



# The performance effects of vertical and horizontal subsidiary knowledge outflows in multinational corporations



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## ABSTRACT

Horizontal and vertical subsidiary knowledge outflows in multinational corporations (MNCs) are argued to be central to effective MNC performance. Building on the knowledge-based view of the firm, we develop a conceptual model to investigate the performance consequences, determinants and interaction effects due to coordination and control mechanisms, of horizontal and vertical MNC subsidiary knowledge outflows. The hypotheses are empirically tested with a dataset comprised of survey and archival data from over 200 MNC subsidiaries. Results indicate that explicitness and communication positively influence vertical and horizontal subsidiary knowledge outflows and that national cultural distance, centralization, formalization, and specialized resources moderate these influences. We also find that knowledge outflows to headquarters and to peer subsidiaries enhance an MNC's financial performance (i.e., return on assets). The results provide substantive evidence as to how vertical and horizontal knowledge operate within MNCs.

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## 1. Introduction

Firm competitive advantage is derived from the possession and configuration of appropriate tangible and intangible resources (Barney, 1991; Grant, 1996a, 1996b; Peteraf, 1993). Through the development and leveraging of unique combinations of heterogeneous and imperfectly mobile resources, firms are able to achieve and sustain competitive positions resulting in above normal returns (Ju, Zhou, Gao, & Lu, 2013; Peteraf, 1993). However, outside of natural resource monopolies, research indicates that competitive advantage is founded on heterogeneous intangible resources (Hitt, Bierman, Shimizu, & Kochhar, 2001). In fact, it is argued that knowledge, of all the resources a firm may hold, has the greatest ability to serve as a source of sustainable competitive advantage (Filipescu, Prashantham, Rialp, & Rialp, 2013; Fletcher, Harris, & Richey, 2013; Grant, 1996b; Griffith, Kiessling, & Dabic, 2012; Kogut & Zander, 1993; Roth, Jayachandran, Dakhli, & Colton, 2009).

The knowledge-based view of the firm rests on the idea that firms should be analyzed based on their knowledge resources (Grant, 1996b). Recognizing the importance of knowledge within a multinational corporation (MNC) (Cui, Griffith, & Cavusgil, 2005; Kogut & Zander, 1993; Michailova & Minbaeva, 2012), scholars have begun to map not only the MNC network, but the knowledge flows within these networks (Fletcher et al., 2013; Ghoshal & Bartlett, 1990; Noorderhaven & Harzing, 2009; O'Donnell, 2000), as it is argued that through knowledge flows a firm can leverage knowledge within its network for competitive advantage (Kogut & Zander, 1993). For example, Gupta and Govindarajan (2000) studied knowledge inflows and outflows of MNC subsidiaries, examining issues such as motivations, channels, and absorptive capacity. Similarly, Noorderhaven and Harzing (2009) examined social interaction among managers on intra-MNC knowledge flows. While these investigations into vertical and horizontal intra-MNC knowledge flows have substantively advanced our knowledge, research has yet to examine vertical and horizontal knowledge flow jointly, the mechanisms influencing or moderating these effects (e.g., MNC policies such as formalization, centralization, etc.), or the implications of subsidiary knowledge outflows to the financial performance of an MNC. Given these

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limitations, this work contributes to the literature in two distinct ways.

First, this research extends the current literature by building on the concept of the MNC as a network of multiple centers of knowledge (Kogut & Zander, 1993; Roth et al., 2009) and exploring the performance implications of intra-firm knowledge flows. We conceptualize the MNC as composed of multiple knowledge units, where each subsidiary serves as a key knowledge node capable of acquiring, converting, and transferring knowledge throughout the MNC. A considerable amount of previous studies on knowledge transfer do not distinguish between horizontal and vertical knowledge flows (Michailova & Mustaffa, 2012), treating knowledge as a single composite variable and therefore preventing the comprehension of the nature of and the mechanisms behind the different directions of flows. Our study contends that it is through these horizontal and vertical knowledge flows that MNC performance is enhanced. As such, we extend the literature by investigating the performance effects of subsidiary knowledge outflows (*horizontally* and *vertically*) within the MNC network. By doing so, we are able to isolate the contribution of subsidiary knowledge outflows (both to headquarters and to other subsidiaries) on MNC financial performance (i.e., return on assets). Examining the performance effects of knowledge flows is important as prior research has not jointly explored empirically horizontal and vertical knowledge flows, nor has it explored subsidiary knowledge flow effects on MNC financial performance.

Second, though knowledge can be considered a strategic resource, knowledge in itself cannot create sustainable competitive advantage. Rather, it is the 'effective integration of knowledge' that is the key driver of competitive advantage (De Luca & Atuahene-Gima, 2007). When viewing the MNC as a knowledge network (Kogut & Zander, 1993), the effective integration of knowledge requires the ability to transmit knowledge acquired from different national markets (Lee, Chen, Kim, & Johnson, 2008; Lee, 2010; Roth et al., 2009). Consequently, it becomes critical from both a theoretical and managerial perspective to understand the coordination and control mechanisms that an MNC can put in place to facilitate knowledge flows. To address this issue, this research analyzes the implementation of coordination and control mechanisms (e.g., formalization, centralization) as active elements that an MNC can engage in to influence subsidiary knowledge outflows. As such, this work extends the literature by shedding light on the coordination and control mechanisms of an MNC in facilitating or hindering vertical and horizontal subsidiary knowledge outflows.

We test our hypotheses with a dataset comprised survey and archival data from over 200 Portuguese subsidiaries of MNCs headquartered in North America, Europe, and Japan. We find that explicitness and frequency of communication are important antecedents of subsidiary knowledge outflows; national cultural distance, centralization, formalization, and specialized resources have significant moderator effects within the subsidiary knowledge outflows process; and subsidiary knowledge outflows to the headquarters and to peer subsidiaries enhance an MNC's financial performance (using the objective performance measure of MNC return on assets (ROA)). Implications of the work are discussed.

## 2. Theoretical background

'Knowledge has emerged as the most strategically-significant resource of the firm' (Grant, 1996a, p. 375). The ability to manage knowledge is perceived as the 'single most important strategic challenge of the multinational enterprises' (Becker-Ritterspach, 2006, p. 359). Firms and their business units differ not only in their abilities to create knowledge, but also in their abilities to transfer knowledge (Kogut & Zander, 1993; Martin & Salomon, 2003). Some MNCs are effect at accumulating knowledge, but lack the capacity

to transfer it efficiently. Others MNCs have weak capacities to create knowledge, yet are quite able to understand, articulate, and transfer it (Martin & Salomon, 2003).

The knowledge-based view of the firm conceptualizes the MNC as a knowledge-sharing network whose existence is explained by its ability to transfer, create, and absorb knowledge more efficiently than markets (Foss & Pedersen, 2004; Kogut & Zander, 1993). According to this literature, knowledge and learning are at the root of understanding how competitive advantage is acquired and maintained (Foss & Pedersen, 2004; Grant, 1996b; Kogut & Zander, 1992). However, in spite of the argument that MNCs exist mainly due to their superior ability to transfer knowledge in the intra-corporate context (compared to external markets mechanisms) (Kogut & Zander, 1993), that does not imply that intra-corporate knowledge transfers occur on an effective and efficient basis (Gupta & Govindarajan, 2000). In fact, the main challenge to managing knowledge flows within the MNC is the development of mechanisms that facilitate the efficient creation, development, and sharing of knowledge (Fey & Furu, 2008, p. 1302).

Knowledge flows within MNCs occur within the context of an interorganizational network of differentiated units (Gupta & Govindarajan, 1991, 2000). Intra-organizational knowledge flows allow firms to leverage multiple competencies across geographically dispersed units of the MNC. In this study we focus on the knowledge outflows that the focal subsidiaries send to other subsidiary units within the MNC (i.e., horizontal outflows) as well as to headquarters (i.e., vertical outflows). This perspective is important because as Michailova and Mustaffa (2012) emphasize, subsidiary knowledge outflows have received considerably less research attention than knowledge inflows. Consequently, 'the idea of subsidiaries as sources of knowledge for the entire MNC is still under-researched and less understood' (Michailova & Mustaffa, 2012, p. 389). Subsidiaries have traditionally been treated as passive recipients of knowledge from headquarters (Michailova & Mustaffa, 2012), however past research has revealed that foreign subsidiaries are critical to the international competitiveness of the MNC, taking into consideration their important role as a source of strategic resources (Birkinshaw, 1996; Gupta & Govindarajan, 1991; Roth & Morrison, 1992; Tippmann, Scott, & Mangematin, 2012), as MNC subsidiaries develop unique, differentiated sets of competences and capabilities due to their different local environments (Birkinshaw, Hood, & Jonsson, 1998; Ghoshal & Nohria, 1989). Within the MNCs context, the traditional role of headquarters as leading source of knowledge is changing, due to its increasing role as receivers of knowledge from multiple international subsidiaries (Ambos, Ambos, & Schlegelmilch, 2006). However, the focus of the majority of studies is placed on the traditional knowledge transfer direction (from the headquarters to subsidiaries), and consequently, lateral knowledge transfers (from subsidiary to subsidiary), and particularly as recognized by Ambos et al. (2006) the transfers from the subsidiary to the headquarters (also denominated as reverse knowledge transfer), have been investigated by very few studies. As such, this work specifically answers the call by Michailova and Mustaffa (2012) who recommend that future research should examine outcomes of subsidiary knowledge outflows, both horizontal and vertical.

We develop a conceptual model (Fig. 1), building on the knowledge-based view of the firm and the extant literature on knowledge flows (e.g., Nonaka, 1991; Ambos & Schlegelmilch, 2007). We argue that subsidiary vertical and horizontal knowledge outflows are influenced by the explicitness/tacitness of knowledge (Nonaka, 1991) as well as by the frequency of communication within the MNC (vertical and horizontal) (Monteiro, Arvidsson, & Birkinshaw, 2008), as these factors reflect both the characteristic of knowledge and the channel through which knowledge can flow. While type of knowledge and channel influence vertical and

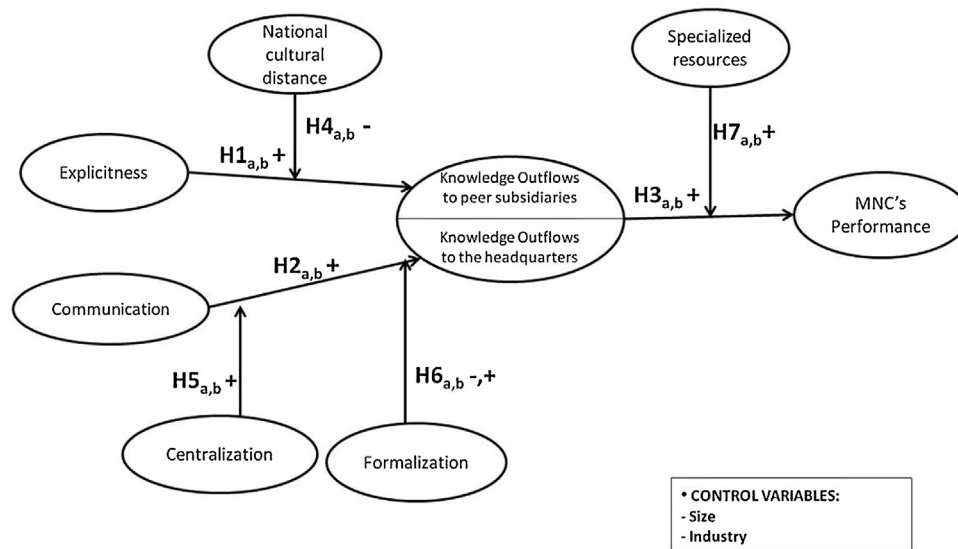


Fig. 1. Determinants, moderator effects, and consequences of subsidiary knowledge outflows: a theoretical framework.

horizontal subsidiary knowledge outflows, we contend that these effects are moderated by the coordination and control aspects of the MNC, such as centralization (Gupta & Govindarajan, 2000), formalization (Ambos and Schlegelmilch, 2007; Bartlett & Ghoshal, 1989; Gupta and Govindarajan, 1991; Nobel & Birkinshaw, 1998) as well as national cultural distance. Research has demonstrated that coordination and control policies enacted by MNCs create a context of efficiency and inefficiency, and therefore we contend that these coordination and control policies, as well as the structure set forth by the MNC, has both leveraging and suppressing effects on the established antecedents of subsidiary knowledge outflows. Furthermore, we conceptualize that vertical and horizontal knowledge outflows not only directly influence MNC performance, but also that their influence is moderated by specialized resources, as resources must be specialized under the knowledge-based view for resource advantage to result (Birkinshaw et al., 1998). In the following section we detail the theoretical arguments linking the constructs within our conceptual model.

### 3. Hypotheses

#### 3.1. Explicitness as an antecedent of subsidiary knowledge outflows

Organizational knowledge is created through a dynamic and continuous process and is conceptualized to range from explicit to tacit (Nonaka, 1991). Explicit knowledge is highly codified and is transmittable in formal and systematic language, while tacit knowledge is considered to be more abstract, deeply rooted in action, commitment, and involvement in a specific context, being harder to formalize, articulate, and transfer (Dhanaraj, Lyles, Steensma, & Tihanyi, 2004; Li, Poppo, & Zhou, 2010; Nonaka & Takeuchi, 1995). Although the role of explicitness (tacitness) in the knowledge transfer process has been explored in contexts such as internal joint ventures (e.g. Dhanaraj et al., 2004) and strategic alliances (e.g. Simonin, 1999), its role within internal knowledge transfers of MNCs still remains vastly unexplored. The need to understand how the characteristics of the knowledge being transferred influence the MNC's internal knowledge transfer process is called for in the MNC knowledge transfer literature (e.g. Fey & Furu, 2008; Gupta & Govindarajan, 2000).

In terms of the ability of a subsidiary to transfer knowledge either horizontally to other subsidiaries or vertically to headquarters, one must examine the ease of knowledge type

transference. Explicit knowledge is entrenched in standardized procedures (Martin & Salomon, 2003; Nelson & Winter, 1982), is codifiable, and as such is easier and quicker to acquire (Kogut & Zander, 1993). In contrast, tacit knowledge is embedded in non-standardized processes and absorbed by closely observing the knower in action or through interactions with the knower (Dhanaraj et al., 2004), thus making it harder to transfer without close geographic proximity (Fey & Furu, 2008). As such, it can be argued that tacitness renders knowledge substantially problematic for transfer to different international locations (Martin & Salomon, 2003), whether it be between subsidiaries (horizontally) or between a subsidiary and its headquarters (vertically). More formally:

**Hypothesis<sub>1a</sub>.** Explicitness of knowledge is positively associated with knowledge outflows from the subsidiary to peer subsidiaries.

**Hypothesis<sub>1b</sub>.** Explicitness of knowledge is positively associated with knowledge outflows from the subsidiary to headquarters.

#### 3.2. Frequency of communication as an antecedent of subsidiary knowledge outflows

While type of knowledge is a determinant of knowledge outflows, knowledge flows cannot take place without the existence of transmission channels (Ghoshal & Bartlett, 1988). Specifically, the density of communications determines knowledge flows (Daft & Lengel, 1986; Gupta & Govindarajan, 1991, 2000). Furthermore, when organizational units are closely connected they are motivated to share ideas (Tsai, 2001) and therefore explore mutual benefits from complementary knowledge (Sparrowe, Liden, Wayne, & Kraimer, 2001).

In the context of MNCs, it is argued that the intensity of corporate-subsidiary and inter-subsidiary communication enhances the transference of knowledge (Ghoshal & Bartlett, 1988; Gupta & Govindarajan, 1994). Frequent communication in an interorganizational context helps to lower barriers for knowledge transfer (Park, 2012). It can be argued that increased frequency of communication in vertical and horizontal MNC relationships can create aid in knowledge flows. This argumentation is consistent with the work of Monteiro et al. (2008) who consider that frequent communications between MNC units increase managers' motivation to learn and increase the perceived

capabilities of the other unit, thus stimulating managers to leverage competencies. More formally:

**Hypothesis<sub>2a</sub>.** The frequency of communication between the subsidiary and peer subsidiaries is positively associated with knowledge outflows from the subsidiary to peer subsidiaries.

**Hypothesis<sub>2b</sub>.** The frequency of communication between the subsidiary and headquarters is positively associated with knowledge outflows from the subsidiary to headquarters.

### 3.3. The impact of subsidiary knowledge outflows on MNC performance

Knowledge is one the most important strategic resources of firms (Grant, 1996b; Kogut & Zander, 1993; Roth et al., 2009). The ability to use and leverage organizational knowledge can be a source of competitive advantage and sustained superior performance (Fey & Furu, 2008; Grant, 1996b; Kogut & Zander, 1992; Roth et al., 2009). The research focusing on measuring knowledge and its value for firm performance is considered to still remain evasive (Kotabe, Dunlap-Hinkler, Parente, & Mishra, 2007). As Monteiro et al. (2008) emphasize, only a few studies in the knowledge transfer literature actually measure performance. Williams (2007) states that although scholars generally assume that knowledge transfer is a key source of competitive advantage, the hypothesized link between knowledge transfer and performance is rarely tested.

Since each unit of the MNC network faces unique market conditions and possesses different knowledge competencies, knowledge transfers between headquarters and its subsidiaries can benefit the MNC as a whole (Luo, 2003). Specifically, taking into consideration the network perspective of the MNC, where multiple centers (i.e., subsidiaries) are able to build their own knowledge-based competencies, we posit that horizontal and vertical subsidiary knowledge outflows enable the MNC to increase its performance. It is argued that as MNC subsidiaries transfer knowledge horizontally, other subsidiaries are able to build their knowledge stores and learn from the peer experiences, thus making the subsidiary more effective, which when aggregated, increases the MNC's performance. Similar argumentation can be applied to vertical knowledge flows. Specifically, as a subsidiary engages in vertical knowledge outflows, the knowledge it shares with its headquarters can help the MNC to develop strategies that are more effective across its global operations, thus enhancing its overall performance. More formally:

**Hypothesis<sub>3a</sub>.** Knowledge outflows from the subsidiary to peer subsidiaries are positively associated with the MNC's performance.

**Hypothesis<sub>3b</sub>.** Knowledge outflows from the subsidiary to headquarters are positively associated with the MNC's performance.

### 3.4. The moderating role of national cultural distance

National cultural distance is conceptualized as the degree of divergence in the norms and values between two cultures (Hofstede, 2001). As national cultural distance increases, the relationship between two parties becomes more asymmetric in terms of information transference and sharing. Researchers have found that national cultural distance may serve as a key obstacle to the process of knowledge sharing. For example, Lyles and Salk (2007) document that conflicts and cultural misunderstandings rooted in cultural differences can minimize flows of information and learning. Mowery, Oxley, and Silverman (1996) report that

cultural differences between partners of international alliances resulted in less of knowledge transfer, Simonin (1999) find that cultural alignment between partners set the boundaries of knowledge flows and Zeng, Shenkar, Lee, and Song (2013) argue that MNCs may learn incorrectly from their early expansions when new to a different culture, because their learning abilities are reduced by cultural differences.

In the context of horizontal and vertical knowledge outflows, we contend that national cultural distance between a subsidiary and its headquarters or between peer subsidiaries makes it more difficult to transfer knowledge. National cultural distance decreases the level of comfort and trust between exchange partners, making it more difficult to work together (Barkema & Vermeulen, 1997; Hansen & Lovas, 2004). Management processes between an MNC's headquarters and subsidiaries are typically complicated by distance, national boundaries and culture (Brock, Barry, & Thomas, 2000), which generates difficult internal relations. Therefore, knowledge sharing is expected to be easier between people sharing similar cultural backgrounds (Makela, Andersson, & Seppala, 2012). National cultural distance may shrink the capacity to interpret and transfer knowledge, by making explicit knowledge "less explicit". These arguments together lead us to theorize that national cultural distance will moderate the positive relationship between explicitness and knowledge outflows (both horizontal and vertical), strengthening the relationship as national cultural distance decreases. More formally:

**Hypothesis<sub>4a</sub>.** The positive effect of explicitness on knowledge outflows from the subsidiary to peer subsidiaries is stronger as national cultural distance decreases.

**Hypothesis<sub>4b</sub>.** The positive effect of explicitness on knowledge outflows from the subsidiary to headquarters is stronger as national cultural distance decreases.

### 3.5. The moderating role of centralization

Subsidiaries have privileged access to critical market knowledge. As such, it becomes essential to headquarters to be able to disseminate this knowledge throughout the entire organization (Kogut & Zander, 1993). Consequently, coordination and control mechanisms between headquarters and their subsidiaries become important facilitators of knowledge transfer originating in different national boundaries (Buckley & Casson, 1998). In this context, control has been defined as any process implemented by the organization to guarantee the execution of organizational objectives (Ambos & Schlegelmilch, 2007). Among the different control instruments available to headquarters, centralization can be referred to as the act of confining the decision-making power at headquarters (Ambos & Schlegelmilch, 2007; Bartlett & Ghoshal, 1989; Gupta & Govindarajan, 1991). Through centralization, MNCs have the ability to structurally enhance knowledge flow within the MNC (Gupta & Govindarajan, 2000). Centralization, as a hierarchical coordination mechanism, is a determinant of coercive pressure on the subsidiary created by headquarters, which is able to intensify knowledge transfers through existing subsidiary-headquarters communication channels. It can be further argued that as centralization is employed as an MNC mechanism to enhance subsidiary to headquarters knowledge flows, it may actually hamper subsidiary to subsidiary (i.e., horizontal) knowledge flows (as centralization forces knowledge vertically as opposed to horizontally). Foss and Pedersen (2002) found that subsidiary autonomy (the opposite of centralization) positively stimulates knowledge flows to other subsidiaries. Lower levels of centralization (i.e., giving a subsidiary greater autonomy) allow a subsidiary to be better integrated into diverse knowledge networks, which

facilitates subsidiary engagement in knowledge transfers with other subsidiaries. More formally:

**Hypothesis<sub>5a</sub>.** The positive effect of frequency of communication on knowledge outflows from the subsidiary to peer subsidiaries is weaker when centralization mechanisms are high than when they are low.

**Hypothesis<sub>5b</sub>.** The positive effect of frequency of communication on knowledge outflows from the subsidiary to headquarters is stronger when centralization mechanisms are high than when they are low.

### 3.6. The moderating role of formalization

Formalization, a control mechanism available to headquarters, is conceptualized as the process whereby decision-making power is implemented with strict routines, rules, and procedures (Ambos & Schlegelmilch, 2007; Bartlett & Ghoshal, 1989; Gupta & Govindarajan, 1991). Through formalization, flexibility is minimized throughout the organization, and structure is imposed on the actions of its members. Through formalization an MNC can ensure that specific actions are taken throughout the organization.

Formalization brings greater clarity to the operations of the MNC as a whole, with each subsidiary following the same rules and procedures. Formalization, as an MNC policy, emanates from headquarters. As formalization emanates from headquarters, it is also monitored and enforced by headquarters, therefore leading to compliance by subsidiaries in relation to its vertical communications. As such, we theorize that through the formalization of routines, rules, and procedures throughout the MNC the effectiveness of communication on vertical subsidiary knowledge outflows is enhanced. While formalization positively moderated the effect of communication on vertical knowledge outflows, we argue that formalization suppresses the positive effect of communication on horizontal knowledge outflows. The argumentation underlying this is that peer-to-peer interactions that take place among subsidiaries typically occur in a more informal manner. Placing formalized policies upon subsidiaries in relation to their knowledge activities, suppresses the positive effect of communication on vertical knowledge outflows. More formally:

**Hypothesis<sub>6a</sub>.** The positive effect of frequency of communication on knowledge outflows from the subsidiary to peer subsidiaries is weaker when formalization mechanisms are high than when they are low.

**Hypothesis<sub>6b</sub>.** The positive effect of frequency of communication on knowledge outflows from the subsidiary to headquarters is stronger when formalization mechanisms are high than when they are low.

### 3.7. The moderating role of specialized resources

The knowledge-based view necessitates that resources be specialized to afford a firm a competitive advantage. An MNC that possesses specialized resources can employ such resources as a leveraging mechanism, enabling the MNC to enhance the value of other resources, such as knowledge flows. Consistent with this approach, it is argued that the potential value of a subsidiary's resources is in their specialization, which is conceptualized as resources, competencies, and capabilities that are superior to those available elsewhere (Birkinshaw et al., 1998).

When horizontal or vertical knowledge flows take place in an MNC, the action of a set of facilitator mechanisms is not indifferent

in terms of influencing performance. Specifically, the quality of the resources, competencies and capabilities of the source unit has the potential to magnify the influence exerted on the MNC performance, allowing the firm to more fully utilize its resources (i.e., leverage its knowledge resources through combination with specialized resources). Therefore, we expect that the existence of specialized resources, competencies, and capabilities by the subsidiary, compared to other units in the MNC, should act as a moderator variable to strengthen the influence that knowledge outflows from the subsidiary on the MNC performance, both vertically and horizontally. Thus:

**Hypothesis<sub>7a</sub>.** The positive effect on an MNC's performance of knowledge outflows from the subsidiary to peer subsidiaries is stronger when subsidiary specialized resources are high than when they are low.

**Hypothesis<sub>7b</sub>.** The positive effect on an MNC's performance of knowledge outflows from the subsidiary to headquarters is stronger when subsidiary specialized resources are high than when they are low.

### 3.8. Control variables

To minimize spuriousness of results, other factors that may influence intra-MNC subsidiary knowledge outflows were included. Specifically, we account for subsidiary size, as larger subsidiaries are more likely to have strong capabilities (Noorderhaven & Harzing, 2009) and the MNC's industry (i.e. manufacturing or services), since industries differ in knowledge intensity (Gupta & Govindarajan, 2000).

## 4. Method

### 4.1. Sample and data collection

Data for this study were collected through a combination of an online survey and archival data. The questionnaire was developed after an extensive review of literature on knowledge transfer and on MNC's intra-organizational relationships. The survey was prepared first in English and then translated into Portuguese. It was checked for accuracy after it was back-translated. In the subsequent phase, three academic experts with extensive knowledge of MNCs reviewed the survey. Finally, the questionnaire was pretested to evaluate its clarity in 12 face-to-face interviews with subsidiary presidents.

The sample was drawn in 2010 from the financial database SABI, the Iberian Balance Sheet Analysis System, provided by INFORMA D&B and Bureau Van Dijk. The initial sample consisted of 1,227 multi-industry firms. Following Noorderhaven and Harzing (2009) subsidiaries with fewer than 25 employees were excluded. All firms were contacted by telephone to explain the purpose of the study, identify key informants (subsidiary presidents) and request their participation. We excluded 219 firms from the initial database: 162 were facing insolvency or were in bankruptcy, and 57 did not respond due to company policy, resulting in a sample of 1008 Portuguese subsidiary firms. The final questionnaire was made available online and its link sent by e-mail to the president (also titled as general manager, CEO, and managing director) of the identified Portuguese subsidiaries (headquartered in North America, Europe, and Japan). Two incentives were offered to participate: (1) a summary of the findings and strategic recommendations, (2) an invitation to a workshop about internationalization.

A personalized text accompanying each questionnaire explained the purpose of the study and provided assurances regarding confidentiality. In the first part of the questionnaire the

**Table 1**  
Scale items and reliabilities.

Model – peer subsidiaries	Scale items	Standardized factor loading	t-Value
<b>Knowledge outflows to peer subsidiaries</b> (Cronbach alpha = 0.959, Composite reliability = 0.96, AVE = 0.72) Question: For each of these nine items of knowledge flow data indicate the extent to which the subsidiary engaged in transfers of 'knowledge and skills' in the following direction - Provides knowledge and skills to peer subsidiary: Scale: 1 = 'Not at all'; 7 = 'A very great deal' (The first seven items were adapted from Gupta & Govindarajan, 2000; the last two items were added to the scale in result of the pre-tests interviews with the subsidiaries' presidents).	1. Marketing know-how	0.89	16.23
	2. Distribution know-how	0.92	16.92
	3. Technology	0.89	16.23
	4. Product designs	0.86	15.25
	5. Process designs	0.81	13.75
	6. Purchasing know-how	0.84	14.62
	7. Management systems and practices	0.81	14.00
	8. Customer service know-how	0.79	13.30
	9. R&D	0.84	14.58
<b>Explicitness of the knowledge transferred to peer subsidiaries</b> (Cronbach alpha = 0.936, Composite reliability = 0.94, AVE = 0.83) Question: To what extent is the knowledge that you have sent to peer subsidiary: Scale: 1 = 'Little'; 7 = 'To great extent' (Adapted from Dhanaraj et al., 2004)	1. Written knowledge about the technology.	0.92	16.77
	2. Procedural manuals or technical manuals.	0.88	15.67
	3. Written knowledge about management techniques.	0.94	17.44
<b>Frequency of communication with peer subsidiaries</b> (Cronbach alpha = 0.902, Composite reliability = 0.91, AVE = 0.71) Question: Indicate the frequency of communication between your company and executives from the peer subsidiary for each mode of communication: Scale: 1 = 'Less often than once a year'; 7 = 'Daily' (Adapted from Gupta et al., 1999)	1. Face-to-face	0.75	12.19
	2. Over the telephone or video conference	0.86	15.04
	3. Routine and periodic formal reports	0.88	15.51
	4. Electronic or paper-based letters or memos	0.88	15.50
<b>Centralization</b> (Cronbach alpha = 0.969, Composite reliability = 0.97, AVE = 0.92) Question: Please indicate: Scale: 1 = 'Little' to 7 = 'To great extent' (Adapted from Ambos & Schlegelmilch, 2007)	1. The degree of direct supervision	0.96	18.27
	2. The existence of integrated planning systems	0.99	19.73
	3. The utilization of reporting systems	0.92	17.20
	4. The degree of local autonomy <sup>a</sup>	0.92	17.20
<b>Formalization</b> (Cronbach alpha = 0.932, Composite reliability = 0.94, AVE = 0.88) Question: Please indicate: Scale: 1 = 'Little' to 7 = 'To great extent' (Adapted from Ambos & Schlegelmilch, 2007)	1. The emphasis placed on standardized processes and procedures	0.87	25.37
	2. The degree to which formalized rules and policies were enforced	1	
<b>Specialized resources</b> (Cronbach alpha = 0.896, Composite reliability = 0.90, AVE = 0.60) Question: How do you classify the competencies and capabilities of your subsidiary compared to the other peer subsidiaries: Scale: 1 = 'Very much lower'; 7 = 'Very much higher' (Adapted from Birkinshaw et al., 1998; Fey & Furu, 2008)	1. R&D	0.79	13.02
	2. Manufacturing	0.86	14.71
	3. Marketing and sales	0.76	12.39
	4. Management of international activities	0.72	11.38
	5. Entrepreneurship activities	0.83	14.05
	6. Service provider	0.65	9.97
<b>National cultural distance</b> was measured through Kogut and Singh's (1988) index which is based on Hofstede's (1980) dimensions of national culture. Algebraically: $CD_j = \sum_{i=1}^4 \{(I_{ij} - I_{ip})^2 / V_i\} / 4$ where $CD_j$ stands for the cultural distance between the $j_{th}$ country (the peer subsidiary country) and the subsidiary home country (Portugal), $I_{ij}$ is the index of the $i_{th}$ cultural dimension (e.g., individualism, power distance, masculinity–femininity, and uncertainty avoidance) and $j_{th}$ country, $I_{ip}$ is the cultural dimension index for the subsidiary's home country (p), and $V_i$ is the variance of the index in the $i_{th}$ dimension.		N.A.	N.A.
<b>Multinational corporation objective performance</b> was measured by the indicator Return on Assets (ROA). These data were collected at the Datastream financial database, Thomson Reuters, referring to the year of 2010, the same year when the subjective measures were collected.		N.A.	N.A.
Model–headquarters	Scale items	Standardized factor loading	t-Value
<b>Knowledge outflows to the headquarters</b> (Cronbach alpha = 0.936, Composite reliability = 0.93, AVE = 0.61) Question: For each of these nine items of knowledge flow data indicate the extent to which the subsidiary engaged in transfers of 'knowledge and skills' in the following direction - Provides knowledge and skills to the headquarters: Scale: 1 = 'Not at all'; 7 = 'A very great deal' (The first seven items were adapted from Gupta & Govindarajan, 2000; the last two items were added to the scale in result of the pre-tests interviews with the subsidiaries' presidents).	1. Marketing know-how	0.80	13.35
	2. Distribution know-how	0.79	13.18
	3. Technology	0.79	13.23
	4. Product designs	0.77	12.69
	5. Process designs	0.75	12.09
	6. Purchasing know-how	0.77	12.63
	7. Management systems and practices	0.78	12.97
	8. Customer service know-how	0.78	13.05
	9. R&D	0.79	13.19
<b>Explicitness of the knowledge transferred to the headquarters</b> (Cronbach alpha = 0.911, Composite reliability = 0.91, AVE = 0.77) Question: To what extent is the knowledge that you have sent to your headquarters: Scale: 1 = 'Little'; 7 = 'To great extent' (Adapted from Dhanaraj et al., 2004)	1. Written knowledge about the technology	0.90	16.13
	2. Procedural manuals or technical manuals	0.88	15.38
	3. Written knowledge about management techniques	0.86	15.00

Table 1 (Continued)

Model – peer subsidiaries	Scale items	Standardized factor loading	t-Value
<b>Frequency of communication with the headquarters</b> (Cronbach alpha = 0.931, Composite reliability = 0.93, AVE = 0.78)  Question: Indicate the frequency of communication between your company and executives from the headquarters for each mode of communication: Scale: 1 = 'Less often than once a year'; 7 = 'Daily' (Adapted from Gupta et al., 1999) <b>National cultural distance</b> was measured through Kogut and Singh's (1988) index which is based on Hofstede's (1980) dimensions of national culture. Algebraically: $CD_j = \sum_{i=1}^4 \{(I_{ij} - I_{ip})^2 / V_i\} / 4$ where $CD_j$ stands for the cultural distance between the $j_{th}$ country (headquarters country) and the subsidiary home country (Portugal), $I_{ij}$ is the index of the $i_{th}$ cultural dimension (e.g., individualism, power distance, masculinity–femininity, and uncertainty avoidance) and $j_{th}$ country, $I_{ip}$ is the cultural dimension index for the subsidiary's home country ( $p$ ), and $V_i$ is the variance of the index in the $i_{th}$ dimension. <b>Control variables</b> <b>Subsidiary size:</b> Size was measured as the natural log of the number of people working at the subsidiary. Source: SABI <b>Industry:</b> We created dummy variables for industries (manufacturing and services) coded 1 for non-manufacturing MNCs and 0 for the manufacturing ones. Source: SABI	1. Face-to-face	0.76	12.63
	2. Over the telephone or video conference	0.90	16.44
	3. Routine and periodic formal reports	0.95	17.99
	4. Electronic or paper-based letters or memos	0.90	16.43
		N.A.	N.A.
		N.A.	N.A.
		N.A.	N.A.

N.A. = not applicable.

<sup>a</sup> We deleted this item during the scale purification process.

respondent was asked to select a peer subsidiary. To ensure variation in the nature of the relationships selected we followed the methodological approach of Morgan, Kaleka, and Katsikeas (2004) and created two versions of the questionnaire, version A wherein managers responded pertaining to a subsidiary with which they frequently interacted and version B wherein managers responded pertaining to a subsidiary with which they non-frequently interacted. Versions A and B were randomly assigned to each potential respondent.

One month after sending the first e-mail, if the firm had not answered, a follow-up telephone call was made. Most of the firms requested that the e-mail be re-sent. One month after the telephone follow-up, an e-mail follow-up was made. This procedure produced 202 usable questionnaires (an effective response rate of 20 percent). Respondent subsidiaries averaged 138 employees and 43 million USD in annual sales. Key informant quality was assessed by asking informants to indicate, on a seven-point scale, their degree of knowledge about knowledge flows related to the subsidiary (from one = 'very limited knowledge', to seven = 'very substantial knowledge'). The mean for the degree of knowledge was 5.84 (standard deviation = 0.98), indicating that respondents had significant knowledge about subsidiary knowledge flows.

Nonresponse bias was tested by comparing early and late respondents on all key constructs. We found no significant differences between early and late respondents. We also compared responding and non-responding firms with regard to size (number of employees) and industry. No significant differences were found on any of the variables. Thus, nonresponse bias was not considered to be a significant problem.

We checked for common-method bias by first examining the data for the presence of a single common factor (Podsakoff, 2003). The data did not conform to a single factor model. Our performance measure was from an archival data source (i.e., objective data obtained from Datastream financial database, Thomson Reuters), thereby eliminating common method bias in the relationship between knowledge outflows and MNC performance. Finally, we ran Lindell and Whitney's (2001) test, which uses a theoretically unrelated construct (termed a *marker* variable). High correlations among any of the items of the study's principal constructs and the marker variable would indicate common method bias. We conducted the test using the age of the respondents as the marker variable as it was theoretically unrelated to our principal constructs. The average correlation between the study's principal

constructs and the age of the respondent was low and nonsignificant ( $r = .005$ , average  $p$ -value = 0.635), indicating that common method bias was not a concern.

#### 4.2. Measures

Survey measures are presented in Table 1. The measure of knowledge outflows selected in our study, examines different complementary knowledge domains from which MNC units can develop synergies. *Knowledge outflow* data were collected on the following nine items: marketing know-how, distribution know-how, technology, product designs, process designs, purchasing know-how, management systems and practices, customer service know-how, and R&D (adapted from Gupta & Govindarajan, 2000). For each item, the respondent was asked to indicate the extent to which the subsidiary engaged in transfers of knowledge, respectively, with peer subsidiaries and with headquarters. A three-item scale (adapted from Dhanaraj et al., 2004) was used to measure the *explicitness* of the knowledge transferred with the peer subsidiaries and with headquarters, focusing on written knowledge about the technology, procedural manuals or technical manuals, and written knowledge about management techniques. The measure of *frequency of communication* between peer subsidiaries and between the subsidiary and headquarters was adapted from Gupta, Govindarajan, and Malhotra (1999). Respondents were asked to indicate the frequency of communication established with the peer subsidiaries and with headquarters regarding four modes of communication: face-to-face; telephone or video conference; routine and periodic formal reports, and electronic or paper-based letters or memos. *Centralization* was measured through a three-item scale adapted from Ambos and Schlegelmilch (2007), assessing the degree of direct supervision, the existence of integrated planning systems, and the utilization of reporting systems. *Formalization* was measured through a two-item scale adapted from Ambos and Schlegelmilch (2007), measuring the emphasis placed on standardized processes and procedures, and the degree to which formalized rules and policies were enforced. The *specialized resources* measure was adapted from Birkinshaw et al. (1998) and Fey and Furu (2008). Respondents were asked to classify six different competencies and capabilities of his/her subsidiary compared to peer subsidiaries, in respect to R&D, manufacturing, marketing and sales, management of international activities, entrepreneurship activities, and service. *National cultural distance* between the focal subsidiary and the headquarters and

**Table 2**

Correlation matrix and descriptive statistics of measures–model knowledge outflows to peer subsidiaries.

Variables	Mean	Standard deviation	1	2	3	4	5	6	7	8	9	10
1. Knowledge outflows to peer subsidiaries	3.17	1.41	0.85									
2. Explicitness subsidiaries	3.70	1.68	0.66**	0.91								
3. Communication subsidiaries	3.45	1.59	0.79**	0.57**	0.84							
4. MNC's performance	13.05	12.38	0.78**	0.61**	0.69**	N.A.						
5. Centralization	4.72	1.77	0.33**	0.15*	0.08	0.25**	0.96					
6. Formalization	4.59	1.83	0.30**	0.20**	−0.01	0.23**	0.88**	0.94				
7. National cultural distance subsidiaries	1.66	1.60	−0.26**	−0.33**	−0.17*	−0.23**	−0.06	−0.15*	N.A.			
8. Specialized resources	4.98	1.40	0.08	0.07	0.15*	0.10	−0.06	−0.06	−0.14	0.77		
9. Subsidiary size (log)	1.86	0.44	0.02	0.00	0.01	0.06	0.06	0.05	−0.06	0.05	N.A.	
10. Industry	0.71	.046	0.02	0.08	0.02	0.04	−0.09	−0.07	−0.10	−0.04	−0.24**	N.A.

Notes: The diagonal shows the square roots of the AVE; N.A. = not applicable.

\*  $p < 0.05$ .\*\*  $p < 0.01$ .

between peer subsidiaries was measured through [Kogut and Singh \(1988\)](#) index. *MNC objective performance* was measured by Return on Assets (ROA). ROA was collected from the Thomson Reuters Datastream financial database, referring to the year of 2010, the same year when the subjective measures were collected (as it is theorized that subsidiary knowledge outflows during the year enhance that year's MNC performance). [Tables 2 and 3](#) contain the main descriptive statistics and correlations among the variables utilized in the model focused on knowledge outflows to peer subsidiaries and in the model focused on knowledge outflows to headquarters.

To assess convergent and discriminant validity of the measures, items were subjected to a confirmatory factor analysis that was carried out with the maximum likelihood estimation in LISREL 8.8. Following recent literature on intra-MNC's knowledge flows ([Gupta & Govindarajan, 2000](#); [Noorderhaven & Harzing, 2009](#)) we conducted separate model examinations of knowledge outflows (horizontal and vertical). The fit indexes reported indicate that each model fits the data reasonably well (horizontal:  $\chi^2 = 436.1$ ,  $df = 310$ ,  $\chi^2/df = 1.41$ ,  $NFI = 0.97$ ,  $NNFI = 0.99$ ,  $CFI = 0.99$ ,  $IFI = 0.99$ ,  $RMSEA = 0.045$ ; vertical:  $\chi^2 = 482.11$ ,  $df = 302$ ,  $\chi^2/df = 1.60$ ,  $NFI = 0.95$ ,  $CFI = 0.98$ ,  $IFI = 0.98$ ,  $RMSEA = 0.054$ ).

All  $t$ -values for the estimated factor loadings for the constructs are significant, demonstrating convergent validity. The composite reliability for each construct is greater than the recommend 0.7 and the average variance extracted for each construct is above 0.5. Evidence of discriminant validity is seen in the fact that the shared variance among any two constructs (i.e., the square of their intercorrelation) was less than the average variance explained in the items by the construct ([Fornell & Larcker, 1981](#)). We also

checked for possible collinearity problems by examining variance inflation factors, which in each regression model were below five, indicating that multicollinearity was not a concern ([Hair, Anderson, Tatham, & Black, 1995](#)).

## 5. Results

The data were analyzed with structural equation modeling (SEM). We estimated moderated regression equations to test the hypotheses. We mean centered variables before creating the interaction terms ([Aiken & West, 1991](#)). To test our hypotheses we first regressed each of our dependent variables (knowledge outflows to the headquarters and knowledge outflows to peer subsidiaries) on the two control variables (subsidiary size and industry) (models 1 and 4). We then entered the independent variables (explicitness, frequency of communication) and the measure of performance (models 2 and 5). In the last step we included the interaction terms concerning the moderator effects of national cultural distance, centralization, formalization, and specialized resources (models 3 and 6). Following [Noorderhaven and Harzing's \(2009\)](#) and [Gupta and Govindarajan's \(2000\)](#) methodological approach we estimated two separate models (i.e., one for vertical knowledge outflows and one for horizontal knowledge outflows).

### 5.1. Horizontal subsidiary knowledge outflows model

Model 3 shows that the explicitness is positively associated with knowledge outflows from the subsidiary to peer subsidiaries ( $b = 0.19$ ,  $p < 0.01$ ), supporting  $H_{1a}$ . Frequency of communication

**Table 3**

Correlation matrix and descriptive statistics of measures–model knowledge outflows to the headquarters.

Variables	Mean	Standard deviation	1	2	3	4	5	6	7	8	9	10
1. Knowledge outflows to the headquarters	3.24	1.42	0.78									
2. Explicitness headquarters	3.68	1.69	0.67**	0.88								
3. Communication headquarters	3.62	1.68	0.62**	0.69**	0.88							
4. MNC's performance	13.05	12.38	0.68**	0.67**	0.74**	N.A.						
5. Centralization	4.72	1.77	0.16*	0.19**	0.08	0.25**	0.96					
6. Formalization	4.59	1.83	0.16*	0.18**	0.06	0.23**	0.88**	0.94				
7. National cultural distance headquarters	2.12	1.68	−0.42**	−0.47**	−0.44**	−0.47**	−0.28**	−0.27**	N.A.			
8. Specialized resources	4.98	1.40	0.08	0.10	0.12	0.10	−0.06	−0.06	−0.03	0.77		
9. Subsidiary size (log)	1.86	0.44	0.08	−0.03	0.04	0.06	0.06	0.05	0.04	0.05	N.A.	
10. Industry	0.71	0.46	0.09	0.09	0.06	0.04	−0.09	−0.07	−0.02	−0.04	−0.24**	N.A.

Notes: The diagonal shows the square roots of the AVE; N.A. = not applicable.

\*  $p < 0.05$ .\*\*  $p < 0.01$ .

is positively related to knowledge outflows from the subsidiary to peer subsidiaries ( $b = 0.67, p < 0.01$ ), supporting H<sub>2a</sub>. Knowledge outflows from the subsidiary to peer subsidiaries is positively associated with the MNC's performance ( $b = 0.90, p < 0.01$ ), supporting H<sub>3a</sub>.

The interaction term for explicitness and national cultural distance is negatively related to knowledge outflows from the subsidiary to peer subsidiaries ( $b = -0.08, p < 0.05$ ), thus supporting H<sub>4a</sub>. The interaction term for frequency of communication and centralization is positively related to knowledge outflows from the

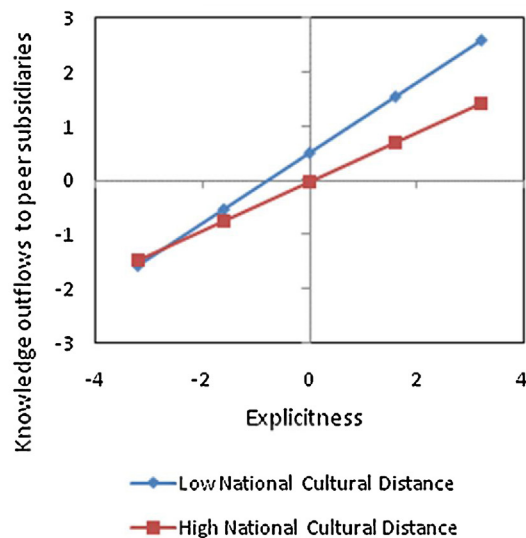
subsidiary to peer subsidiaries ( $b = 0.21, p < 0.01$ ). Thus, H<sub>5a</sub> is not supported. The moderator effect of formalization on the relationship between frequency of communication and knowledge outflows from the subsidiary to peer subsidiaries is as predicted ( $b = -0.23, p < 0.01$ ), thus supporting H<sub>6a</sub>. The interaction term for knowledge outflows and specialized resources is positively related to MNC performance ( $b = 0.09, p < 0.05$ ), thus supporting H<sub>7a</sub>.

To gain further insight into the moderation effects we plotted the interactions and conducted simple slope tests. The simple slope test involved splitting the moderator variable – national cultural

### Interaction effects

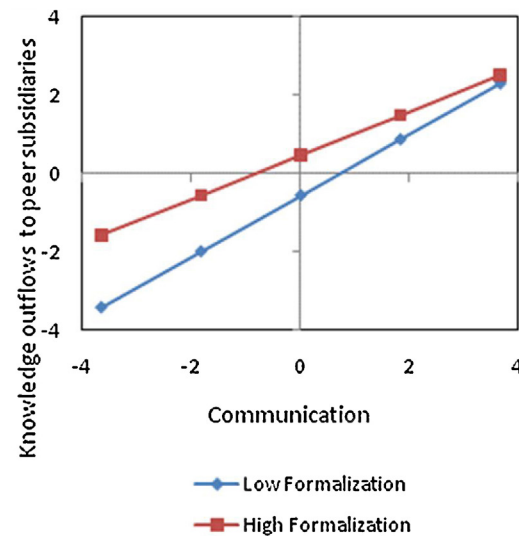
#### A: Moderating effect of national cultural distance

Interaction of national cultural distance and explicitness on knowledge outflows to peer subsidiaries



#### B: Moderating effect of formalization

Interaction of formalization and communication on knowledge outflows to peer subsidiaries



#### C: Moderating Effect of Specialized Resources

Interaction of specialized resources and knowledge outflows on MNC's performance

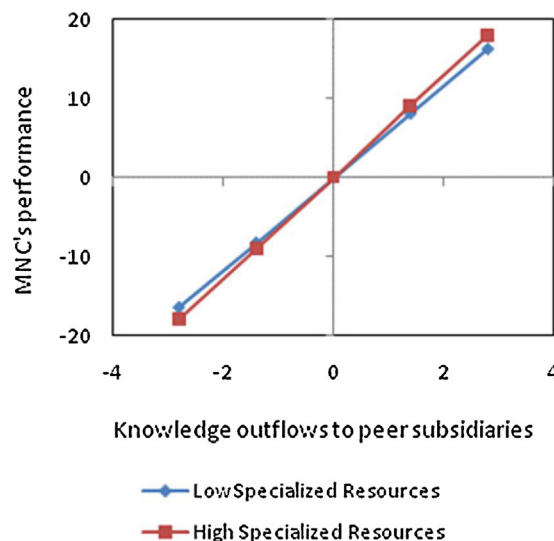


Fig. 2. Interaction effects.

**Table 4**

Horizontal outflows model.

Variables	Hypotheses	Model 1	Model 2	Model 3
<b>Control variables</b>				
Size		0.04 (0.4)	0.02 (0.48)	0.01 (0.33)
Industry		0.04 (0.4)	−0.01 (−.19)	0.00 (0.04)
<b>Independent variables</b>				
Explicitness → Knowledge outflows	H <sub>1a</sub>		0.29 (5.12)**	0.19 (3.65)**
Communication → Knowledge outflows	H <sub>2a</sub>		0.66 (10.06)**	0.67 (10.55)**
Knowledge outflows → Performance	H <sub>3a</sub>		0.90 (20.37)**	0.90 (20.24)**
N. Cultural Distance → Knowledge outflows				−0.07 (−1.94)
Centralization → Knowledge outflows				0.08 (1.16)
Formalization → Knowledge outflows				0.21 (2.94)**
Specialized resources → Performance				0.07 (1.62)
<b>Relevant Interaction effects</b>				
Explicitness x national cultural distance → Knowledge outflows	H <sub>4a</sub>			−0.08 (−2.32)*
Communication x centralization → Knowledge outflows	H <sub>5a</sub>			0.21 (3.74)**
Communication x formalization → Knowledge outflows	H <sub>6a</sub>			−0.23 (−3.96)**
Knowledge outflows x specialized resources → Performance	H <sub>7a</sub>			0.09 (2.11)*

Notes: Final Structural Model (Model 3) Goodness-of-fit statistics:  $\chi^2 = 655.85$ ,  $p < .000$ ,  $\chi^2/df = 1.6$ , NFI = .96, NNFI = .98, CFI = .99, IFI = .99, RMSEA = .041.

We report standardized regression coefficients ( $t$ -values are in parentheses). We used a two-tailed test for all hypotheses.

\*  $p < .05$ .

\*\*  $p < .01$ .

distance – into a high group (two standard deviations greater than the mean) and a low group (two standard deviations less than the mean), and re-estimating the relationship between explicitness and knowledge outflows to peer subsidiaries. The plot in Fig. 2, Panel A, shows that when national cultural distance is low, the positive relationship between explicitness and knowledge outflows is stronger (simple slope:  $b = 0.653$ ,  $t = 4.09$ ,  $p < 0.01$ ) than when it is high (simple slope:  $b = 0.454$ ,  $t = 3.318$ ,  $p < 0.01$ ). Fig. 2, Panel B, shows that when formalization is low, the positive relationship between frequency of communication and knowledge outflows is stronger (simple slope:  $b = 0.785$ ,  $t = 9.742$ ,  $p < 0.01$ ) than when it is high (simple slope:  $b = 0.56$ ,  $t = 6.157$ ,  $p < 0.01$ ). Fig. 2, Panel C, shows that when specialized resources are high, the positive relationship between knowledge outflows and MNC performance is stronger (simple slope:  $b = 6.415$ ,  $t = 7.072$ ,  $p < 0.01$ ) than when they are low (simple slope:  $b = 5.816$ ,  $t = 4.778$ ,  $p < 0.01$ ) (Table 4).

## 5.2. Vertical subsidiary knowledge outflows model

Model 6 shows that explicitness is positively associated with knowledge outflows from the subsidiary to headquarters ( $b = 0.46$ ,  $p < 0.01$ ), supporting H<sub>1b</sub>. Frequency of communication is positively related to knowledge outflows from the subsidiary to headquarters ( $b = 0.34$ ,  $p < 0.01$ ), supporting H<sub>2b</sub>. Knowledge outflows from the subsidiary to headquarters are positively associated with the MNC's performance ( $b = 0.77$ ,  $p < 0.01$ ), supporting H<sub>3b</sub>.

The interaction term for explicitness and national cultural distance is negatively related to knowledge outflows from the subsidiary to headquarters ( $b = -0.11$ ,  $p < 0.01$ ), supporting H<sub>4b</sub>. The interaction term for centralization on the relationship between frequency of communication and knowledge outflows from the subsidiary to headquarters is positive ( $b = 0.17$ ,  $p < 0.05$ ), thus supporting H<sub>5b</sub>. The interaction term for frequency of communication and formalization is positively related to knowledge outflows from the subsidiary to headquarters ( $b = 0.16$ ,  $p < 0.05$ ), supporting H<sub>6b</sub>. The relationship between knowledge outflows from the subsidiary to headquarters and MNC's performance is not moderated by the existence of specialized resources. As such, H<sub>7b</sub> is not supported.

The plot in Fig. 3, Panel A, shows no relationship between explicitness and knowledge outflows to headquarters when national

cultural distance is high (simple slope:  $b = 0.174$ ,  $t = 1.339$ , n.s.) but it shows a positive effect when national cultural distance is low (simple slope:  $b = 0.526$ ,  $t = 5.567$ ,  $p < 0.01$ ). Fig. 3, Panel B, shows a positive relationship between frequency of communication and knowledge outflows to headquarters when centralization is high (simple slope:  $b = 0.873$ ,  $t = 11.261$ ,  $p < 0.01$ ). There is no relationship between the two constructs when centralization is low (simple slope:  $b = -0.259$ ,  $t = -1.438$ , n.s.). Fig. 3, Panel C, shows a positive relationship between communication and knowledge outflows to headquarters when formalization is high (simple slope:  $b = 0.835$ ,  $t = 14.432$ ,  $p < 0.01$ ) but no relationship when it is low (simple slope:  $b = -0.074$ ,  $t = -0.486$ , n.s.). Tables 5 and 6 summarize the hypotheses and empirical conclusions of the study.

## 6. Discussion and managerial relevance

This study investigated the determinants, moderator effects, and consequences of vertical and horizontal subsidiary knowledge outflows within MNCs. The results support our conceptual model and provide new and substantive insights. Most importantly, the results contribute to the literature by demonstrating the influence of subsidiary knowledge flows on an MNC's performance (measured objectively). The results demonstrate that not only do vertical and horizontal subsidiary knowledge outflows enhance MNC performance (i.e., return on assets), but that the size of the effect is considerable (providing evidence of the strategic value of knowledge resources as envisioned under the knowledge-based view). While earlier research on knowledge transfer within MNCs has analyzed the determinants of knowledge flows, the current work is one of the first to demonstrate the performance effects of knowledge flows. As such, this work specifically answers the call by Noorderhaven and Harzing (2009), who indicate that studies of intra-MNC knowledge flows should examine performance effects.

Our results demonstrate that there can be multiple centers of knowledge within an MNC that are able to develop knowledge-based competencies. Specifically, our results demonstrate that knowledge outflows take place vertically and horizontally and that these flows have a very similar intensity. This similar knowledge flows' intensity (comparing knowledge flows established between peer subsidiaries and knowledge flows established between subsidiaries and headquarters) suggests that MNCs are characterized more by an interdependent than by a hierarchical structure (a point of debate within the literature). As such, the results indicate

## Interaction effects

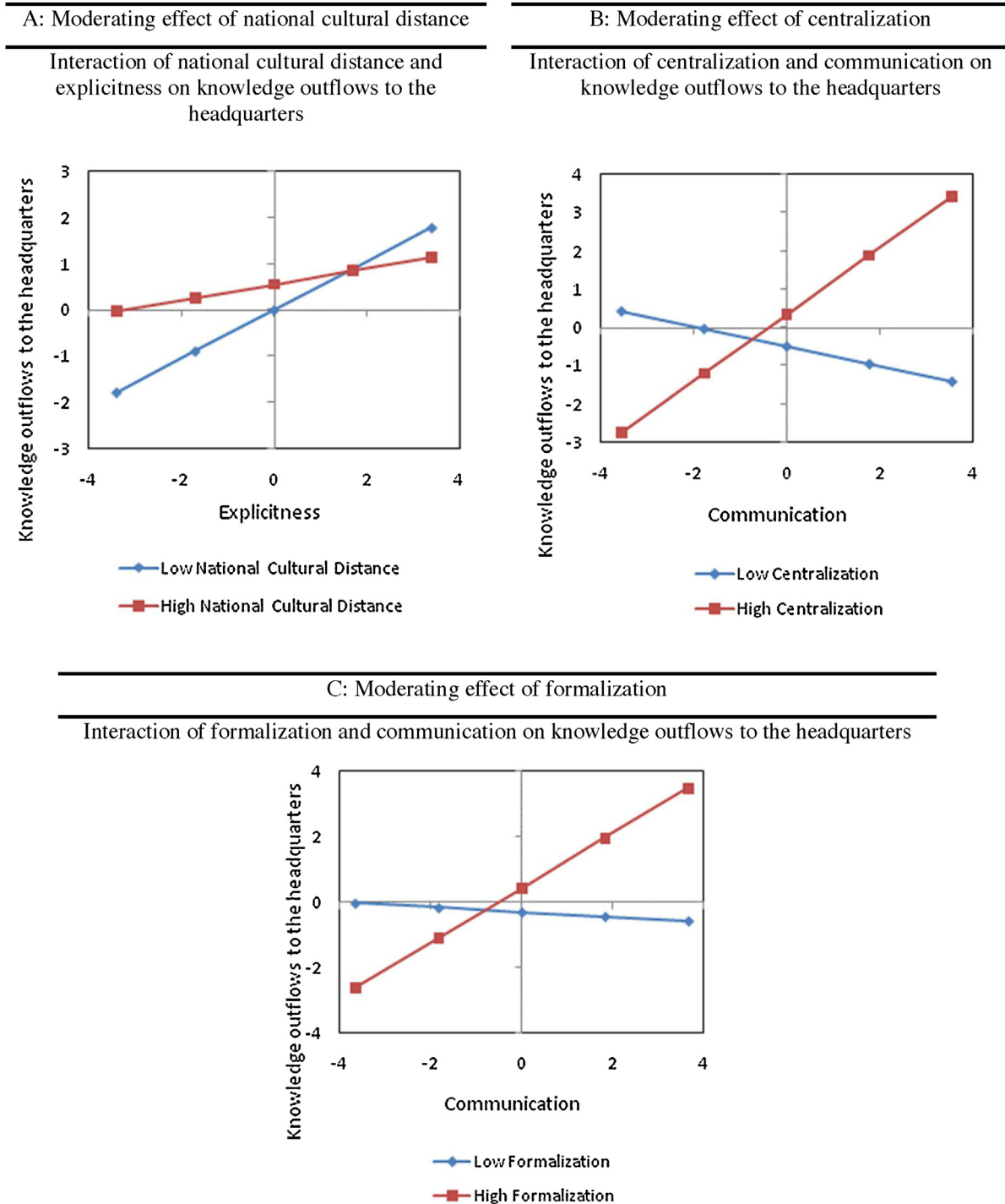


Fig. 3. Interaction effects.

that if a subsidiary is an important center of knowledge, it is able to act as a knowledge diffuser into different units of the MNC directly, not only through headquarters. Thus, not only do our findings illustrate existing subsidiary knowledge outflows, the results suggest that a greater focus of the literature on horizontal knowledge outflows is needed. These results extend the exploratory work of Roth et al. (2009), who qualitatively investigate the importance of horizontal knowledge flows within MNCs.

Further, our results suggest that the characteristics of knowledge are fundamental to the intensity of knowledge outflows both to headquarters and to peer subsidiaries. Our findings indicate that explicitness of knowledge is a critical antecedent of subsidiary knowledge outflows, demonstrating that not all knowledge may effectively transfer vertically or horizontally. This suggests that to enhance knowledge outflows, management should work to implement processes for converting tacit into

**Table 5**

Vertical outflows model.

Variables	Hypotheses	Model 4	Model 5	Model 6
<b>Control variables</b>				
Size		0.15 (1.61)	0.15 (2.08)*	0.08 (1.63)
Industry		0.15 (1.65)	0.06 (0.94)	0.04 (0.78)
<b>Independent variables</b>				
Explicitness → Knowledge outflows	H <sub>1b</sub>		0.55 (6.25)**	0.46 (5.88)**
Communication → Knowledge outflows	H <sub>2b</sub>		0.31 (3.76)**	0.34 (4.72)**
Knowledge outflows → Performance	H <sub>3b</sub>		0.77 (11.80)**	0.77 (11.84)**
N. Cultural Distance → Knowledge outflows				−0.06 (−1.28)
Centralization → Knowledge outflows				0.13 (1.66)
Formalization → Knowledge outflows				0.06 (0.88)
Specialized resources → Performance				0.05 (0.91)
<b>Relevant interaction effects</b>				
Explicitness × National Cultural Distance → Knowledge outflows	H <sub>4b</sub>			−0.11 (−2.64)**
Communication × Centralization → Knowledge outflows	H <sub>5b</sub>			0.17 (2.45)*
Communication × Formalization → Knowledge outflows	H <sub>6b</sub>			0.16 (2.36)*
Knowledge outflows × Specialized resources → Performance	H <sub>7b</sub>			0.06 (1.10)

Notes: Final Structural Model (Model 6) Goodness-of-fit statistics:  $\chi^2 = 747.61$ ,  $p < .000$ ,  $\chi^2/df = 1.6$ , NFI = .94, NFI = .97, CFI = .98, IFI = .98, RMSEA = .054.

We report standardized regression coefficients (*t*-values are in parentheses). We used a two-tailed test for all hypotheses.

\*  $p < .05$ .

\*\*  $p < .01$ .

**Table 6**

Summary of hypotheses and empirical conclusions.

Hypotheses	Expected sign	Empirical conclusions
H <sub>1a</sub> : Explicitness of knowledge is positively associated with knowledge outflows from the subsidiary to peer subsidiaries.	+	Supported
H <sub>1b</sub> : Explicitness of knowledge is positively associated with knowledge outflows from the subsidiary to headquarters.	+	Supported
H <sub>2a</sub> : The frequency of communication between the subsidiary and other peer subsidiaries is positively associated with knowledge outflows from the subsidiary to peer subsidiaries.	+	Supported
H <sub>2b</sub> : The frequency of communication between the subsidiary and the headquarters is positively associated with knowledge outflows from the subsidiary to headquarters.	+	Supported
H <sub>3a</sub> : Knowledge outflows from the subsidiary to peer subsidiaries are positively associated with the MNC's performance.	+	Supported
H <sub>3b</sub> : Knowledge outflows from the subsidiary to the headquarters are positively associated with the MNC's performance.	+	Supported
H <sub>4a</sub> : The positive effect of explicitness on knowledge outflows from the subsidiary to peer subsidiaries is stronger as national cultural distance decreases.	−	Supported
H <sub>4b</sub> : The positive effect of explicitness on knowledge outflows from the subsidiary to headquarters is stronger as national cultural distance decreases.	−	Supported
H <sub>5a</sub> : The positive effect of frequency of communication on knowledge outflows from the subsidiary to peer subsidiaries is weaker when centralization mechanisms are high than when they are low.	−	Not supported (+)
H <sub>5b</sub> : The positive effect of frequency of communication on knowledge outflows from the subsidiary to headquarters is stronger when centralization mechanisms are high than when they are low.	+	Supported
H <sub>6a</sub> : The positive effect of frequency of communication on knowledge outflows from the subsidiary to peer subsidiaries is weaker when formalization mechanisms are high than when they are low.	−	Supported
H <sub>6b</sub> : The positive effect of frequency of communication on knowledge outflows from the subsidiary to headquarters is stronger when formalization mechanisms are high than when they are low.	+	Supported
H <sub>7a</sub> : The positive effect on an MNC's performance of knowledge outflows from the subsidiary to peer subsidiaries is stronger when subsidiary specialized resources are high than when they are low.	+	Supported
H <sub>7b</sub> : The positive effect on an MNC's performance of knowledge outflows from the subsidiary to headquarters is stronger when subsidiary specialized resources are high than when they are low.	+	Not supported (n.s.)

explicit knowledge. As knowledge loses some of its tacitness to become more explicit, it becomes less costly to share with others. Since knowledge conversion from tacit to explicit is important for expanding knowledge (Nonaka & von Krogh, 2009), management has the potential to perform a critical intervention in the process of knowledge creation and expansion. However, while knowledge explicitness is a driver of knowledge outflows, these effects are suppressed as national cultural distance increases within the MNC (both vertically and horizontally). While not unexpected in light of the prevailing literature, this finding suggests the need for research on mechanisms MNCs can employ to overcome this effect.

The results also provide evidence that frequency of communication plays a central role in facilitating subsidiary knowledge outflows within the MNC (both horizontal and vertical). Frequent communications between members of the MNC help managers to become aware of opportunities for leveraging competencies, assuming a critical role as an antecedent of the knowledge

outflows process. This result advances the work of Monteiro et al. (2008), who argued that frequent communications between MNC units increase the perceived capabilities of the other unit and stimulate the motivation to learn, by demonstrating these effects in both horizontal and vertical MNC relationships. The results also support our predictions concerning the positive effect of centralization on the relationship between frequency of communication and vertical subsidiary knowledge outflows. Centralization is one of the crucial dimensions of organization design and our results indicate that the implementation of these control mechanisms can significantly enhance vertical subsidiary knowledge outflows.

When investigating the role of formalization as a control mechanism influencing knowledge flows, we found that in headquarters-subsidiary relationship formalization is able to strengthen the influence of frequency of communication on knowledge outflows. However, formalization exerts a negative influence on horizontal knowledge transfers within the MNC. This

result demonstrates that formalization, a control mechanism implemented by headquarters, restricts flexibility within the MNC. This finding demonstrates that the MNC control mechanism of formalization can have disruptive effects on knowledge flows within the MNC subsidiary network, thereby hampering the performance of the MNC itself.

Finally, our results indicate that subsidiaries' specialized resources are a facilitator of the relationship between knowledge outflows and an MNC's performance, with the potential to increase the positive effect that inter-subsidary knowledge transfers have on MNC performance improvement. Therefore, we conclude that subsidiaries with strong resources, competencies and capabilities are better able to increase the positive influence that knowledge outflows have on performance. This is suggestive of the leveraging effect of knowledge outflows in development and retaining a competitive advantage.

## 7. Conclusions

The MNC is perceived as a mechanism for internal dissemination of knowledge. The diversity of environments where an MNC's subsidiaries operate provides it the opportunity to gain access to unique skills and capabilities. This heterogeneity in competencies across subsidiaries presents an opportunity to improve global MNC's performance by transferring and leveraging competencies. As competition in global industries has become more knowledge-intensive, the capacity of MNCs to transfer their competencies across internationally dispersed subsidiaries provides a greater opportunity to establish competitive advantage. However, the effectiveness and efficiency of knowledge transference within the MNCs network is challenged on a daily basis. Consequently, the synergies and benefits that may arise from the MNCs multiple centers of knowledge may be put at risk without a clear identification of the factors supporting or inhibiting internal organizational knowledge sharing.

In fact, the majority of work in the area of MNC knowledge flows focus attention on subsidiary knowledge inflows, giving less attention to lateral knowledge transfers (between peer subsidiaries) and particularly to transfers that occur between the subsidiary to the headquarters (subsidiary knowledge outflows). The growing emphasis placed on the network vision of the MNC requires detailed attention to both its lateral and vertical internal knowledge flows, in order to capture the consequences that knowledge flows sent via MNCs' subsidiaries exert on the MNC as a whole. This study, emphasizing the concept of MNCs as a network of multiple centers of knowledge, provides for the exploration of performance consequences via vertical and horizontal subsidiary knowledge outflows.

Specifically, instead of treating knowledge as a single composite variable and therefore inhibiting the comprehension of the nature of and the mechanisms behind the different directions of knowledge outflows, this study distinguished between horizontal and vertical knowledge outflows, thereby allowing the identification of separate subsidiary knowledge outflows (to the headquarters and to peer subsidiaries) on MNC financial performance. Through this study it was found that knowledge outflows to peer subsidiaries and to headquarters have a positive significant influence in improving the objective performance of the MNC, contributing to the performance of the entire network as a whole. These findings reinforce the predictions that the ability to use, leverage and integrate organizational knowledge is as key driver of superior performance.

Furthermore, the findings demonstrate that the subsidiary's specialized resources can be perceived as a facilitator of the relationship between knowledge outflows and MNC performance, with the potential to increase the positive effect that inter-subsidary

knowledge transfers have on an MNC's performance improvement. Therefore, it can be concluded that subsidiaries with relatively strong resources, competencies and capabilities are more able to strengthen the positive influence that knowledge outflows have on the improvement of an MNC's performance.

Additionally, the study identified managerial coordination and control mechanisms (e.g. centralization and formalization) that can be put in place as active elements to influence subsidiary knowledge outflows. It was determined that the implementation of centralization as a control mechanism can help to implement a common vision through the MNC, since subsidiaries exposed to higher levels of centralization will more likely be motivated to engage in knowledge transfer activities. Regarding formalization, subsidiaries effectively use this mechanism in vertical relationships within MNCs, because they are required. However, in lateral relationships within MNCs, the capacity of headquarters to monitor the effective use of formalization procedures is reduced, therefore diminishing subsidiaries' willingness to implement them.

Although this work substantively advances our understanding of vertical and horizontal subsidiary knowledge outflows within an MNC, the findings must be viewed in the context of the limitations of the study. First, although we were able to capture vertical and horizontal knowledge outflows, we captured these from the subsidiary itself. While we believe this accurately reflects subsidiary knowledge outflows, it does not capture knowledge inflows that match those outflows. The collection of dyadic data would greatly enhance the findings of this study. Thus, investigating issues such as absorptive capacity related to vertical and horizontal subsidiary knowledge outflows, or the specific content of the knowledge flows (and therefore its usefulness to the target), would extend this research.

Second, although we identify and demonstrate the effects of various headquarters control and coordination mechanisms on subsidiary knowledge outflows, a number of mechanisms were not addressed. For example, social norms within the organization prescribe a set of behaviors. Investigation of norms of relational behaviors, such as information exchange, solidarity, and flexibility could also provide valuable insights to the knowledge flows within an MNC. Furthermore, it could be argued that the norms of relational behaviors may provide unique interaction effects pertaining to the directionality and intensity of subsidiary knowledge outflows within an MNC.

Third, while this research identifies a number of factors related to subsidiary knowledge outflows, it does not look to develop best practices. Obstacles to the internal transfer of best practices 'raise a fundamental question for the knowledge-based view of the firm – why organizations do not know what they know' (Szulanski, 1996, p. 38). The actual impediments to internal best-practice transfer create a gap between what organizations know and what organizations put to use. One of the main advantages of MNCs is its ability to transfer knowledge inside the corporation (Kogut & Zander, 1993). However, the fact that its units are dispersed around the world poses considerable challenges for the knowledge transfer process.

Fourth, although we capture subsidiary knowledge outflows, we do not capture the motivations for those outflows. While research on motivations has been conducted, a question can be posed in relation to subsidiary knowledge outflows as to why subsidiaries engage in these practices. Are subsidiary knowledge outflows voluntary to enhance organizational performance or mandatory due to corporate policies? Are there differences in motivation across vertical and horizontal subsidiary knowledge outflows? These and other questions about MNC subsidiary knowledge outflows are yet to be investigated and could substantively enhance our knowledge of MNCs.

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