foss and Pedersen, 2002), which should be transferred effectively throughout the organization to generate improved products and services. Therefore, our focus in this paper is on the transfer of new know-how between units of intracorporate MNCs.

The performance of MNCs depends on their ability to coordinate geographically dispersed knowledge resources. To this end, MNCs are confronted with paradoxical challenges of exploiting existing knowledge resources and exploring new ones (He and Wong, 2004). Exploration implies firm behaviors characterized by search, discovery, experimentation, risk taking and innovation. Exploitation, in contrast, implies firm behaviors characterized by refinement, implementation, efficiency, production and selection. For example, Information Technology (IT) Centers of Excellence (CoEs) are special units used by MNCs to pool strategic IT expertise across the globe (Moore and Birkinshaw, 1998; Sia et al., 2010). These units often do not have operational responsibilities but they serve as strategic resources that focus on designing and developing new solutions (i.e., new know-how). To this end, Galliers (2007) contends that "while exploiting an organization's key human, technological, and informational assets are key components, so are the more exploratory components associated with knowledge sharing, informal information collection, cross-project learning, and human interaction" (p. 8). The contention is that sharing codified (i.e., explicit) knowledge can be supported through information and communication technologies such as enterprise systems and knowledge management systems (Hansen et al., 1999). However, focusing merely on exploiting explicit capabilities through such systems may not result in a sustainable source of strategic advantage. Therefore, to compete effectively, firms should also explore and share unique tacit knowledge through informal communication among the actors who can use it to improve products and services (Earl, 2001).

It is the IT organization (IT CoE) that is expected to take up the challenge: "CEOs today are asking their CIOs and IT organizations to play bigger roles in the growth agenda by providing the tools for collaborative innovation; by participating in innovation initiatives of all kinds; by building an integrated platform of business processes, information systems and technology; and by sharing their experience and expertise" between units (Cash et al., 2008, p. 92). Thus, IT departments are expected to play a major knowledge management role in enterprises that are increasingly confronted with paradoxical challenges of exploiting existing explicit knowledge resources and exploring new tacit knowledge. Such a knowledge creation and sharing infrastructure within the context of organizational know-how can provide organizations with the requisite agility to respond to the dynamic nature of organizations' business imperatives (Galliers, 2007). In addition to facilitating exploration and exploitation throughout the organization, the IT CoE is concerned with exploration in the form of information systems development and software development that needs to be subsequently exploited by other MNC units. Within the context of information systems development (ISD), for example, agility is concerned with (1) improving the sensing and response capabilities of ISD that result from the need for organizations deploying IS to obtain their applications faster, or to discover and quickly adopt new types of IS applications and (2) swiftly sensing and adopting innovations that either enable quicker delivery of ISD or offer an opportunity to change the IS discovery and delivery mechanisms (Lyytinen and Rose, 2006). Software development, that is increasingly globally distributed, requires swift transfer of new know-how between subsidiaries (Lee et al., 2006).

Notwithstanding its importance, MNCs find transfer of new know-how between actors in different units challenging. For instance, Galbraith (1990) reports that many firms find intra-firm transfer of new know-how much more difficult than expected and Gupta and Govindarajan (2000) describe how expectations for the transfer of new know-how into a unit from other MNC units (i.e., unit-to-unit) are often unmet. The reason is that when know-how is first created (e.g., in an IT CoE) it is closely tied to its originating context (Dennis and Vessey, 2005). To use it in a different context, the new know-how must be "contextualized" to fit the new environment. This entails deconstructing the new know-how, putting it into a general form (explicit knowledge/know-that), and then reconstructing it in a new context (Dennis and Vessey, 2005). Deconstruction and reconstruction across different units of MNCs are difficult because actors must understand how to modify the knowledge to fit their own context. Recipient units might be unable to exploit outside sources of knowledge; that is, they may lack absorptive capacity. Such capacity is largely a function of recipient unit's pre-existing stock of knowledge (i.e., potential absorptive capacity) and it becomes manifest in the ability to value, assimilate and apply new knowledge to commercial ends (i.e., realized absorptive capacity, that is the dependent variable in our research model). In the absence of such ability, initial difficulties during the assimilation and application of received know-how may become an excuse for discontinuing its use and, in some cases, reverting to the previous status quo. The difficulty associated with transfer of new know-how between MNC units is related to its stickiness nature (Jensen and Szulanski, 2004). Stickiness pertains to the degree of perceived difficulty in transferring new know-how in organizations, which, in turn, refers to the extent of problems (e.g., communication difficulties, unmet expectations) and the extent of eventfulness (e.g., the escalation of disruptive, transfer-related problems) (Jensen and Szulanski, 2004).

MNCs have complex internal environments, with spatial, cultural, and organizational distance; language barriers; inter-unit power struggles; and possible inconsistencies and conflict among the interests, values, practices, and routines used in the various parts of the organization (Kostova et al., 2008). Therefore, transfer of new know-how between units of MNC requires specialized coordination mechanisms to realize these flows (Bartlett and Ghoshal, 1989; Ghoshal and Bartlett, 1990; Gupta and Govindarajan, 1991; Sia et al., 2010). The mechanisms of coordination could be divided roughly into two complementary groups: formal and informal (Martinez and Jarillo, 1989). Almeida et al. (2002) demonstrate that the MNC's use of multiple formal and informal mechanisms – structure, management systems and processes, culture and leadership, for example – permit it to transfer product and process knowledge, often having tacit components, across borders. However, according to Martinez and Jarillo (1989), the evolution of the significance of coordination has been from a focus on the formal to an increasing focus on informal mechanisms because of the recognition of their importance. This is in line with the knowledge-based view that points to the central role of the firm in providing a set of "higher-level organizing principles" and a rich social context to support the creation, transfer, and integration of knowledge (Kogut and Zander, 1992, 1996). For example, Ghoshal et al. (1994) identify the important role of interpersonal networks among the subsidiary managers of Philips and Matsushita, while Gupta and Govindarajan (2000) also show how informal mechanisms promote knowledge flows within MNCs. Informal flow of knowledge among organizational actors is embedded in and influenced by a social context that is created and sustained through their ongoing relationships (Nahapiet and Ghoshal, 1998).

The foregoing discussion of social aspects of know-how transfer between units pertains to elements such as trust, shared values and other aspects of similarity. Discussion on social aspects of ongoing relationships is captured within the framework of social capital proposed in the network literature. In this line of literature, social capital is conceptualized as a set of relational resources embedded in relationships that positively influence firm conduct and performance (Gulati et al., 2000; Nahapiet and Ghoshal, 1998). Because the acquisition and exploitation of tacit knowledge are predominantly social processes (Kogut and Zander, 1992), social capital is believed to be an important catalyst in managing knowledge resources (Alavi et al., 2005; Huang et al., 2001; Nahapiet and Ghoshal, 1998). Furthermore, considering the role of social agents in the MNC context, Kostova et al. (2008) contend that actor interactions in support of knowledge transfer are influenced by socialization processes involving norms and values and that these norms and values arise largely from localized or national settings. Nonetheless, in the MNC context, social agents must reconcile such preferences at collective levels above the level of a particular national environment (i.e., at the global MNC level), thereby confronting institutional complexity, contradictions, and even voids. Therefore, very distinct processes are involved in mitigating stickiness in the unit-to-unit transfer of know-how in MNCs.

Little is known, however, about the impact of organizational factors that can cause (or conversely mitigate) stickiness in the flow of new know-how between MNC units (Gupta and Govindarajan, 2000; Jensen and Szulanski, 2004). To ameliorate this gap, the objective of this paper is: (1) to formulate specific hypotheses based on pertinent extant MNC literature, and (2) to subject those hypotheses to meta-analytic structural equation modeling. To this end, we present the theoretical foundation for postulating six hypotheses. Next, we present the methodology used to collect data and perform meta-analytic structural equation modeling (MASEM). The results of these analyses are presented in Section 4. Discussion of the findings and their implications for research and practice is presented in Section 5. Concluding remarks close the paper.

2. Theoretical foundation

Nonaka (1994) elucidated two dimensions of knowledge in organizations: explicit and tacit. The explicit dimension of knowledge is articulated, codified, and communicated in symbolic form and/or natural language (e.g., operating manual of Customer Relationship Management software). The tacit dimension of knowledge is comprised of both cognitive and technical elements (Nonaka, 1994). The cognitive element refers to an individual's mental models consisting of mental maps, beliefs, paradigms, and viewpoints. The technical component consists of concrete know-how, crafts, and skills that apply to a specific context (e.g., how to use Customer Relationship Management software to serve specific customer segments). The two are not dichotomous states of knowledge, but mutually dependent and reinforcing qualities of knowledge: tacit knowledge forms the background necessary for assigning the structure to develop and interpret explicit knowledge (Polanyi, 1966). In this study, we focus on the transfer of largely procedural types of knowledge (e.g., change management, product design, distribution know-how, etc.) but not on the transfer of largely declarative types of knowledge (e.g., monthly financial data). In other words, this study focuses on the transfer of knowledge that exists in the form of "know-how" rather than on the transfer of knowledge that exists in the form of "operational information". However, transfer of know-how is not a simple process in that organizations often do not know what they know and have weak systems for locating and retrieving know-how that resides in them (Huber, 1991). Communication processes and information flows drive knowledge transfer in organizations.

Alavi and Leidner (2001), in their review of the knowledge transfer literature, contend that transfer occurs at various levels: transfer of knowledge between individuals, from individuals to explicit sources, from individuals to groups, between groups, across groups, and from the group to the organization. The involvement of multiple individuals inevitably introduces diversity in the information, interpretive schemes, and goals of the participants (Feldman and Pentland, 2003). The individuals performing organizational routines do not all have access to the same information, and even if they did, they might not interpret and act on the information in the same way. Considering the distributed nature of organizational cognition, an important process of knowledge management in organizational settings is the transfer of knowledge to locations where it is needed and can be used (Alavi and Leidner, 2001). The context of transferring organizational practices between MNC units provides a poignant example. As a case in point, within the context of MNCs, Williams and Wheeler (2009) reported the substantial resistance and social challenges faced by British American Tobacco towards enactment of common information systems by subsidiaries. They found that "global and local leaders have different objectives for embracing common systems. Furthermore, some objectives are explicitly stated in strategic plans and business cases, while others remain tacit and are rarely discussed openly" (Williams and Wheeler, 2009, p. 59).

The MNC form of organization is conceptualized as an interorganizational network comprised of a headquarters "unit" and geographically dispersed subsidiary "units" (Ghoshal and Bartlett, 1990), each of which assumes a strategic role in the implementation of the MNC's global strategy (Gupta and Govindarajan, 1991). The basic premise for this research is that competitive advantages can be achieved from orchestrating transfer of new know-how to those MNC units that can exploit the knowledge to execute the global strategy. New know-how can be transferred into subsidiaries from three sources: (1) transfers from other MNC units (i.e., source units); (2) transfers from market partners such as customers and suppliers; and, (3) transfers from resources in the local market such as educated workforces (Foss and Pedersen, 2002). Whereas the latter two sources are market-based, new know-how that is derived within an MNC unit from *exploration* (e.g., experiential learning, research and development) and subsequently transferred to subsidiaries that can *exploit* that knowledge is the firm-specific type of knowledge highlighted in knowledge-based theories of the firm. In this literature, the focus has been on exploration and exploitation of new know-how embodied in organizational practices. It is the ability to transfer this firm-specific knowledge more efficiently and effectively within the MNC that advantages the MNC organizational form over markets (Ghoshal, 1987; Gupta and Govindarajan, 2000). Therefore, our focus in this research is on the transfer of new know-how embodied in organizational practices into a subsidiary from other MNC units (i.e., unit-to-unit). In his theory of practice, Bourdieu (1977) argued that practice is inherently improvisational. Practices are carried out against a background of rules and expectations (i.e., operational knowledge), but the particular courses of action we choose are always, to some extent, novel (i.e., know-how). And just as musical improvisation involves listening to what others are playing, improvisation in organizational practices involves attending to the actions taken by relevant others and the details of the situation (Feldman and Pentland, 2003). To this end, in assessing the success of knowledge flow within the context of MNCs, Inkpen (2005, p. 133) contend that, "there is no doubt that some knowledge can be reduced to digitized form and easily transferred within an organization. However, complex knowledge with real strategic value must be managed and transferred through social networks, not computer networks". When the knowledge is explicit, it can easily be codified and transferred among different actors. On the contrary, when the knowledge is mostly tacit, it is "sticky" to whoever owns that knowledge (von Hippel, 1994). When applied more specifically to the transfer of new know-how between units, stickiness has come to represent perceived difficulty in the transfer of organizational practices that is caused by organizational factors ("factors of stickiness") (Szulanski and Jensen, 2006). In their seminal paper on knowledge transfer in MNCs, Gupta and Govindarajan (2000) conceptualized four organizational factors that mitigate against (or in their absence, increase) stickiness of knowledge transfer: (1) the absorptive capacity of the receiving unit, (2) the existence and richness of transmission channels, (3) the motivational disposition of the source (i.e., their willingness to share knowledge), and (4) the motivational disposition of the receiving unit (i.e., their willingness to acquire knowledge from the source). In this paper, we adopt the above four factors of stickiness to theorize the transfer of new know-how embodied in organizational practices into a subsidiary from other MNC units. We further theorize that the richness of the transmission channel should encompass not only the structural dimension of relationships among the actors in different MNC units as conceptualized by Gupta and Govindarajan (2000), but also two complementary dimensions, the *cultural-cognitive* and *relational trust* dimensions, which are instrumental in transfer of new know-how.

Our premise, in regard to existence and richness of transmission channels, is that organizational social capital is instrumental in unit-to-unit transfer of know-how. To this end, social capital can be defined as the "aggregate of resources embedded within, available through, and derived from the network of relationships possessed by an individual or organization. The central proposition in this view of social capital is that networks of relationships are a valuable resource (i.e., capital) for the individual or organization" (Inkpen and Tsang, 2005, p. 151). Social capital represents the ability of actors to secure benefits by virtue of membership in social networks or other social structures (Portes, 1998). At an organizational level, benefits include privileged access to knowledge and information, preferential opportunities for new business, reputation, influence, and enhanced understanding of network norms. Flow of know-how among the individuals/units through social relationships embedded in an ongoing social context is particularly relevant for the intracorporate network form of MNC (Inkpen and Tsang, 2005), which is the focus of this paper. In this paper we seek to understand how know-how flows within intracorporate networks (MNCs) with social capital as the conduit or transmission channel for flows of know-how. To achieve this objective, we adopt Nahapiet and Ghoshal's (1998) three dimensions of social capital: structural, cognitive, and relational.

Social capital in a relationship not only leads to desirable behaviors in transfers of new know-how among actors but also lowers the costs of maintaining the relationship, since it reduces the likelihood of opportunism and the need, therefore, to monitor the other party (Adler and Kwon, 2002). Relationships that form the basis of social capital occur primarily at the level of the individual actors in the unit who have direct interactions with other units, referred to as *boundary spanners.* Drawing from previous work (Zaheer et al., 1998), a boundary spanner can be defined as an individual employed at a unit who currently has, or has previously had, direct contact(s) with other units' actors through joint projects, meetings, task forces, and so forth (e.g., information systems specialists). Through these personal encounters, boundary spanners form relationships with contacts in other MNC units and, with time, develop a set of perceptions and attitudes toward those contacts

(Rempel et al., 1985). It is these beliefs and attitudes that constitute the basis for actors' private social capital. As Lin (1999) suggests, "it is the interacting members who make the maintenance and reproduction of this social asset possible" (p. 32). From this perspective, social capital is essentially a *private good* for the individual. As a private good, "social capital is implicitly an asset that individuals can 'spend' to better their own situations" (Leana and Van, 1999, p. 539). However, in turn, boundary spanners can convey to the other employees at their unit their experiences in working with and personal attitudes toward other units. Through such processes of social information processing (Salancik and Pfeffer, 1978), unit employees will come to form perceptions about and attitudes toward other MNC units. In this way the privately held social capital of the boundary spanners will be transformed into a *public good* of the *unit.*

Based on the prior research, we conceptualize four factors that influence transfer of new know-how embodied in organizational practices into a subsidiary from other units of intracorporate MNCs as follows: (1) the absorptive capacity of the receiving unit, (2) the existence and richness of transmission channels in form of social capital, (3) the motivational disposition of the source (i.e., their willingness to share knowledge), and (4) the motivational disposition of the receiving unit (i.e., their willingness to acquire knowledge from the source). Our conceptualization is depicted as the research model in Fig. 1. Next, we will develop the six hypotheses of our research model theorizing the affects of the four factors on the unit-to-unit transfer of new know-how embodied in organizational practices.

2.1. Realized absorptive capacity of recipient unit

The unit-to-unit transfer of new know-how embodied in an organizational practice (i.e., the dependent variable in our research model) is not considered complete until it becomes adopted in the routines of the recipient unit (Kostova, 1999). Consequently, the transfer of new know-how involves a transformational process on the part of the recipient unit. In the transformational process, recipient units combine newly acquired know-how with their previously acquired knowledge and they develop and alter routines (Zahra and George, 2002). By combining knowledge, the unit develops new insights and recognizes new opportunities to exploit new know-how. Exploitation is a dynamic capability based on routines that allow the unit to refine, extend, and leverage existing competencies or to create new ones by incorporating new know-how into its operations. The capability constitutes the unit's *realized absorptive capacity* (Zahra and George, 2002). Consistent with this conceptualization, prior MNC studies have operationalized the transfer of new know-how as the extent to which a subsidiary exhibits in their organizational practices know-how sourced from other units, such as know-how regarding technology (information systems, engineering, R&D, and technical aspects of production and products), strategic business practices (e.g., Kostova and Roth, 2002; Schulz, 2003), and innovation capability (e.g., Hansen, 1999).

2.2. Potential absorptive capacity of recipient unit

Units cannot exploit new know-how, however, without first assimilating it (Zahra and George, 2002). Assimilation refers to units' capability to interpret – to analyze, process, and understand – newly acquired know-how (Szulanski, 1996). Research on organizational learning finds that past successes and failures lead individuals within firms to develop cognitive

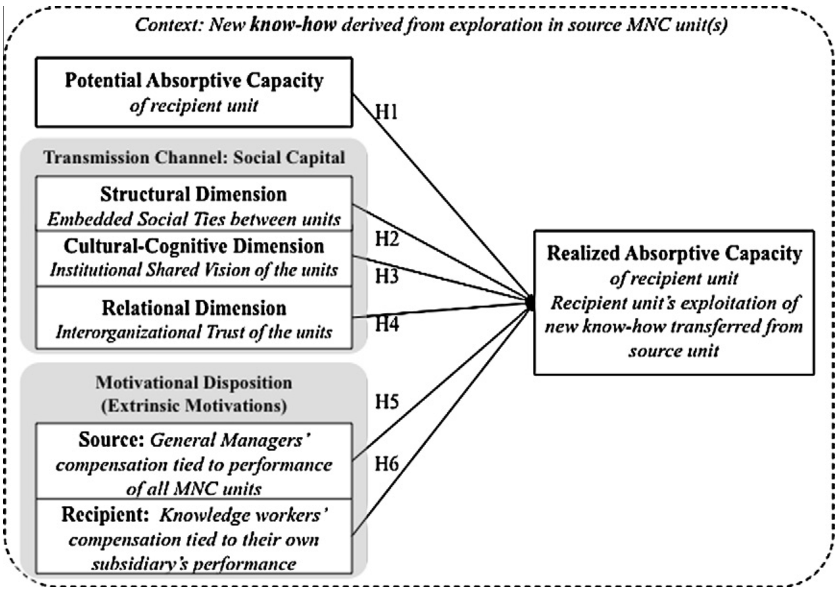

Fig. 1. Research model: factors of stickiness affecting the flow of new know-how between MNC units.

frameworks that affect their interpretation of future events (Lant et al., 1992). In particular, Martins and Kambil (1999) find that prior success leads managers to develop cognitive frameworks that produce a favorable outlook toward future events. The ability of a firm to recognize the value of new external know-how and assimilate it is critical to its innovative capabilities. This capability is labeled as receiving units' *potential absorptive capacity* (Zahra and George, 2002). For example, Adenfelt and Lagerström (2006) reported Chronus' difficulty with absorptive capacity of receiving units constraining the transfer of new know-how related to computer-based hydropower control systems. Within MNCs, Monteiro et al. (2008) and Szulanski et al. (2004) find a strong significant positive relationship between subsidiaries' potential absorptive capacity and subsidiaries' adoption of new know-how from other MNC units (i.e., realized absorptive capacity), while Lee (2005) and Gupta and Govindarajan (2000) find only partial support for the relationship. Based on the preceding literature, we postulate the following hypothesis:

Hypothesis H1. A receiving unit's potential absorptive capacity will be positively related to the receiving unit's exploitation of new know-how (realized absorptive capacity) from source units.

2.3. Transmission channels between units in the form of social capital

2.3.1. Structural dimension of social capital

Informal relationships form the basis of social capital that occurs primarily through boundary spanners between units. Frequent interaction between employees of different units is an important mechanism that enables them to develop social ties (Jansen et al., 2005; Teigland and Wasko, 2009; Zaheer et al., 1998). Through a history of interpersonal interaction that establishes embedded social ties, actors develop social capital characterized by relationship-specific trust, mutual obligations and shared codes and language that enable actors to exchange and combine their knowledge (Nahapiet and Ghoshal, 1998). The role of social relations in organizational knowledge transfers has been discussed in research on organizational networks and organizational communication. At the core of both literatures is a focus on the ease of communication as a result of tie characteristics – such as strength and informality – that increase the ease of communication, especially of tacit knowledge (Schulz, 2003). Through ties embedded in an ongoing social relationship, actors are exposed to diverse sources of knowledge, which encourages them to rethink the systematic nature of existing practices and revisit the structure of those practices (Jansen et al., 2005). As a result, embedded social ties enable actors to combine sets of existing and newly acquired knowledge (Jansen et al., 2005); a dynamic capability that constitutes units' realized absorptive capacity (Zahra and George, 2002). Consistent with the foregoing conceptualization of embedded social ties, prior MNC studies have measured the number of direct interpersonal social ties and the frequency of interpersonal communication between actors in the recipient subsidiary and the source unit (e.g., Ghoshal and Bartlett, 1988; Schulz, 2003; Tsai, 2002). Based on the literature, we postulate the following hypothesis:

Hypothesis H2. Embedded social ties between units, manifested in the frequency of communication between actors in a receiving unit and actors in source unit, will be positively related to the receiving unit's exploitation of new know-how (realized absorptive capacity) from the source unit.

2.3.2. Cultural-cognitive dimension of social capital

Tacit knowledge can be difficult to transfer (i.e., sticky) because the source unit is reluctant to share knowledge for fear of losing ownership, a position of privilege, or superiority; can resent not being adequately rewarded for sharing their knowledge; or can be unwilling to devote time and resources to support the transfer (Szulanski, 1996). A shared institutional vision helps to mitigate this stickiness as follows. Subsidiaries develop a shared vision comprised of common goals and a set of shared values through global (institutional) strategies and policies mandated by MNC headquarters (Riusala and Smale, 2007). The existence of common goals enhances other units' responsiveness to a recipient subsidiary's needs and helps to create an environment conducive to the transfer of new know-how to that subsidiary (Nohria and Ghoshal, 1994). Gupta and Govindarajan (2002) assert the importance of a set of shared values for unit-to-unit transfer of new know-how and relate VeriFone units' notable ability to acquire new know-how from various global units, for example, to VeriFone's success in instilling a widely shared set of values. They propose that a set of deeply ingrained and widely shared values implicitly requires subsidiaries to make sense of their local context from the perspective of the MNC's institutional strategy. Accordingly, shared values provide a common mindset on which to build a constructive rather than unproductive, conflict-ridden dialog among units that have diverse local contexts and knowledge bases. Consistent with the foregoing predictions, scholars find that social contexts characterized by common goals and shared values (i.e., shared vision) are positively associated with subsidiaries' institutionalization of new know-how emanating from other units (e.g., Kostova and Roth, 2002); that is, the capability to exploit new know-how that underlies organizations' realized absorptive capacity (Zahra and George, 2002). Based on the literature, we postulate the following hypothesis:

Hypothesis H3. The extent to which a receiving unit shares institutional vision with source unit will be positively related to the receiving unit's exploitation of new know-how (realized absorptive capacity) from the source unit.

2.3.3. Relational dimension of social capital

Whereas knowledge transfer can be sticky because the source is not perceived as reliable (Szulanski, 1996), interorganizational trust of the source can help to mitigate this stickiness. Interorganizational trust describes the extent to which organizational actors have a collectively held trust orientation toward another organization (Zaheer et al., 1998). A trusting orientation engenders a sense of obligation and reciprocity between the units that manifests in norms of cooperation rather than opportunism as follows. Initially, boundary spanners can convey to the other actors at their unit their experiences in working with, as well as their personal attitudes toward, other units. Through such processes of social information processing (Salancik and Pfeffer, 1978), unit employees will come to form perceptions about and attitudes toward other MNC units, even in the absence of direct personal contact. Organizational actors tend to perceive new know-how emanating from a trusted unit as more credible than knowledge emanating from other sources (Almeida et al., 2002) and are more likely to exploit new know-how emanating from that unit by transforming existing practices (Szulanski et al., 2004). Exploitation is the dynamic capability underlying the unit's realized absorptive capacity (Zahra and George, 2002). Consistent with the foregoing conceptualization of interorganizational trust, prior MNC studies have measured the extent to which actors in the recipient subsidiary perceive that the source unit is trustworthy, avoids opportunistic behavior and meets obligations to the recipient subsidiary (e.g., Barner-Rasmussen et al., 2002; Kostova and Roth, 2002). Based on the literature, we postulate the following hypothesis:

Hypothesis H4. The level of interorganizational trust between a receiving unit and a source unit will be positively related to the receiving unit's exploitation of new know-how (realized absorptive capacity) from the source unit.

2.4. Motivational disposition

Rivalry among actors and the ''Not-Invented-Here'' syndrome impede the transfer of know-how between units. When actors encounter their colleagues, they often perceive them as rivals and experience threat (Tesser, 1988), mental anguish and envy (Salovey, 1991). Their relationship to a rival determines whether they construe that knowledge as tainted (i.e., using it threatens their personal identity and status) or as tempting (i.e., using it enhances their sense of competence and status) (Menon et al., 2006). The tainted knowledge can play a dysfunctional role in transfer of new know-how among the actors situated in different units because of the in-group and out-group effect. When actors categorize some in-group members as unlikable ''black sheep'' (Marques et al., 1998) and others as falling short of the in-group prototype (White and Langer, 1999), they resent them because they blur category boundaries and reduce optimal distinctiveness from out-groups (Brewer, 1991). Furthermore, power struggles within organizations can lead some managers to try to undermine the potential power of peer units by pretending that the knowledge stock possessed by these peer units is not unique and valuable (Gupta and Govindarajan, 2000). Power struggles can also lead to reluctance on the part of source units to share crucial knowledge for fear of losing ownership, a position of privilege or superiority, and fear of not being adequately rewarded for sharing hard-won success can lead to resentment and unwillingness to devote time and resources to support the transfer (Szulanski, 1996). Such sentiments can act as a major barrier to the transfer of new know-how into a receiving unit *in situ*. These forces can be mitigated through coordination mechanisms. As discussed earlier, control and coordination mechanisms in MNCs can be roughly divided into formal and informal mechanisms (Martinez and Jarillo, 1989).

Social capital can be used as an effective *informal* mechanism to coordinate flow of know-how in the network of MNC units. The foregoing three dimensions of social capital provide fertile ground for the creation of *intrinsic* motivation in support of knowledge flow among the units (Osterloh and Frey, 2000; Teigland and Wasko, 2009). Intrinsic motivation is fostered by commitment to the work itself: ''there is no apparent reward except the activity itself'' (Deci, 1975, p. 23). Interactions that lead to personal relationships can promote actors' intrinsic motivational dispositions to cooperate with each other as psychological contracts based on emotional loyalties are established (Osterloh and Frey, 2000). In turn, actors that have established interpersonal loyalties can convey to the other employees at their unit their personal attitudes toward other units. Through such processes of social information processing (Salancik and Pfeffer, 1978), unit employees will come to form an intrinsic motivational disposition toward cooperating with other MNC units. This intrinsic element of motivational disposition is manifested in commitment to the collective (i.e., MNC) that serves to increase actors' sense of mutual goodwill, which provides a positive foundation for unit-to-unit transfer of know-how (Salancik and Pfeffer, 1978; Teigland and Wasko, 2009). A high level of commitment to the MNC is likely to promote behaviors that help attain organizational goals in a cooperative, coordinated fashion. Therefore, commitment of both source unit and receiving unit to the MNC, a manifestation of social capital that reflects an intrinsic motivational disposition to cooperate with other units, can be expected to facilitate the transfer of know-how between MNC units (Dhanaraj et al., 2004; Teigland and Wasko, 2009).

The *formal* mechanism of linking actors' monetary motives to the goals of the organization engenders *extrinsic* motivation of the actors to cooperate in support of knowledge flows among MNC units (Osterloh and Frey, 2000; Tosi and Gomez-Mejia, 1989). Monetary compensation is a formal coordination and control mechanism aimed at aligning the interests and goals of the subsidiaries with those of the parent company in the MNC (Gomez-Mejia and Wiseman, 1997; Minbaeva, 2008; O'Donnell, 1999, 2000). Subsidiary top management compensation structure is potentially a key motivational mechanism that provides incentives to overcome both hoarding tendencies and the ''Not-Invented-Here'' syndrome and thus for subsidiaries to participate actively in all aspects of knowledge sharing (Fey and Furu, 2008). Considering that goals differ between subsidiaries, control and coordination can be facilitated by implementing a compensation system for subsidiary managers that rewards their contributions toward achieving headquarters' goals (Fey and Furu, 2008). Two compensation strategies have been advanced in support of (i) outflows and (ii) inflows of new know-how. Fey and Furu (2008) contend that tying the compensation of the general manager of the source unit to MNC performance goals is expected to motivate them to participate actively in sharing subsidiary know-how with other units (i.e., outflows), as it will lead to better MNC performance and increase the manager's performance-based bonus. Furthermore, the subsidiary general manager has incentives to encourage employees working at the subsidiary to share knowledge with employees of other subsidiaries so that the MNC will perform better and increase the manager's performance-based bonus. Along the same line, Gupta and Govindarajan (2000) contend that "the greater the need to motivate a unit general manager to focus on system-wide optimization as distinct from local optimization, the better it is to link the incentives to the performance of a cluster of units" (p. 478). Whereas Gupta and Govindarajan (2000) found no significant effect, Fey and Furu (2008) found that tying the unit general manager's compensation to the performance of the entire MNC has a significant positive effect on knowledge transfer by source units to receiving units. Based on the preceding literature, we postulate the following hypothesis:

Hypothesis H5. The proportion of the source unit general manager's compensation that is based on the performance of the entire MNC is positively related to the receiving unit's exploitation of new know-how (realized absorptive capacity) from the source unit.

Extrinsic motivation in the form of monetary compensation has also been recommended as a means of formal control and coordination to motivate subsidiaries to *acquire* new know-how from peer MNC units (i.e., inflows). Gupta and Govindarajan (2000) contend that tying the compensation of subsidiary general manager to his/her own subsidiary's performance would create a stronger disposition to acquire know-how from other peer units to enhance the performance of the managers' subsidiary. Nonetheless, they found compensation of subsidiary's general managers to have no significant effect on the inflow of know-how to their units. However, Minbaeva (2008) found a positive effect on the inflow of know-how when the compensation was extended to *all the employees* of the receiving unit. Considering that the boundary spanners can be any of the unit's knowledge workers sanctioned to acquire new know-how from peer units, it is best to apply compensation as an extrinsic motivation for all the knowledge workers rather than only for the general manager of the subsidiary. Based on the preceding literature, we postulate the following hypothesis:

Hypothesis H6. The proportion of the receiving unit knowledge workers' compensation that is based on the performance of their subsidiary is positively related to the receiving unit's subsidiary's exploitation of new know-how (realized absorptive capacity) from other MNC units.

2.5. Summary

The research model of factors of stickiness affecting unit-to-unit transfer of new know-how in MNCs, depicted in Fig. 1, synthesizes the preceding six hypotheses. Notwithstanding the theoretical predictions in the extant literature regarding individual hypotheses, transfer of new know-how between MNC units has not previously been assessed as a complete model as depicted in Fig. 1. Nonetheless, the quantitative methods of meta-analytic structural equation modeling enable us to test new theoretical models based on data reported in prior studies (Cheung and Chan, 2005; Viswesvaran and Ones, 1995) in order to contribute deeper insights to the field. As elaborated next, we subjected the research model, depicted in Fig. 1, to statistical analysis based on data from 31 studies and 10,432 cases of unit-to-unit transfer of know-how.

3. Methodology

Prior research shows that meta-analysis is not only a useful tool for review and synthesis of research (e.g., Hwang, 1996; Lee et al., 2003; Montazemi and Wang, 1989), but also an effective instrument for testing new theory (e.g., Hom et al., 1992; Joseph et al., 2007; Sharma and Yetton, 2003; Viswesvaran and Ones, 1995; Wu and Lederer, 2009a). Because correlation matrices can be computed through meta-analytic techniques, the structural equation modeling (SEM) approach to validating a set of hypotheses in a structural model can be applied to secondary data cumulated from existing studies (Viswesvaran and Ones, 1995). This technique has been called meta-analytic SEM or "MASEM".

3.1. Rationale for using two-stage MASEM technique to test new theory

Application of meta-analysis to estimate pooled correlations across studies, then employing a two-stage process with tests of a measurement model in the first stage and a structural model in the second stage, has several advantages over a primary study for two reasons as follows:

1. Meta-analytical correction for statistical artifacts, such as unreliability, improves parameter estimates during SEM estimation (Hom et al., 1992; Hunter and Schmidt, 2004).

2. Accumulation of multiple samples through meta-analysis increases the sample size and bolsters a model test's statistical power relative to that of single-sample studies (Hom et al., 1992). MASEM can therefore detect valid parameters during SEM estimation that studies with modest sample sizes fail to detect (Hom et al., 1992). By cumulating studies before model estimation, taking into account uneven sample sizes, meta-analysis can generate more robust model estimates and avoid illusory statistical artifacts arising from model tests on relatively small samples (Hom et al., 1992).

Our objective in this research is to validate the six hypotheses comprising our research model depicted in Fig. 1. Based on the rationale for using two-stage versus traditional MASEM technique (elaborated in Appendix A), we proceeded to apply recent two-stage MASEM technique (e.g., Cheung and Chan, 2005) in the following steps:

1. Developing hypotheses in the form of a structural model (Fig. 1).
2. Literature search and criteria for inclusion: Identifying studies to be included in the data set for analysis.
3. Coding of data from primary studies.
4. Evaluation of measurement model.
5. Evaluation of the research model (Fig. 1).

3.2. Literature search and criteria for inclusion

To identify studies that could potentially supply data with which to validate our research model, we searched electronic databases (e.g., Informs, AIS, ACM, ScienceDirect, InterScience, Factiva, Gale Cengage, Palgrave Macmillan, Extenza, Metapress, Highwire Press, Sage, Emerald) and database aggregators (e.g., EBSCOhost, JSTOR, Scholar's Portal). Search terms included several variations on "knowledge transfer" (i.e., "knowledge flow", "transfer of know-how", "transfer of best practices", "technology transfer") and "multinational corporations" (i.e., "MNC", "multinational enterprise", "MNE", "subsidiaries"). Bibliographies of identified studies were also scanned to locate additional studies. Because it is widely accepted that journals are more likely to publish studies with significant effect sizes, we considered conference proceedings, working papers and dissertations in order to minimize the potential of biasing our data (Rosenthal and DiMatteo, 2001; Wu and Lederer, 2009a). To that end, we searched Google, digital theses libraries (e.g., Center for Research Libraries dissertations, EThOS, NDLTD, ProQuest, WorldCat) and posted requests to various listservs (e.g., AOM's OCIS and IDT, AIS ISWorld/ACM SIGMIS). The search initially yielded more than 600 studies broadly examining knowledge transfer in MNCs. The studies were then examined for inclusion in our data sample.

Not all the studies retrieved are appropriate for inclusion in a meta-analysis. Recognizing this, Rosenthal (1995) recommends that researchers assess information quality in the primary studies by establishing criteria for inclusion. To that end, we established six inclusion criteria. Specifically, we included only studies in which (1) the context was the intracorporate form of MNCs, (2) knowledge transfers were clearly inflows to subsidiaries from peer or parent MNC units, (3) the knowledge being transferred was new know-how, (4) the analysis was quantitative and provided sample sizes, reliabilities, and correlations, or sufficient data to compute these measures using formulas presented in Appendix B, (5) measurements exhibited an average reliability (Cronbach's alpha) of at least 0.70 (Nunnally, 1978) and (6) measurement instruments for a given construct were consistent with the operationalizations described in our hypothesis development. With respect to criteria #6, we mapped constructs in prior studies to our operationalized constructs *based on the instrument measure used in the primary study rather than the author's label* in order to code only measures that were consistent with our operational definition (He and King, 2008) and avoid violation of the SEM assumption of measurement invariance (Cheung and Chan, 2005). Application of the six foregoing inclusion criteria substantially reduced the pool of potential studies. For example, the majority of studies applied qualitative methodologies that provided no data for meta-analysis.

3.3. Coding of data from primary studies

In order to facilitate MASEM analysis, we followed the data-coding procedure specified by Cheung (2009). Accordingly, we coded a 5×5 matrix of bivariate correlations (among the five constructs in our model that had sufficient data) for each study based on the bivariate correlations supplied by each study. Zeros were coded for any missing pairings in the respective study and the missing data were identified for each matrix so that the zeroes would not affect pooled correlations. Sample sizes and measurement reliabilities were also coded for each study. There were insufficient data to include *extrinsic motivations of source units* and *extrinsic motivations of recipient units* in the bivariate correlation matrices. Therefore, these factors were dropped from further analysis. Next, we followed the two-stage process for meta-analytic SEM (Cheung, 2009; Cheung and Chan, 2005, 2009): in stage one we evaluated the measurement model and in stage two we tested the structural model as follows.

3.4. Evaluation of measurement model (stage one analysis)

Notwithstanding the advantages of using meta-analytic technique for testing new theory (as previously discussed), the potential exists that the pooling of data from multiple primary studies could introduce artifacts into SEM parameter estimates. Drawing on Hunter and Schmidt (2004), prior studies have identified artifacts that potentially affect meta-analytic tests of new theory: (1) non-independence of data sets, (2) coding errors, (3) measurement error, (4) missing studies, (5) type II error, and (6) second-order sampling error arising from between-study measurement variance (Cheung and Chan, 2005; Wu and Lederer, 2009a). As elaborated next, we evaluated and corrected for the artifacts in order to be confident that the final parameter estimates are a result of the relationships hypothesized in our structural model rather than artifacts.

3.4.1. Ensuring independence of data sets

Non-independence of data sets would violate an important assumption in meta-analytic computations (Wu and Lederer, 2009a). Therefore, we applied the following criteria to ensure the independence of data sets. We included only one data set if two or more studies used the same sample (e.g., Schulz, 2003 was included and not Schulz, 2001). Conversely, Dhanaraj et al. (2004) and Tsai (2001) each present data sets from two separate samples and were retained as separate data sets as per Wu and Lederer (2009a). Similarly, when a study presented one set of correlations for inflows from the parent unit and another set for inflows from peer subsidiaries, the two data sets were retained in our meta-analytic computations. This approach is considered appropriate and does not violate the independence assumption (Hunter et al., 1982; Wu and Lederer, 2009a).

As a result of applying the preceding criteria, our sample included 31 data sets (k) comprised of 10,432 cases (n) for analysis. Each study contributing data is denoted in the reference section.

3.4.2. Assessing and correcting coding error

As recommended by Rosenthal (1995) and Wu and Lederer (2009a) we employed an inter-rater reliability test in order to assess (i) the selection and independence of primary study samples, (ii) the mapping of construct operationalizations (i.e., measurement) in each primary study to the operationalization in our study, and (iii) the coding of data from primary studies. To that end, two of the authors independently coded data from each primary study and evaluated the data according to the preceding criteria. For example, each rater independently mapped constructs from prior studies to our operationalized constructs and coded correlations, reliabilities and sample sizes from each primary study. We then assessed inter-rater reliability. Average agreement was 92% and the inter-rater reliability measure, Kappa, was acceptable at 0.77 (Landis and Koch, 1977). Disagreements were resolved by discussion with a third author, and we proceeded only when we obtained unanimous agreement with respect to the coding.

As per Hunter and Schmidt (2004), we also assessed the coded data for outliers that could indicate inconsistent operationalizations (i.e., measurement artifacts). We further reviewed the operationalization of outliers and retained only operationalizations that the researchers unanimously accepted as consistent with the other studies. The procedures used to identify outliers and the final mappings are elaborated in Appendix C section C.2.

3.4.3. Correcting for measurement error

We next corrected primary studies' reported effect sizes for measurement error, as recommended by Hunter and Schmidt (2004), to remove bias from parameter estimates. We used the standard formula presented in Appendix C section C.3. We subsequently coded the corrected effect size matrices in a single file, used TSSEM software (Cheung, 2009) to prepare the data for processing in LISREL (Cheung, 2009), and used LISREL 8.70 (Jöreskog and Sörbon, 2005) to compute the pooled correlation matrix. We report the pooled correlation matrix in Table 1 along with mean measurement reliabilities on the diagonal. Mean measurement reliabilities for realized absorptive capacity ($\alpha = 0.86$), potential absorptive capacity ($\alpha = 0.91$), interorganizational trust ($\alpha = 0.87$), institutional shared vision ($\alpha = 0.77$) and embedded social ties ($\alpha = 0.90$) are all above 0.70 as recommended by Nunnally (1978).

3.4.4. Assessing potential missing-study artifacts

The potential exists for a "file drawer problem" in which studies that find non-significant effects for our hypothesized relationships are not published or identified (Hunter and Schmidt, 2004; Rosenthal, 1995). As reported in Appendix C section C.4, we calculated the "fail-safe" K; that is, number of missing studies with non-significant results (null findings) that would need to exist for the correlations for our respective hypotheses to be rendered non-significant. The high fail-safe Ks for our study (reported in Appendix C) provide confidence in the robustness of our meta-analysis with respect to possible missing studies.

Table 1
Meta-analytic pooled correlation matrix for SEM.

Variables		1	2	3	4	5
1	Realized absorptive capacity	**0.86**				
2	Potential absorptive capacity	0.27	**0.91**			
3	Interorganizational trust	0.28	0.26	**0.87**		
4	Institutional shared vision	0.34	0.22	0.09	**0.77**	
5	Embedded social ties	0.35	0.20	0.04	0.28	**0.90**

Notes: n = 10,432; bold values on the diagonal are mean measurement reliabilities (Cronbach's alpha).

3.4.5. Assessing Type II error

An important component of statistical test is the notion of statistical power, defined as the probability that the results of a statistical test will not lead to acceptance of the null hypothesis when it is truly false (i.e., Type II error) (Baroudi and Orlikowski, 1989; Kline, 2005). To assess the risk of Type II error, we identified the power of pooled correlations for each of our hypotheses based on respective pooled sample sizes (Cohen, 1988; Wu and Lederer, 2009a). A power level of 0.80 is widely accepted as the minimum required power for statistical tests (Baroudi and Orlikowski, 1989; Cohen, 1988). Because the results of our power analyses (reported in Appendix C section C.5) exceed 0.80, we were confident that our data set has sufficient power to reject rather than accept null hypotheses that are truly false.

3.4.6. Assessing and correcting for second-order sampling error

Cheung and Chan (2005) caution that ignoring variances across studies (i.e., heterogeneity) is problematic for MASEM analysis. Traditionally in MASEM-based studies, researchers used SEM to compute parameter estimates based on the pooled correlations, thus treating the underlying measures as observed variables with no measurement variability. However, the assumption of no measurement variability should be tested because variances between correlations reported in primary studies introduce second-order sampling error into researchers' pooled correlations. Furthermore, unless homogeneity is substantiated, using the pooled correlations "as is" could violate the SEM assumption of measurement invariability.

Rigorous precautions were taken to address the foregoing concerns. We first assessed the level of between-study homogeneity (i.e., study-level measurement invariance) present in our data set. Whereas between-study variance (i.e., heterogeneity) among effect sizes supplied by primary studies is to be expected in meta-analyses, Cheung and Chan (2005) recommend that we (i) confirm that the effect sizes supplied by primary studies demonstrate adequate fit to their respective pooled correlation (i.e., homogeneity), and (ii) treat any heterogeneity that does exist as a form of second-order measurement error to be corrected during the structural modeling test in stage two. First, we followed Cheung's (2009) test of homogeneity for meta-analyses: we prepared the primary data using TSSEM software (Cheung, 2009), which enabled us to model the relationships between effect sizes provided by primary studies and their respective pooled correlations in order to evaluate fit of the measurement model (i.e., homogeneity) using LISREL 8.70 (Jöreskog and Sörbon, 2005). Fit indices of the RMSEA (root mean square error of approximation) 0.10 or less are recommended and CFI (comparative fit index) of 0.80–0.89 indicate adequate fit (Meyers et al., 2006). The LISREL results for the *test of measurement homogeneity* (RMSEA = 0.10 and CFI = 0.86 for measurement model) demonstrate adequate measurement homogeneity (i.e., invariability) for the purposes of meta-analysis. Second, we retained the asymptotic covariance matrix ("ACM") outputs from LISREL. The ACM captures any second-order sampling error that exists in our pooled correlation matrix based on the variance (i.e., heterogeneity) and covariance between measures reported in primary studies (Cheung and Chan, 2005). The ACM enables us to correct for second-order sampling error by weighting pooled correlations during evaluation of the structural model.

Having mitigated the potential of artifacts to affect our meta-analytic computations, we were confident that it is our hypotheses – not artifacts – that explain the parameter estimates computed for our structural model as follows.

3.5. Evaluation of structural model (stage two analysis)

The second stage of analysis refers to the parameter estimation stage of structural equation modeling (SEM). SEM computes fit statistics (e.g., RMSEA) with which to evaluate the goodness of fit of a structural model. The objective of evaluating the goodness of fit is to reject a misspecified model and retain an acceptably specified model for interpretation (Hu and Bentler, 1998). To that end, we first confirmed that our sample size (n) provides sufficient power to substantiate the goodness-of-fit statistics computed by SEM. Based on the 6 degrees of freedom (df) in our model, our sample size (n) of 10,432 exceeds the minimum sample size (n) of 1238 required to accurately compute a statistic indicating good fit (e.g., RMSEA $\leqslant$ 0.08), and exceeds the minimum sample size (n) of 1069 required to accurately compute a statistic indicating poor fit (e.g., RMSEA > 0.10) (MacCallum et al., 1996, Table 4). Therefore, we proceeded to compute the goodness-of-fit statistics and the structural parameters (i.e., the hypotheses) of our research model using LISREL 8.70 (Jöreskog and Sörbon, 2005) as follows.

Whereas the SEM method commonly used in primary studies evaluates structural parameters of the research model based on a covariance matrix derived from primary data, in MASEM the matrix consists of the pooled correlations derived from meta-analytic calculations in stage one (Viswesvaran and Ones, 1995). In addition to the matrix of pooled correlations, we use a weighting matrix (i.e., ACM) to correct for second-order sampling error inherent in pooled correlations, and differences in sample sizes for each pair in the matrix because, in practical reality, not all primary studies measured all variables simultaneously (cf. Viswesvaran and Ones, 1995). Specifically, we used TSSEM software (Cheung, 2009) to multiply each pair in the ACM by the total sample size of the studies that contributed correlations to each respective pair. This process is recommended by Cheung and Chan (2005) to enable SEM to weight pairs in the pooled correlation matrix to correct for their second-order sampling error (i.e., captured in the ACM) and the relative sample size of each pooled correlation. By assigning a weight to each correlation, the researchers give each data point its proper amount of impact on the final parameter estimates (Wu and Lederer, 2009a).

Finally, to test the hypotheses of our structural model, we estimated structural parameters and model fit statistics using LISREL 8.70 (Jöreskog and Sörbon, 2005). We implemented generally weighted least squares (GWLS[1]) estimation in LISREL in

[1] Also called asymptotically distribution-free (ADF) estimation (Cheung, 2009).

order to evaluate the model based on a correlation matrix and a weighting matrix (Cheung, 2009; Cheung and Chan, 2005). Since chi-square statistic is sensitive to the large sample size, as is the case in our study (n = 10,432), as recommended, we evaluated three complementary fit indices: the absolute fit index RMSEA, the relative fit index CFI, and the parsimonious fit index AGFI (adjusted goodness of fit index) (Meyers et al., 2006). Values of the RMSEA 0.080 or less, CFI of at least 0.90, and AGFI of at least 0.90 indicate very good model fit (Kline, 2005; Meyers et al., 2006). However, as reported by Cheung and Chan (2009, p. 46), when researchers use GWLS (i.e., ADF estimation) estimation in LISREL in the second stage of TSSEM, the resulted goodness-of-fit indices are not usually as good as the results of ordinary SEM analysis with maximum likelihood as the estimation method, which is simply due to using GWLS as the estimation method and does not necessarily mean that the proposed model is wrong.

4. Results

The results of LISREL SEM analysis using the GWLS estimation method are presented in Fig. 2. Based on the literature, stage one LISREL analysis demonstrates adequate fit between measures supplied by primary studies and their respective pooled correlations (i.e., fit indices or "homogeneity" of the *measurement model*: RMSEA = 0.10 and CFI = 0.86) and our proposed research model (i.e., structural model) exhibits good fit to the data reported in primary studies (i.e., fit indices for the *structural model*: RMSEA = 0.064; CFI = 0.87; AGFI = 0.99). Path coefficients (i.e., estimated beta values) and significances are presented for each path in Fig. 2, along with the squared multiple correlation for the dependant variable (i.e., interpreted as R^2, cf. Kelloway, 1998).

The results of our analyses show that, as hypothesized, recipient units' potential absorptive capacity has a significant positive effect on their realized absorptive capacity (H1, $\hat{\beta} = 0.23$, $p < 0.05$). Therefore, a recipient subsidiaries' dynamic capability to exploit new know-how emanating from a source MNC unit by transforming practices (i.e., realized absorptive capacity) is a function of the knowledge that the subsidiary has acquired in the past that is related to the new know-how (i.e., potential absorptive capacity). As hypothesized, the results show significant positive effects on recipient units' realized absorptive capacity from the structural dimension (H2, $\hat{\beta} = 0.31$, $p < 0.05$), cultural-cognitive dimension (H3, $\hat{\beta} = 0.31$, $p < 0.05$), and relational dimension (H4, $\hat{\beta} = 0.25$, $p < 0.05$) of social capital as the transmission channel for flows of know-how from source unit. Due to the lack of data, we were unable to test the effect of motivational disposition (extrinsic motivations) of source and recipient units on recipient unit's exploitation of new know-how transferred from source unit (i.e., H5 and H6 not tested). Together, the hypothesized relationships validated in our research model explain 30% of recipient subsidiaries' capability to mitigate stickiness, which enables them to exploit new know-how emanating from other MNC units. As elaborated next, the research model (depicted in Fig. 1), which was validated through SEM analysis (Fig. 2), provides a theoretical lens that sheds new light on how to mitigate stickiness in unit-to-unit transfer of know-how.

5. Discussion and implications

Our contention in this paper is that all three factors of stickiness, depicted in Fig. 1, should be managed in concert to enhance the flow of new know-how between MNC units. Further, the richness of transmission channels should encompass not

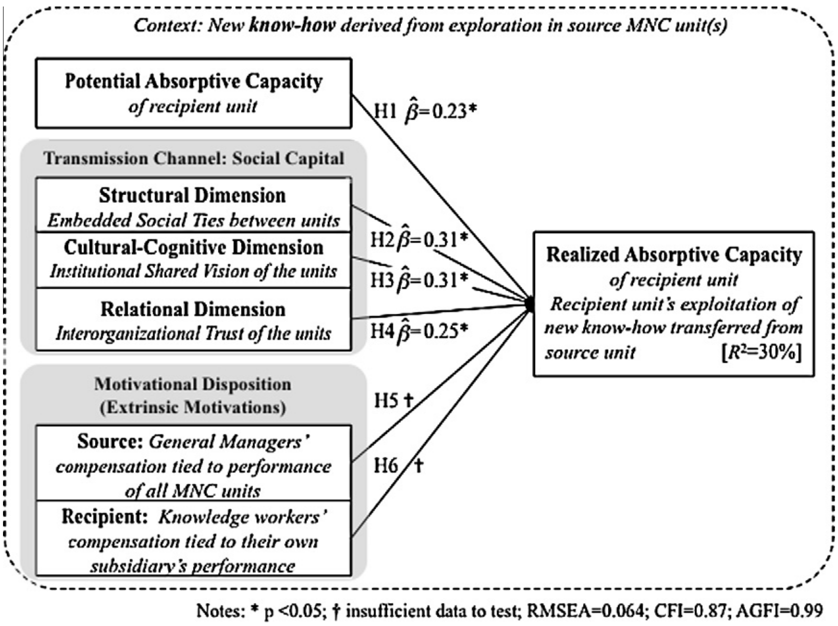

Fig. 2. Results of SEM analysis.

only the structural dimension of relationships among the actors in different MNC units, as conceptualized by Gupta and Govindarajan (2000), but also two complementary dimensions, the cultural-cognitive and relational trust dimensions, which we find are instrumental in enabling transformation and innovation of business practices in other units; that is, the transfer of new know-how. Whatever the strategic impetus, the firm typically innovates with IT through a multi-stage change process (Kirsch, 2004; Swanson and Ramiller, 2004). As described by Swanson and Ramiller (2004), the firm first engages in comprehension of a particular innovation (i.e., new know-how) through an organizing vision that comes to its attention (e.g., *institutional shared vision*). It notes, through *embedded social ties* of its boundary spanners, which other firms (units) have already adopted this innovation. If mindful (i.e., has *motivational disposition* to seek/accept/share new knowledge), the firm seeks to grasp the innovation's meaning in its specific local context (source unit) taking into account *interorganizational trust*. Should the vision be judged compelling, the firm next considers the innovation's adoption, tailoring its business case to these same circumstances. The firm also considers its readiness for the undertaking (i.e., *potential absorptive capacity*). Should the case be successfully made and the time judged to be right, the firm then undertakes implementation, carrying out a project to acquire and deploy the new technology, do the necessary training, and initiate operation and use. Finally, the firm must allow for assimilation of the new IT into its everyday work, a learning process that involves appropriation of the technology by its users, and combines informal experimentation with routinization (i.e., *realized absorptive capacity*). Only with this learning and assimilation is the firm likely over time to achieve new capabilities and benefits that justify the innovation's adoption (Swanson and Ramiller (2004)). In fact, as users discover new uses for the technology, reinventing it locally, these new capabilities can differ from those originally envisioned. These new capabilities (know-how) can then be transferred to other firms.

In the process of transferring new know-how, MNCs are confronted with paradoxical challenges of exploiting existing resources and exploring new ones (He and Wong, 2004). Earlier studies often regarded the trade-offs between these two activities as insurmountable, but more recent research describes *ambidextrous* organizations that are capable of simultaneously exploiting existing competencies and exploring new opportunities (He and Wong, 2004; Raisch et al., 2009). For example, structural differentiation, or the subdivision of organizational tasks into different units (Hall, 1977; Lawrence and Lorsch, 1967), can help ambidextrous organizations to maintain multiple competencies that address paradoxical demands (Gilbert, 2005). It protects ongoing operations in exploitative units from interfering with emerging competences being developed in exploratory units. Hence, it ensures that exploratory units are able to enjoy the required freedom and flexibility to develop new know-how and skills. However, to exploit the new know-how and skills, the receiving units must learn about it through the boundary spanners, have the requisite absorptive capacity to operationalize it within their own organizational context, and trust the source of knowledge being transferred. In addition, institutional vision in sharing knowledge between units is instrumental in the transfer of new know-how. For example, the challenges that the SAP Competency Center in China (i.e., IT CoE) experienced in transferring locally developed innovations to other units, as reported by Sia et al. (2010), could be related to factors identified in our model that would render knowledge transfer difficult or "sticky". The proposed model advanced in Fig. 2 suggests that the control and coordination of subsidiary information system (IS) operations where the subsidiary has sufficient access to the necessary IS resources (hence, low dependence on the parent) must be achieved through "softer" informal mechanisms, rather than the more heavy-handed formal mechanism of control (Rao et al., 2007). Specifically, transfer of new know-how from one unit (e.g., CoEs) to another requires: (1) interorganizational trust developed between exploitive units and CoEs, (2) institutional shared vision, (3) embedded social ties between the boundary spanners in the units with expertise at CoEs, and (4) absorptive capacity of the receiving unit. In support of this assertion, the case study of an IT CoE at Bell Atlantic (Clark et al., 1997) provides a rich description of the factors in Fig. 2 as they pertain to the design of CoEs that yield measurable gains in IS performance. However, Bell Atlantic was a single-national firm that faced different challenges than MNCs face in regard to information system development (Akmanligil and Palvia, 2004; Mohdzain and Ward, 2007). Considering the significance of CoE in support of information system development (Clark et al., 1997), future research can shed light on the significance of our research model (depicted in Fig. 1) in transferring new know-how from IT CoEs to other units in pursuit of ambidexterity.

Ambidextrous organizations strive to achieve agility. To this end, agility encompasses the exploration and exploitation of opportunities for market arbitrage, referring to "the ability to detect opportunities for innovation and seize…opportunities by assembling requisite assets, knowledge and relationships" (Sambamurthy et al., 2003, p. 9). We submit that our model of factors of stickiness in transfers of know-how (depicted in Fig. 1) could be instrumental in achieving agile ISD. Partial support for this conjecture can be gleaned from an exploratory case study reported by Hovorka and Larsen (2006), which investigated the interactions between social network structure, social information processing, organizational homophily, and absorptive capacity of the actors during the adoption of a large-scale IT system in two network organization environments within New York State. Their findings suggest that network organization characteristics and communication processes that reinforced social influence and supported knowledge transfer, positively influenced IS adoption agility. Future research should also assess the significance of our model on ISD agility within the context of MNCs. Such a research undertaking is much needed because of the increasing importance of decentralized global ISD as organizations seek to deliver high-quality software to global users and customers at lower development costs.

Global boundaries and barriers hinder the efficiency and effectiveness of traditional task processes employed in software projects, which can negatively affect project outcomes, making it more difficult to succeed in globally distributed projects than in co-located projects (Lee et al., 2006). Conventional agile software development values people over processes/tools, working software over comprehensive documentation, stakeholder collaboration over contract negotiation, and responding to change over following a plan (Cockburn, 2001). Furthermore, in agile software development, tacit knowledge is more important than explicit knowledge and informal communication is more useful than traditional formal communication (Nerur et al., 2005). However, based on a study of 22 globally distributed software projects, Lee et al. (2006) contend "detailed, comprehensive documentation as well as codified, explicit knowledge are critical in global contexts because communication is problematic and tacit knowledge is difficult to share. In addition, in globally distributed software development environments, formal communication is also important because informal communication is often less effective due to cultural differences, language barriers, and organizational boundaries" (Lee et al., 2006, p. 40). These findings imply that global management of software development is facing challenges in transferring new know-how among dispersed teams (units). Thus, instead of coordinating "soft" dimensions of social capital to transfer new know-how among the units, MNCs have opted to bypass transfer of know-how to deal only with explicit knowledge. Future research can assess this conjecture in light of our model of factors of stickiness in transfers of new know-how in support of software development within the context of management of IS functions.

The management of IS function is a complex task, particularly in the case of MNCs where installations dispersed across distance, time, and cultures can lead to diverse and incompatible systems spread among foreign subsidiaries (Rao et al., 2007; Williams and Wheeler, 2009). The need to globally control and coordinate the IS management function is often met with resistance from local IS managers, who can perceive corporate standards as intrusive. This is in line with the findings of the Mohdzain and Ward (2007) and Williams and Wheeler (2009) assessments of IS strategic planning as practiced by MNCs. They found that MNC's main focus was to control cost and achieve scale economies. As a result, IS planning became more tactical than strategic and was dominated by IT infrastructure planning. Project implementation was the main criterion used to measure IS planning success. Furthermore, Rao et al. (2007) found that under conditions where subsidiary IS management has only limited local access to resources needed to provide adequate technological infrastructure, it will depend on the parent company for the required resources. This resource dependency, along with the strategic role of the subsidiary, will significantly determine the nature of the *strategic relationship* between parent and subsidiary units in a given MNC. They further contend that:

> "While the use of informal mechanisms is significantly associated with IS resource availability, formal mechanisms are not. This may mean that the control and coordination of subsidiary IS operations where the subsidiary has sufficient access to the necessary IS resources (hence, low dependence on the parent) must be achieved through "softer" informal mechanisms, rather than the more heavy-handed formal mechanism of control. ... In situations where there is high mutual dependence between the headquarters and subsidiary with little power imbalance (due to subsidiaries' operating in resource-rich environments), there is significant scope for the two actors to negotiate. Excessive demands from one party (headquarters) in the shape of formal controls are likely to be less successful than "softer" informal mechanisms. Thus, while RDT may apply for formal mechanisms of control and coordination, it may not appropriately explain the use of informal mechanisms. (Rao et al., 2007, p. 24).

Let us assess these findings through the lens of our research model. On the one hand, when subsidiary's absorptive capacity is insufficient to understand and use pertinent information systems, formal control mechanisms are used to force compliance that can result in resistance to change. After all, implementation of highly structured systems (seemingly explicit knowledge) such as Enterprise Resource Planning creates resistance to change of the pre-existing business processes to which subsidiary actors have become accustomed. In this case, lack of trust and shared vision can further hamper implementation of IS in the subsidiary. On the other hand, MNC units would benefit from receiving new know-how from subsidiaries that have access to rich local IS resources. Consequently, informal relationships (i.e., embedded social ties), interorganizational trust, institutional shared vision, extrinsic motivations to seek/accept and share new knowledge, and absorptive capacity can be instrumental in coordination and control of new know-how transfers between units in support of management of the IS function. This conjecture is also in need of further investigation. After all, ambidextrous organizations that strive to achieve agility need to take advantage of their know-how efficiently. The model advanced in this study could be instrumental towards achieving this endeavor.

6. Concluding remarks

This study brings conceptual clarity to motivational factors and statistically tests the effect of two factors on stickiness in transfer of new know-how between units of MNCs. The results are compelling: the factors of receiving units' absorptive capacity and transmission channel in form of social capital that is enacted through its three dimensions (i.e., embedded social ties between units, institutional shared vision of units, and interorganizational trust of units) significantly affect stickiness in unit-to-unit transfer of new know-how. As a case in point, the tainted knowledge discussed earlier in this paper can increase stickiness in transfer of new know-how among the actors situated in different units because of the in-group and out-group effect. Furthermore, Menon et al. (2006) contend that:

> "People in groups and organizations have the incentive to reinvent the wheel over and over again, rather than learn from one another. They have personal motivations to engage in costly pursuits of knowledge from outsiders, such as competitors or consultants, when that knowledge was available internally." (p. 1142).

We can advance two reasons for such behaviors based on our findings: lack of social capital and lack of potential absorptive capacity of the learner. Therefore, it could be that engaging outsiders such as consultants can increase learners' stock of relevant knowledge. For example, Adenfelt and Lagerström (2006) reported that units' managers acting as boundary spanners formed teams that enabled them to develop embedded socials ties to transfer new know-how about computer-based hydropower control system to their subsidiaries. These boundary spanners were also assigned to foster recipients' interorganizational trust to support reception of the pertinent new know-how. Nonetheless, the MNC faced problems in transferring the new know-how because of deficiencies of receiving units' potential absorptive capacity. Thus, all factors of stickiness should be managed in pursuit of taking optimal advantage of valuable new know-how.

The foregoing insight is important for CIOs that are being asked to support both the exploitation of existing knowledge and the unit-to-unit transfer of new know-how derived in units from exploration. To this end, Cash et al. (2008) have proposed formation of two agencies in support of an IT agenda: a distributed innovation group, and an enterprise integration group. A distributed innovation group combines a company's own innovation efforts with the best of external technology to create new business variations. The enterprise integration group folds yesterday's new variations into the operating model of the enterprise. Thus, IT departments are expected to play a major role in enterprises that are increasingly confronted with paradoxical challenges of exploiting existing resources and exploring new ones, within the context of knowledge management. Knowledge management within this new mandate is more than data warehousing, installing intranets, developing expert systems, or refining organizational routines. There is no doubt that knowledge management systems play an important role in enabling actors to identify expertise residing in the firm and, to some extent, support actors' interaction toward effectuating knowledge transfer (Dennis and Vessey, 2005). However, considering the broader mandate of IT units to oversee company's exploitation of innovations in their operating model, knowledge management must deal with the four factors of stickiness presented in this paper to boost the transfer of know-how among the actors in different units of MNCs.

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Appendix A. Rationale for using two-stage MASEM technique to test a new theory: an elaboration

Meta-analysis and structural equation modeling (SEM) are two popular statistical methods in the social and behavioral sciences. Meta-analysis evaluates the accumulation of knowledge by synthesis and integration of the primary results from a pool of empirical studies, whereas SEM is used to fit hypothetical models on the population estimates. The two statistical methods used to be generally treated as two unrelated areas in the literature. However, based on the abounding contributions of these two methods in social and behavioral sciences, many researchers have stated the benefits of integrating meta-analytic techniques with SEM in testing hypothetical models (e.g., Cheung and Chan, 2005; Shadish, 1996; Viswesvaran and Ones, 1995).

Meta-analytic structural equation modeling (MASEM), as a statistical technique, has been developed based on the integration of meta-analytic techniques with SEM which allows researchers to conduct a more precise, theory-driven, and complex quantitative synthesis of the results of the primary studies in the literature (Joseph et al., 2007; Viswesvaran and Ones, 1995). As one of its major advantages, MASEM can address the problem of missing data (Viswesvaran and Ones, 1995), "the most pervasive problem in large scale meta-analysis" about which the researchers have called for "development of more effective ways to carry out meta-analyses involving missing data" (Hedges, 1992). In addition, MASEM can address the problem with the significant chi-square statistic for evaluating the fit of the models. Since the chi-square statistic is considerably affected by the sample size (N), when the sample size is large, which is usually the case in a meta-analysis, the chi-square will be significant regardless of the true fit of the model which can lead to rejection of the good models (Type II error). Since MASEM incorporates SEM for evaluating structural models, it provides goodness-of-fit indices in addition to the chi-square statistic that are less sensitive to sample size and can thus enhance confidence in the goodness-of-fit of structural models. To that end, MASEM-based studies have traditionally applied meta-analytic techniques on a series of correlation matrices from primary studies to create a pooled correlation matrix. This pooled correlation matrix is then used as the observed covariance matrix in fitting structural models using SEM (e.g., Joseph et al., 2007).

Traditional MASEM techniques can, however, cause three statistical problems when fitting the structural models using the pooled correlation matrix. The first problem is analyzing a correlation matrix in lieu of a covariance matrix. Many researchers have warned about the problems of analyzing the correlation matrix in lieu of the covariance matrix in SEM. Specifically, the chi-square statistics and the standard errors of parameter estimates may be incorrect (Cheung and Chan, 2005; Cudeck, 1989). The second problem arises from ignoring the sampling variation across studies by treating the pooled correlation matrix like an observed covariance matrix without considering the sampling variation across studies. In traditional MASEM technique, the sampling variation is not reflected because the standard errors of the pooled correlations are ignored. Moreover, the covariation among the correlations is ignored despite the fact that the correlations are likely to covary to some extent (Cheung and Chan, 2005). The third problem is in deciding on an appropriate sample size for the model fitting in SEM. Because the pooled correlation matrix in conventional MASEM techniques is usually formed by averaging across different studies based on pair-wise deletion (i.e., is due to missing data), researchers have to decide on an appropriate sample size (N) for the analysis in SEM. Researchers have used a variety of sample sizes such as the arithmetic mean, the harmonic mean, the median, or the total of the primary studies' sample sizes. Each approach is simply ad hoc solutions and is not based on statistical theory (Cheung and Chan, 2005). Because the Type I error of the chi-square test statistics, the statistical power, and the standard errors of parameter estimates all depend on the sample size used for SEM, using different sample sizes can result in different inferences.

With the purpose of addressing aforementioned shortcomings, Cheung and Chan (2005) proposed a new MASEM technique, called Two-stage structural equation modeling (TSSEM). The new MASEM technique employs a two-stage process in analyzing the gathered correlation matrices from primary studies. In the first stage of TSSEM, the multiple-group confirmatory factor analysis (Meyers et al., 2006) approach is employed to test the homogeneity of effect sizes reported in the pool of primary studies. If the homogeneity of the correlation matrices is unacceptable (using the SEM goodness-of-fit indices), then potential moderators should be tested to address the heterogeneity and classify the studies into homogeneous subgroups. Once the homogeneity of the correlation matrices is reached (using the SEM goodness-of-fit indices), then we can proceed with analysis in stage two. In stage one, an asymptotic covariance matrix (ACM) is obtained that captures the variance of the pooled correlations on its diagonal and the covariances among the pooled correlations on its off-diagonal elements. The values in the ACM represent second-order sampling error arising from pooling correlations across multiple studies. The ACM values are used to weight (correct) the pooled correlations in stage two of analysis, structural model estimation.

In stage two of TSSEM, the pooled correlation matrix, the ACM, and the total sample size of all studies (N) are used as the inputs to SEM. Generally weighted least squares (GWLS) estimation (i.e., Asymptotically Distribution-Free (ADF) estimation method[2]) in LISREL is used for fitting the model based on the pooled correlation matrix, total sample size (N), and the weighting matrix (i.e., ACM). A main difference between the TSSEM and the other approaches is that both stage one and stage two analyses are conducted under the general SEM framework using SEM software such as LISREL (Jöreskog and Sörbon, 2005). (For more detailed description of TSSEM, we refer readers to Cheung and Chan, 2005, 2009).

There are two advantages to using TSSEM in comparison with traditional MASEM techniques. First, TSSEM enables LISREL estimation of structural parameters to incorporate and correct for the sampling error and covariance between effect sizes reported in primary studies by weighting the pooled correlation matrix by the ACM. By assigning a weight to each observation, the researchers give each data point its proper amount of impact on the final parameter estimates; that is, less (more) weight will be given to correlations with large (small) amounts of sampling variation (Cheung and Chan, 2005). The weighting is congruent with common meta-analytic techniques in which less (more) weight is given to studies with greater (smaller) sampling variances (Hunter and Schmidt, 2004).

Second, rather than deciding ad hoc what sample size to report to SEM, TSSEM provides the total sample size (N) to LISREL but multiplies each pair in the ACM by the total sample size of the studies that contributed correlations to each respective pair because, in practical reality, not all primary studies measured all effect sizes simultaneously (cf. Viswesvaran and Ones, 1995). This technique, which has been developed on a theoretical basis as substantiated by Cheung and Chan (2005), enables correct inferences from parameter estimates by controlling Type I, Type II, and standard errors of parameter estimates (Cheung and Chan, 2005).

Appendix B. Procedures utilized to convert test statistics into correlations

Based on the guidelines provided by Wu and Lederer (2009b), we have utilized the following procedures in order to derivate correlations from the test statistics, in prior studies:

1. If the shared variance (r^2) is reported, correlation (r) is obtained by calculating the square root of shared variance.
2. If β value, the standardized regression coefficient, is reported and there is only one independent variable for the dependent variable, correlation (r) equals to β.

If β (β_1 and β_2) values are reported and there are only two independent variables (variable 1 and variable 2), the correlation between dependent variable and independent variable 1 (r_{y1}) is obtained by applying the following formula:

$$r_{y1} = \beta_1(1 - r_{12}^2) + r_{y2}r_{12}$$

Similarly, the correlation between dependent variable and independent variable 2 (r_{y2}) is resulted by applying the following formula:

$$r_{y2} = \beta_2(1 - r_{12}^2) + r_{y1}r_{12}$$

1. If non-standardized regression coefficients (b) is reported, β value is obtained through following formula:

$$\beta = b \times \frac{\sigma_x}{\sigma_y}$$

[2] ADF estimation method is an estimation method employed in SEM, which, unlike maximum likelihood (ML) estimation method, is free from any normality assumption about the input data.

where σ is the standard deviation for the variables (x and y) that b denotes their relation.

Then proceed with step 2.

Appendix C. Addressing study artifacts

The potential exists that the pooling of data from multiple primary studies during meta-analysis could introduce artifacts into the data. Drawing on Hunter and Schmidt (2004), prior studies identify artifacts that potentially affect MASEM-based analyses: (1) non-independence of data sets, (2) coding errors, (3) measurement error, (4) missing studies, (5) Type II error, and (6) second-order sampling error arising from between-study measurement variance (Cheung and Chan, 2005; Hunter and Schmidt, 2004; Wu and Lederer, 2009b). The methods and results used to mitigate each potential artefact are elaborated as follows.

C.1. Non-Independence of data sets

Data sets that represent different samples should be retained separately (Hunter et al., 1982; Wu and Lederer, 2009a). If more than one study is based on same data set, they are treated as one study, and only one is included in the analyses.

C.2. Coding errors

The potential for errors introduced by researchers performing meta-analysis, including transcriptional errors during coding of data from primary studies and coding measurements from primary studies with inconsistent operationalizations, should be addressed through an inter-rater reliability test (Rosenthal, 1995; Wu and Lederer, 2009a). To that end, we had two of the researchers independently map and code primary data. Because the labels that authors apply to their constructs in prior studies can vary, we mapped constructs in prior studies to our operationalized constructs *based on the instrument measures used in the primary study*, *rather than the author's label,* in order to code only measures that are completely consistent with our operational definition (He and King, 2008) and avoid violation of the assumption of measurement invariance (Cheung and Chan, 2005). To assess coding error we calculated average agreement and the inter-rater reliability measure, Kappa as per Landis and Koch (1977). Kappa of 0.77 indicates acceptable inter-rater reliability. Disagreements were resolved by discussion with a third researcher, and we proceeded only when we obtained unanimous agreement with respect to the coding. Table C2 shows the definition and the measurement we have taken as our point of reference for each of our constructs and constructs from primary studies that were included because their operationalization was consistent with the reference operationalization.

As per Hunter and Schmidt (2004), we also assessed the coded data for potential univariate and multivariate outliers. Specifically, we checked for univariate outliers by assessing the number of standard deviations above/below the mean for each primary study correlation using Excel. Researchers further reviewed the operationalization of outliers and retained only consistent operationalizations.

C.3. Measurement error

As per Hunter and Schmidt (2004), we correct for reliability of measures in primary studies using the formula $r'_{ij} = r_{ij}/(\alpha_i \times \alpha_j)^{0.5}$, where r'_{ij} is the corrected effect size, r_{ij} is the correlation between variables i and j provided by the study, and α_i and α_j are the reliabilities (Cronbach's alpha) for the measures of variables i and j in the respective study.

C.4. Missing studies (file drawer problem)

For each of our significant hypotheses, we calculated the number of missing studies with non-significant results (null findings) that are needed to render the significant results for our respective hypotheses non-significant at $p \leqslant 0.05$ (file drawer problem). We calculated the requisite number of studies, called the "fail-safe" K, using the formula presented by Hunter and Schmidt (2004). The larger the fail-safe K, the less likely it is that the result is biased by missing studies. The resulting high fail-safe Ks along with the information about the primary studies supplying data for each of our hypotheses are reported in Table C4.

C.5. Type II error

To assess the risk of Type II error, we identified the power of pooled correlations for each of our hypotheses based on respective pooled sample sizes (Cohen, 1988; Wu and Lederer, 2009a,b). A power level of 0.80 is widely accepted as the minimum required power for statistical tests (Baroudi and Orlikowski, 1989; Cohen, 1988). The results of our analysis are reported in Table C5.

Table C2
Constructs' definitions/measurements and mapped constructs from prior studies.

Construct name	Our reference/standard		Mapped construct based on reference/standard	
	Reference studies	Operational definition	Study	Reason for mapping
Realized absorptive capacity	Kostova and Roth (2002), Schulz (2003) and Hansen (1999)	The extent to which the recipient subsidiary has realized (i.e., exhibited in its organizational practices) know-how from other MNC units (i.e., other subsidiaries, parent or "headquarters")	Thuc Anh et al. (2006)	Realization of new know-how about marketing expertise, managerial techniques transferred from parent to subsidiary
			Barner-Rasmussen et al. (2002)	Realization of new operations know-how transferred from source subsidiaries to the recipient subsidiary
			Dhanaraj et al. (2004) (2 data sets)	Realization of new know-how about marketing expertise, managerial techniques transferred from parent to subsidiary
			Ghoshal and Bartlett (1988)	Realization of the new know-how (innovation) transferred from source subsidiaries to the recipient subsidiary
			Gupta and Govindarajan (2000)	Realization of new operations know-how transferred from source subsidiaries to the recipient subsidiary
			Gupta and Govindarajan (2000)	Realization of new operations know-how transferred from headquarters to the recipient subsidiary
			Hansen (1999)	Realization of new software, hardware, and/or technical and market know-how transferred from parent or source subsidiaries to the recipient subsidiary
			Kostova and Roth (2002)	Realization of new operations know-how transferred from headquarters to the recipient subsidiary
			Lee (2005)	Realization of new operations know-how transferred from source subsidiaries to the recipient subsidiary
			Lyles and Salk (1996)	Realization of new know-how about technological expertise, new marketing expertise, product development, managerial techniques, and manufacturing processes transferred from parent to subsidiary
			Minbaeva (2005)	Realization of new operations know-how transferred from source subsidiaries to the recipient subsidiary
			Minbaeva (2007)	Realization of new operations know-how transferred from parent to subsidiary
			Monteiro et al. (2008)	Realization of new operations know-how transferred from parent to subsidiary
			Monteiro et al. (2008)	Realization of new operations know-how transferred from source subsidiaries to the recipient subsidiary
			Myloni et al. (2007)	Realization of new operations know-how transferred from parent to subsidiary
			Pak et al. (2009)	Realization of new know-how about new product development and manufacturing processes transferred from parent to subsidiary
			Park (2011)	Realization of new operations know-how transferred from parent to subsidiary
			Park et al. (2009)	Realization of new managerial know-how transferred from parent to subsidiary
			Sazali et al. (2009)	Realization of new operations know-how transferred from parent to subsidiary
			Schomaker (2006)	Realization of new operations know-how transferred from parent to subsidiary
			Schulz (2003)	Realization of new operations know-how transferred from source subsidiaries to the recipient subsidiary
			Schulz (2003)	Realization of new operations know-how transferred from parent to subsidiary
			Steensma and Lyles (2000)	Realization of new know-how about technological expertise, marketing expertise, product development, managerial techniques, and manufacturing/production processes transferred from parent to subsidiary

			Szulanski et al. (2004)	Realization of new operations know-how transferred from source subsidiaries to the recipient subsidiary
			Tsai (2001) (2 data sets)	Realization of new product development know-how transferred from parent or source subsidiaries to the recipient subsidiary
			Tsai (2002)	Realization of new operations know-how transferred from source subsidiaries to the recipient subsidiary
			Tsang et al. (2004)	Realization of new know-how about technological expertise, marketing expertise, product development, managerial techniques, manufacturing processes, and operations transferred from parent to subsidiary
			Wang et al. (2001)	Realization of new know-how about managerial and technological knowledge transferred from parent to subsidiary
			Yang et al. (2008)	Realization of new operations know-how transferred from parent to subsidiary
Potential absorptive capacity	Gupta and Govindarajan (2000) and Schulz (2003)	*A priori* similarity of recipient subsidiary operations (i.e., overlapping knowledge related to business practices) to the operations of source: parent or subsidiaries	Thuc Anh et al. (2006)	*A priori* similarity of recipient subsidiary's technology, products, industry, customers, and skill base (i.e., overlapping knowledge related to business operations) to that of the parent (source)
			Gupta and Govindarajan (2000)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the parent (source)
			Gupta and Govindarajan (2000)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the source subsidiary
			Lee (2005)	*A priori* similarity of recipient subsidiary's production processes (i.e., overlapping knowledge related to the production process) to the production processes of the source subsidiary
			Minbaeva (2005)	*A priori* similarity of recipient subsidiary's human resource management (HRM) practices (i.e., overlapping HRM knowledge) to the HRM practices of the source subsidiary.
			Minbaeva (2007)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the parent (source)
			Monteiro et al. (2008)	*A priori* similarity of recipient subsidiary's marketing practices (i.e., overlapping knowledge related to marketing) to the marketing practices of the parent (source)
			Monteiro et al. (2008)	*A priori* similarity of recipient subsidiary's marketing practices (i.e., overlapping knowledge related to marketing) to the marketing practices of the source subsidiary
			Myloni et al. (2007)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the parent (source).
			Pak et al. (2009)	*A priori* similarity of recipient subsidiary's knowledge-base (i.e., overlapping knowledge related to business operations) to the knowledge-base of the parent (source)
			Park (2011)	*A priori* similarity of recipient subsidiary's products/services (i.e., overlapping operational knowledge) to the products/services of the parent (source)
			Park et al. (2009)	*A priori* similarity of recipient subsidiary's products/services (i.e., overlapping production/operational knowledge) to the products/services of the parent (source)
			Sazali et al. (2009)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping operational knowledge) to the operations of the parent (source)

(*continued on next page*)

Table C2 (*continued*)

Construct name	Our reference/standard		Mapped construct based on reference/standard	
	Reference studies	Operational definition	Study	Reason for mapping
			Schomaker (2006)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the parent (source): "absorptive capacity" measured in terms of mode of entry (a determinant of the subsidiary's ex-ante familiarity with the corporate-wide knowledge base)
			Schulz (2003)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the parent (source)
			Schulz (2003)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the source subsidiary
			Szulanski et al. (2004)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the source subsidiary
			Tsai (2001) (2 data sets)	*A priori* similarity of recipient subsidiary's R&D operations (i.e., overlapping knowledge related to R&D practices) to the operations of the source: parent or other subsidiary
			Tsai (2002)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge related to business practices) to the operations of the source subsidiary
			Wang et al. (2001)	*A priori* similarity of recipient subsidiary's managerial and technological operations knowledge-base to the knowledge-base of the parent (source)
			Yang et al. (2008)	*A priori* similarity of recipient subsidiary's operations (i.e., overlapping knowledge of business practices) to the operations of the parent (source)
Institutional shared vision	Kostova and Roth (2002) and Nohria and Ghoshal (1994)	Shared social norms, goals and values between the recipient subsidiary and source: parent or subsidiaries	Thuc Anh et al. (2006)	Shared understanding of norms, goals, and values between the recipient subsidiary and the parent (source)
			Barner-Rasmussen et al. (2002)	Shared social norms, goals and values between the recipient subsidiary and source subsidiaries
			Ghoshal and Bartlett (1988)	Shared social norms, goals and values between the recipient subsidiary and source subsidiaries
			Kostova and Roth (2002)	Shared social norms, goals and values between the recipient subsidiary and parent (source)
			Tsang et al. (2004)	Shared understanding of objectives, strategies, and vision between the recipient subsidiary and parent (source)
Inter-organizational trust	Barner-Rasmussen et al. (2002) and Kostova and Roth (2002)	The extent to which the recipient subsidiary has established a trusting orientation toward the source: parent or subsidiaries	Barner-Rasmussen et al. (2002)	The extent to which the recipient subsidiary has established a trusting orientation toward the source subsidiaries
			Dhanaraj et al. (2004) (2 data sets)	The extent to which the recipient subsidiary has established a trusting orientation toward the parent (source)
			Kostova and Roth (2002)	The extent to which the recipient subsidiary has established a trusting orientation toward the parent (source)
			Szulanski et al. (2004)	The extent to which the recipient subsidiary has established a trusting orientation toward the source subsidiaries

Social ties	Ghoshal and Bartlett (1988), Schulz (2003) and Tsai (2002)	Number of direct ties and/or frequency of direct communication/interaction between recipient subsidiary and source: parent or subsidiaries	Barner-Rasmussen et al. (2002)	The number of direct ties and frequency of communication between recipient subsidiary and source subsidiaries
			Ghoshal and Bartlett (1988)	The frequency of direct communication recipient subsidiary and parent (source)
			Hansen (1999)	The number of direct ties between recipient subsidiary and source subsidiaries
			Lyles and Salk (1996)	The frequency of direct communication between parent (source) and recipient subsidiary
			Minbaeva (2005)	The number of direct ties and frequency of communication between recipient subsidiary and source subsidiaries
			Minbaeva (2007)	The number of direct ties and frequency of communication between recipient subsidiary and source subsidiaries
			Monteiro et al. (2008)	The frequency of direct communication between recipient subsidiary and parent (source)
			Monteiro et al. (2008)	The frequency of direct communication between recipient subsidiary and source subsidiaries
			Myloni et al. (2007)	The frequency of direct communication between recipient subsidiary and parent (source)
			Park (2011)	The degree to which the parent (source) establishes direct interaction ties with the recipient subsidiary
			Schomaker (2006)	The frequency of direct communication between recipient subsidiary and parent (source)
			Schulz (2003)	The number of direct ties and frequency of communication between recipient subsidiary and source subsidiaries
			Schulz (2003)	The number of direct ties and frequency of communication between actors in the recipient subsidiary and parent (source)
			Steensma and Lyles (2000)	The degree to which the foreign parent (source) establishes direct interaction ties with the recipient subsidiary
			Szulanski et al. (2004)	The number of direct ties and frequency of communication between recipient subsidiary and source subsidiaries
			Tsai (2001) (2 data sets)	The number of direct ties and frequency of communication between recipient subsidiary and source subsidiaries
			Tsai (2002)	The frequency of direct communication between recipient subsidiary and source subsidiaries

Table C4
Hypotheses support by meta-analysis data.

Hypotheses	Correlation	Sample size (n)	Correlations in prior studies:	
			Positive ($p < 0.05$)	Positive (significance not reported)
H1	Potential absorptive capacity → realized absorptive capacity	298	Barner-Rasmussen et al. (2002)	
		987		Gupta and Govindarajan (2000)
		987		Gupta and Govindarajan (2000)
		81		Lee (2005)
		92		Minbaeva (2005)
		92	Minbaeva (2007)	
		171	Monteiro et al. (2008)	
		171	Monteiro et al. (2008)	
		82		Myloni et al. (2007)
		60		Schomaker (2006)
		570	Schulz (2003)	
		570	Schulz (2003)	
		122		Szulanski et al. (2004)
		48	Tsai (2001)	
		72	Tsai (2001)	
		552	Tsai (2002)	
		105		Yang et al. (2008)
		173	Thuc Anh et al. (2006)	
		100	Pak et al. (2009)	
		128	Park et al. (2009)	
		246	Park (2011)	
		128	Sazali et al. (2009)	
		297	Wang et al. (2001)	
	Total *N* for H1:	6132		Fail-safe *K*: 598
H2	Social ties → realized absorptive capacity	298	Barner-Rasmussen et al. (2002)	
		66	Ghoshal and Bartlett (1988)	
		120		Hansen (1999)
		92		Minbaeva (2005)
		92	Minbaeva (2007)	
		171		Monteiro et al. (2008)
		171		Monteiro et al. (2008)
		82		Myloni et al. (2007)
		60		Schomaker (2006)
		570	Schulz (2003)	
		570	Schulz (2003)	
		122	Szulanski et al. (2004)	
		48		Tsai (2001)
		72	Tsai (2001)	
		552	Tsai (2002)	
		201	Lyles and Salk (1996)	
		246	Park (2011)	
		121	Steensma and Lyles (2000)	
	Total *N* for H2:	3654		Fail-safe *K*: 612

H3	Institutional Shared Vision → Realized Absorptive Capacity	298	Barner-Rasmussen et al. (2002)	
		66	Ghoshal and Bartlett (1988)	
		3565	Kostova and Roth (2002)	
		173	Thuc Anh et al. (2006)	
		89	Tsang et al. (2004)	
	Total *N* for H3:	4191		Fail-safe *K*: 135
H4	Interorganizational trust → realized absorptive capacity	298	Barner-Rasmussen et al. (2002)	
		3565		Kostova and Roth (2002)
		122	Szulanski et al. (2004)	
		63	Dhanaraj et al. (2004)	
		75	Dhanaraj et al. (2004)	
	Total *N* for H4:	4123		Fail-safe *K*: 165

Table C5
Power analysis for the pooled effect sizes.

Hypothesis	Pooled *r*-value	Sample size	Power
H1: Potential absorptive capacity → realized absorptive capacity	0.27	6132	>0.995
H2: Social ties → realized absorptive capacity	0.35	3654	>0.995
H3: Institutional shared vision → realized absorptive capacity	0.34	4191	>0.995
H4: Interorganizational trust → realized absorptive capacity	0.28	4340	>0.995

C.6. Second-order sampling error

Variance (i.e., heterogeneity) among measures reported in primary studies results in second-order sampling error when primary studies are cumulated for meta-analysis (Cheung and Chan, 2005; Hunter and Schmidt, 2004). We mitigated the effect of second-order sampling error by (i) confirming that the effect sizes supplied by primary studies demonstrate adequate fit to their respective pooled correlation (i.e., homogeneity), and (ii) treating any heterogeneity that does exist as a form of second-order measurement error to be corrected during the structural model test in stage two. First, we followed Cheung's (2009) test of homogeneity for meta-analyses: we prepared the primary data using TSSEM software (Cheung, 2009), which enabled us to model the relationships between effect sizes provided by primary studies and their respective pooled correlations in order to evaluate fit of the measurement model (i.e., homogeneity) using LISREL 8.72 (Jöreskog and Sörbon, 2005). Fit indices of the root mean square error of approximation (RMSEA) 0.10 or less are recommended and comparative fit index (CFI) of 0.80–0.89 indicate adequate fit (Meyers et al., 2006). Second, after confirming acceptable between-study homogeneity, we retained the asymptotic covariance matrix ("ACM") outputs from LISREL. The ACM captures any second-order sampling error that exists in our pooled correlation matrix based on the variance (i.e., heterogeneity) among measures reported in primary studies (Cheung and Chan, 2005). The ACM matrix enables us to correct for this between-study variance by weighting pooled correlations during stage two evaluation of the structural model.

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