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RESEARCH NOTE

Internal embeddedness, geographic distance, and global knowledge sourcing by overseas subsidiaries

Kazuhiro Asakawa[1], YeonJin Park[2], Jaeyong Song[3] and Sang-Ji Kim[4]

[1] *Graduate School of Business Administration, Keio University, 4-1-1 Hiyoshi, Kohoku-ku, 223-8526 Yokohama, Japan;* [2] *Electronics and Telecommunications Research Institute, 218 Gajeong-ro, Yuseong-gu, Daejeon 34129, Korea;* [3] *Graduate School of Business, Seoul National University, Seoul, Korea;* [4] *Samsung Economic Research Institute, Seoul, Korea*

Correspondence:
Y Park, Electronics and Telecommunications Research Institute, 218 Gajeong-ro, Yuseong-gu, Daejeon 34129, Korea.
Tel: 82-10-9825-7885;
e-mail: yeonjin@etri.re.kr

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Abstract
We investigate determinants of global knowledge sourcing of overseas R&D subsidiaries, shedding light on vertical cross-border embeddedness within firms. Drawing on the paradox of embeddedness perspective, which assumes that embeddedness may facilitate or hinder knowledge transfer, we examine the extent to which different types of internal vertical embeddedness – administrative versus knowledge – facilitate global knowledge sourcing. We find that vertical administrative embeddedness inhibits global knowledge sourcing, while vertical knowledge embeddedness promotes it. We also find differing moderating effects of geographic distance between headquarters and its subsidiaries on the association between vertical embeddedness and global knowledge sourcing.

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INTRODUCTION

Globalization of innovation activities is today's salient phenomenon. As globalization of R&D has increased (Ambos, Ambos, & Schlegelmilch, 2006), sourcing knowledge for innovation has evolved over time as well. While subsidiaries have historically been assigned the role of adapting existing products to host-country markets by sourcing key knowledge from headquarters (HQ) (Kuemmerle, 1999), later in history, many subsidiaries started sourcing knowledge locally to accommodate location-specific demand. Over time, certain subsidiaries began to source knowledge from anywhere in the world where important knowledge resides in order to increase their engagement in global innovation (Doz, Santos, & Williamson, 2001; Contractor, Kumar, Kundu, & Pedersen, 2011).

In this article, we examine overseas R&D subsidiaries' global knowledge sourcing (GKS), or sourcing from anywhere outside the home or host country. While extant studies have extensively investigated GKS of MNCs in general, focusing primarily on MNC HQ (Ambos & Ambos, 2011), few empirical studies have explicitly focused on GKS of overseas R&D subsidiaries. However, GKS by

overseas R&D subsidiaries is an important trend which deserves more attention as more and more subsidiaries evolve into global innovators.

Furthermore, in this study, we examine the determinants of GKS by overseas R&D subsidiaries from the perspective of internal embeddedness, reflecting the nature of MNCs as differentiated networks consisting of HQ and overseas subsidiaries (Nohria & Ghoshal, 1997). While extant research in the field of global R&D and innovation management has primarily focused on the impact of external networks (or embeddedness) on GKS (Andersson, Forsgren, & Holm, 2002), very few studies, if any, have explicitly investigated the effect of *internal* embeddedness within MNCs on GKS by subsidiaries. To fill this gap, we examine the impact of internal embeddedness within MNCs as a determinant of GKS by overseas R&D subsidiaries, highlighting subsidiary benefits and constraints from links with HQ.

We draw on the embeddedness perspective (Granovetter, 1985; Uzzi, 1997) to examine the effects of different dimensions of internal embeddedness on GKS. Embeddedness is defined as "closeness in a relationship that reflects the intensity of information exchange and the extent to which resources between the parties in the dyad are adapted" (Song, Asakawa, & Chu, 2011: 383; Uzzi, 1996). Overseas subsidiaries are embedded in multiple environments: the host-country environment and the firm's internal networks, including HQ (Nell & Ambos, 2013). Dual embeddedness of overseas subsidiaries (Meyer, Mudambi, & Narula, 2011; Song et al., 2011) vis-à-vis HQ or external parties may either hinder or facilitate external knowledge sourcing, depending on various contingencies.

Drawing on the argument of the "paradox of embeddedness" (Uzzi, 1997), in which embeddedness has both positive and negative effects on knowledge sourcing, we herein conduct a detailed investigation of how different types of vertical internal embeddedness – administrative- and knowledge-related – affect GKS of overseas R&D subsidiaries both positively and negatively. Here a vertical relationship is defined as the linkage between an overseas R&D subsidiary and its MNC HQ. Building on the work of Meyer et al. (2011), we show the multidimensionality of internal embeddedness and its relative impact on GKS by overseas subsidiaries. In particular, we highlight the two aspects of HQ involvement and their paradoxical impact on GKS: vertical administrative embeddedness (VAE) hampers subsidiaries' GKS, whereas vertical knowledge embeddedness (VKE) facilitates GKS.

Moreover, we "zoom in" on the geographic distance of vertical embeddedness and its effect on GKS (Beugelsdijk & Mudambi, 2013). We argue and test whether geographic distance between HQ and its subsidiaries, measured at the city level, moderates the effects of vertical internal embeddedness on GKS by those subsidiaries.

THEORY AND HYPOTHESES

We examine the effect of internal embeddedness on GKS by subsidiaries. Overseas R&D subsidiaries are embedded in a web of global, external, and internal networks, despite the focus of most extant studies on external embeddedness. The impact of internal embeddedness is less obvious than that of external embeddedness; internal embeddedness may provide useful resources and knowledge to a focal subsidiary, but it may also restrict its activities outside the network (Uzzi, 1997; Meyer et al., 2011; Mudambi, 2011).

Studies show that internal knowledge sharing does have some positive impact on innovation in general (Mudambi & Navarra, 2004). Despite such findings, very few studies explicitly look at the impact of internal embeddedness on GKS by overseas subsidiaries. When sourcing of cross-border knowledge occurs, the shared context is limited (Dellestrand & Kappen, 2012). In such circumstances, internal support becomes useful to overcome barriers to GKS. We herein investigate whether and how different types of internal embeddedness affect overseas GKS by R&D subsidiaries.

We see VAE and VKE as two components of internal embeddedness. This classification builds on the classic organizational theory in which professional and bureaucratic/administrative tasks are seen as distinct by nature (Perrow, 1986). VKE connotes the relationship between MNC HQ and overseas R&D subsidiaries along the knowledge dimension, which may include exchange of knowledge or imposition of knowledge-related mandates. VAE refers to the relationship between MNC HQ and overseas R&D subsidiaries along the administrative dimension, including activities such as formulation of performance goals, evaluation and compensation, and monitoring.

Drawing on the paradox of embeddedness perspective, we now develop hypotheses regarding the contrasting effects of VAE and VKE on GKS. Finally, we hypothesize how geographic distance between

HQ and its subsidiaries moderates the relationship between VAE/VKE and GKS.

Vertical Administrative Embeddedness and Global Knowledge Sourcing

We hypothesize that VAE hinders GKS because HQ administrative involvement in subsidiary operations is likely to impede voluntary knowledge searching by subsidiaries. VAE often involves subsidiaries under the control of HQ (Mudambi & Navarra, 2004). For example, valuable resources may be allocated to subsidiaries based on the fulfillment of their assigned job on a short-term basis. Because GKS is costly, time-consuming, and uncertain, subsidiaries may be discouraged from exploring knowledge searching options beyond host-country boundaries. Subsidiaries that are hierarchically subordinate to HQ at the administrative level (Andersson, Forsgren, & Holm, 2007) may be discouraged from taking risks that may decrease efficiency, such as searching for knowledge in a broader geographic context. Instead, subsidiaries may perceive pressure to fulfill their expected role of tapping into local knowledge. Such pressure may work against subsidiaries engaging in GKS. As a result, strong VAE that leads to oversocialized relationships (Granovetter, 1985) may discourage overseas R&D subsidiaries from searching for knowledge outside the home or host countries. This observation is consistent with the findings of studies discussing the downside of internal embeddedness for subsidiary innovation, which is characterized by the "innovation–integration dilemma" (Mudambi, 2011).

For MNCs investing in expensive "brick-and-mortar" R&D laboratories abroad to gain access to valuable, location-specific knowledge (Castellani, Jimenez, & Zanfei, 2013), the priority is on exploiting the locational advantage as much as possible to make the investment worthwhile. These considerations are often built into the incentive system and routinized at the administrative level. VAE prioritizes the standard role of overseas R&D subsidiaries as engaging in local knowledge sourcing; administrative activities such as formulation of performance goals, evaluation, compensation, and monitoring put pressure on R&D subsidiaries to attain their goals efficiently from the administrative perspective. Hence we hypothesize that:

Hypothesis 1: Vertical administrative embeddedness (VAE) negatively affects global knowledge sourcing (GKS) by overseas subsidiaries.

Vertical Knowledge Embeddedness and Global Knowledge Sourcing

VKE, on the other hand, positively affects GKS in overseas subsidiaries. VKE may provide subsidiaries with a sense of global strategic orientation and direction (Nell & Ambos, 2013). Moreover, HQ may have a good grasp of where the key knowledge resides. For GKS, subsidiaries may need input and guidance from HQ, which keeps abreast of activities in other locations. Since HQ is connected directly to all subsidiaries within the MNC, it plays the role of knowledge broker (Dellestrand & Kappen, 2011), sharing knowledge from all other overseas subsidiaries.

The interests of subsidiaries that are more engaged in local-for-global innovation are more aligned with those of HQ in terms of sharing knowledge and information because HQ can share sufficient information about diverse knowledge available or accessible from different overseas R&D subsidiaries (Dellestrand & Kappen, 2012; Mudambi, 2011). Subsidiaries can also obtain diverse knowledge from other subsidiaries through HQ. Since subsidiaries generally have limited access to knowledge beyond the host-country environment, VKE may facilitate GKS by subsidiaries. Hence we hypothesize that:

Hypothesis 2: Vertical knowledge embeddedness (VKE) positively affects global knowledge sourcing (GKS) by overseas subsidiaries.

Moderating Role of Geographic Distance

We argue that the effects of VAE/VKE on GKS, as predicted by H1 and H2, respectively, are weakened by geographic distance because VAE/VKE reflect the social aspects of relationships. The theorized constraints imposed by HQ characteristic of VAE as well as the advantages generated by VKE are based on the assumption that the effects of internal embeddedness are unchanged by geographic distance between HQ and subsidiaries. However, we posit that the impact of internal embeddedness may decline as geographic distance increases. Since the definition of embeddedness includes the assumption that close interactions and relationships are promoted by geographic proximity (Boschma, 2005), it makes sense that geographic distance weakens the effect of embeddedness. Therefore we hypothesize that:

Hypothesis 3a: Geographic distance weakens the negative relationship between vertical

administrative embeddedness (VAE) and global knowledge sourcing (GKS) of overseas subsidiaries.

Hypothesis 3b: Geographic distance weakens the positive relationship between vertical knowledge embeddedness (VKE) and global knowledge sourcing (GKS) of overseas subsidiaries.

METHODS

Data

To test our hypotheses related to GKS of overseas R&D subsidiaries empirically, we used data from the overseas R&D subsidiaries of Japanese MNCs. We combined data from two sources: a survey conducted by one of the authors of this article and a patent database. Our data were derived from an extensive survey of overseas R&D subsidiaries of Japanese MNCs at multiple time points since the year 2000. First, we extracted a list of 497 overseas R&D subsidiaries from Toyo Keizai's Overseas Operations of Japanese Firms. In total, 102 out of 497 subsidiaries participated in the survey. Of the returned surveys, those from 99 subsidiaries of 62 major Japanese MNCs turned out to be usable, for an effective response rate of 20%.

To maintain our research focus on the characteristics of R&D subsidiaries and their GKS activities, we only included subsidiaries in which patents were registered successfully in the US Patent and Trademark Office (USPTO) between 2001 and 2006. We also checked their US patent registration records. The survey questionnaires were completed by the head officers of each of the R&D subsidiaries, who were well informed about both the technical and administrative sides of subsidiary activities. The head officer of the R&D subsidiaries in a given firm was an ideal respondent to our survey, as he or she had a good grasp of various kinds of embeddedness vis-à-vis HQ and other subsidiaries. Moreover, this person was typically a former professional researcher and thus more aware of both the knowledge and administrative aspects of embeddedness in relation to HQ.

The survey data were used to construct our independent and control variables. We extracted patent data from the USPTO database to measure our dependent variable, GKS of overseas R&D subsidiaries. Patent data have become popular as indicators of knowledge flow and creativity for researchers in recent years (Hall, Jaffe, & Trajtenberg, 2000). Because a firm must file a patent in a specific country to obtain intellectual property protection, and because the United States is the world's largest technology market, non-US firms routinely file patents in the United States (Albert, Avery, Narin, & McAllister, 1991). Thus we use US patent data for more objective comparisons of patent counts of overseas R&D subsidiaries from various countries with different intellectual property regimes.

Following the protocol in previous research related to knowledge sourcing (Almeida, 1996; Jaffe & Trajtenberg, 2002; Song et al., 2003), we used backward patent citation data in this study to capture knowledge flows from other countries (neither home nor host country) to overseas R&D subsidiaries. We allowed a time lag of at least 1 year from the time point of the survey data (2000) and utilized patent data from 2001 to 2006 in order to allow for time spent completing research projects and the patent application processes. Due to the potential bias from fluctuations by year, we decided to limit our observation period to 6 years. As a result, our sample included 617 patents from 41 overseas subsidiaries of 24 major Japanese MNCs.

Variables and Measures

Dependent variable: global knowledge sourcing (GKS)

Our dependent variable, the magnitude of GKS of overseas R&D subsidiaries of Japanese MNCs, was measured at the patent level. GKS is defined as knowledge sourcing from countries other than the home or host countries of overseas R&D subsidiaries. We operationalized the dependent variable as the number of backward citations made by each patent to any patent applied for by assignees or inventors who resided in other countries. First, to construct our dependent variable, we identified patents applied for by overseas R&D subsidiaries in our sample. Then, to identify knowledge sources, we collected more detailed information, such as the names and locations of assignees and inventors of patents that were cited by the patents of overseas R&D subsidiaries in our sample. After matching and merging these citation-related data, we divided and counted the number of citations by source. An increase in this count measure indicates an increase in the degree to which a patent is based on knowledge from other countries (neither the home nor host country) of overseas R&D subsidiaries.

Independent variables

Vertical administrative embeddedness (VAE) Based on the results of the factor analysis, we selected and composed an index based on the survey items related to interactive behaviors, that is, joint involvement of HQ and subsidiaries, in key administrative decision-making. The frequency and magnitude of interaction related to VAE were scored on five-point Likert scales.

Since VAE shows how closely a subsidiary is tied to HQ in making its key decisions, neither the degree of adaptation to HQ practices by subsidiaries (Andersson et al., 2002) nor the strength of the HQ–subsidiary relationship (Nell & Ambos, 2013) sufficiently captures the way subsidiaries are tied to HQ in making key decisions. In this study, therefore, we measure this variable by determining the extent of shared responsibility in the following decision-making: recruiting new hires, promotion, trainee acceptance, and collaboration with external organizations, which are some of the key administrative tasks in R&D management (Cheng & Bolon, 1993).

Vertical knowledge embeddedness (VKE) We extracted survey items associated with knowledge-related/technological interaction between overseas R&D subsidiaries and their MNC HQs based on the results of the factor analysis. The survey included questions regarding frequency of knowledge-related/technological interaction, such as joint research projects, transfer of technology/knowledge, and movement of researchers and engineers (Nell & Ambos, 2013) between overseas R&D subsidiaries and MNC HQs. Based on the score on a five-point Likert scale, we created a composite index about VKE by computing average values.

Geographic distance We measured geographic distance between HQ and each overseas subsidiary by determining the distance between the cities in which they were located. Therefore, we zoomed in on geography on the subnational level (Chan, Makino, & Isobe, 2010; Ma, Tong, & Fitza, 2013).

Control variables

At the patent level, we introduced three control variables: the total number of citations made by a patent in our sample, the number of inventors, and the number of citations to own prior patents of our sample MNCs. We also added subsidiary-level control variables such as the age and technological capabilities of the overseas R&D subsidiaries. Other subsidiary-level control variables consisted of composite indices based on the survey items such as autonomy, local knowledge embeddedness, horizontal knowledge embeddedness (measured as the frequency of collaboration with organizations located in other countries, excluding the home or host country, outside the MNC), and horizontal internal embeddedness (defined as relationships with other subsidiaries of the same MNC located in other countries). In addition, we added three dummy variables: industry, mode of entry, and the target market of innovation for each subsidiary.

Statistical Model: Negative Binomial Regression

We employed negative binomial regression analysis to investigate factors influencing the magnitude of GKS because our dependent variable, GKS, was measured by the number of backward citations to the patent applied for by assignees or inventors who resided in other countries. We clustered standard errors by overseas R&D subsidiaries, since our data included multiple observations for each subsidiary.

In our negative binomial regression models, the probability that the number of patent citations will occur n times is as follows:

$$\mathrm{Prob}(Y = yj) = e^{-\lambda j}\frac{\lambda_j^{Y_j}}{Y_j!},$$

where $\lambda_j = \exp(\sum B_i X_{ij})\exp\left(\mu_j\right)$ and $e^{\mu_j} \sim \mathrm{Gamma}(1/\alpha, 1/\alpha)$ for observed counts of patent citations Y_j with covariates X_i for the jth patent of an overseas R&D subsidiary i.

RESULTS

A summary of the descriptive statistics and the correlation matrix of the variables are presented in Tables 1 and 2. The correlation matrix shows a few high correlations among the variables in our research model. However, the variance inflation factor of each variable is <5. The variance inflation factors of only two control variables (autonomy and local knowledge embeddedness) are >4. Therefore we included all variables in the regressions. Then, we compared the results of the regression models with and without variables with high correlations.

Table 3 presents the statistical findings from the negative binomial regressions. The table includes statistics of five models: the baseline model with control variables (Model I), the model with

Table 1 Descriptive statistics

Variables	Mean	SD	Min	Max
Global sourcing	2.710	3.713	0	36
Total number of citations	4.611	9.053	1	104
Number of inventors	2.363	1.802	1	15
Number of MNC citations	0.924	1.883	0	14
Industry	0.190	0.392	0	1
Mode of entry	0.392	0.489	0	1
Age (ln)	2.550	0.672	0.690	3.780
Autonomy	3.076	1.132	1	5
Subsidiary technological capability	3.180	0.546	1	4.75
Target market for innovation	0.250	0.433	0	1
LKE (local knowledge embeddedness)	1.250	0.608	1	4
HKE (horizontal knowledge embeddedness)	1.073	0.266	1	3
HIE (horizontal internal embeddedness)	1.522	0.581	1	3.33
VAE (vertical administrative embeddedness)	1.875	0.702	1	5
VKE (vertical knowledge embeddedness)	2.814	0.799	1	4
Geographic distance (ln)	9.172	0.193	6.989	9.828

independent variables (Model II), the model with moderating variables (Model III-1 and Model III-2), and the full model (Model IV). The Chi-squared statistics for each model improved statistically significantly ($p < 0.001$) from the baseline model.

Model II shows that both of our main hypotheses associated with the relationship between vertical embeddedness and GKS of overseas R&D subsidiaries are supported statistically. The coefficient of VAE is highly significant ($p < 0.01$) and negative. This finding supports hypothesis 1, suggesting that overseas R&D subsidiaries acquire less knowledge from global sources when they are more administratively linked to MNC HQ. On the other hand, the coefficient of VKE is significant ($p < 0.10$) and positive. This means that overseas R&D subsidiaries that collaborate with their HQs in knowledge-related activities are more likely to rely on GKS frequently. Therefore hypothesis 2 is also supported.

In Model III, we tested for the moderating effects of geographic distance of vertical embeddedness on the relationship between VAE/VKE and GKS of overseas R&D subsidiaries by including the interaction term. We argued that geographic distance between HQ and a subsidiary would weaken the effects of VAE and VKE on GKS (hypotheses 3a and 3b). As can be seen in Model III, the coefficient of the interaction term between geographic distance and VAE (VAE × GD) is not significant; thus, H3a is not supported. On the other hand, the coefficient of the interaction term between geographic distance and VKE (VKE × GD) is significant ($p < 0.05$) and negative, thereby supporting H3b. These results suggest that geographic distance influences the effects of VAE/VKE in different ways: while geographic distance does not matter in terms of the effect of VAE on GKS, it matters for the effect of VKE on GKS.

DISCUSSION AND CONCLUSION

In this study, we examine the determinants of GKS of overseas R&D subsidiaries, with a particular focus on the effects of different types of vertical internal embeddedness of overseas R&D subsidiaries on their GKS. In our empirical investigation of Japanese R&D subsidiaries abroad, we found opposite impacts of VAE and VKE on GKS. VKE facilitates GKS, while VAE impedes it. Both VAE and VKE involve linkages with HQ. It is often the case that HQ sends contradictory messages; now we know that they are based on two different types of embeddedness. Since incentives affect organizational behavior, and VAE is more closely related to incentives to attain short-term, concrete outcomes, employees at subsidiaries are more affected by VAE. This is reinforced by the fact that VAE is more directly linked to levels of power and control at HQ (Mudambi & Navarra, 2004); closer linkages at the administrative level between an MNC's HQ and its subsidiaries often mean that subsidiary performance is under constant review. Since GKS is typically costly and its outcomes uncertain, subsidiaries may tend to avoid seeking knowledge from global sources when VAE is strong (Mudambi, 2011; Mudambi & Navarra, 2004). In addition, we also find differing moderating effects of geographic

Table 2 Correlation matrix

		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16
Global sourcing	V1	1.000															
Total citations	V2	0.035	1.000														
Inventors	V3	0.109*	−0.072	1.000													
MNC citations	V4	0.213*	0.065	0.045	1.000												
Industry	V5	0.218*	−0.067	0.240*	0.077	1.000											
Mode	V6	0.037	0.017	0.083*	−0.024	0.416*	1.000										
Age (ln)	V7	−0.233*	−0.049	−0.103 *	−0.099*	−0.513*	−0.364*	1.000									
Autonomy	V8	0.291*	0.098	0.101*	0.054	0.443*	0.518*	−0.485*	1.000								
Subsidiary capability	V9	0.197*	0.128*	−0.021	0.025	0.100*	0.294*	−0.348*	0.319*	1.000							
Target market	V10	0.187*	−0.017	0.189*	0.027	0.629*	0.580*	−0.507*	0.703*	0.211*	1.000						
LKE	V11	0.029	0.105*	0.049	−0.017	0.005	−0.117*	−0.103*	−0.099*	0.173*	−0.046	1.000					
HKE	V12	0.041	−0.009	−0.055	−0.086*	−0.008	−0.095*	−0.026	−0.243*	0.013	−0.060	0.790*	1.000				
HIE	V13	0.083*	−0.046	0.012	0.017	0.457*	0.664*	−0.418*	0.259*	0.409*	0.359*	−0.015	0.040	1.000			
VAE	V14	−0.247*	−0.082*	0.022	0.029	−0.053	−0.539*	0.222*	−0.667*	−0.290*	−0.355*	0.388*	0.371*	−0.311*	1.000		
VKE	V15	−0.163*	−0.191*	−0.030	−0.048	−0.466*	−0.483*	0.709*	−0.502*	−0.508*	−0.387*	−0.074	0.031	−0.493*	0.318*	1.000	
Geographic distance	V16	0.048	−0.032	−0.044	0.017	0.015	−0.202*	0.190*	−0.039	0.229*	−0.115*	−0.104*	−0.103*	−0.181*	0.090	0.109*	1.000

* $p < 0.05$.

Table 3 Results of negative binomial regression analysis ($n = 617$)

	Model I	Model II	Model III-1	Model III-2	Model IV
Total citations	−0.003	0.000	0.000	0.002	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Inventors	0.104**	0.086	0.086	0.080	0.080
	(0.049)	(0.054)	(0.054)	(0.053)	(0.525)
MNC citations	0.091***	0.084**	0.084**	0.088**	0.088**
	(0.033)	(0.035)	(0.035)	(0.034)	(0.034)
Industry	0.423	0.904**	0.852**	0.798**	0.827**
	(0.405)	(0.366)	(0.371)	(0.337)	(0.352)
Mode	−0.453	−0.601	−0.620	−0.544	−0.530
	(0.499)	(0.398)	(0.401)	(0.369)	(0.373)
Age (ln)	−0.075	−0.352*	−0.350	−0.378**	−0.379**
	(0.212)	(0.213)	(0.214)	(0.191)	(0.191)
Autonomy	0.390***	0.185	0.196	0.245	0.241
	(0.142)	(0.149)	(0.154)	(0.153)	(0.157)
Subsidiary capability	0.391*	0.453*	0.442*	0.400	0.406
	(0.230)	(0.269)	(0.262)	(0.261)	(0.266)
Target market	−0.302	−0.351	−0.339	−0.376	−0.383
	(0.594)	(0.428)	(0.421)	(0.404)	(0.399)
LKE	−0.590**	−0.316	−0.330	−0.365	−0.358
	(0.236)	(0.263)	(0.265)	(0.255)	(0.257)
HKE	1.405**	0.908*	0.972*	1.000**	0.964*
	(0.565)	(0.507)	(0.541)	(0.503)	(0.536)
HIE	−0.085	−0.134	−0.102	−0.094	−0.114
	(0.262)	(0.212)	(0.226)	(0.215)	(0.239)
Geographic distance	−0.268	−0.084	−0.585	3.673*	4.159
	(0.550)	(0.433)	(1.512)	(1.960)	(3.320)
VAE		−0.609***	−3.721	−0.492**	1.524
		(0.205)	(9.445)	(0.200)	(10.659)
VKE		0.421*	0.407*	11.445**	11.918**
		(0.234)	(0.240)	(5.208)	(5.986)
VAE × geographic distance			0.340		−0.220
			(1.031)		(1.161)
VKE × geographic distance				−1.202**	−1.253*
				(0.562)	(0.647)
Constant	0.260	−0.100	4.427	−34.806*	−39.220
	(4.928)	(3.535)	(13.564)	(18.285)	(30.469)
Chi-squared	126.68***	143.47***	159.81***	207.86***	272.48***
df	13	15	16	16	17

Standard errors in parentheses.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

distance between HQ and its subsidiaries on the association between vertical embeddedness and global knowledge sourcing.

This article is not without limitations. The first concerns the issue of the generalizability of our results due to the focus on a single country of origin. We suggest that future studies should attempt to replicate the findings of this study using data from other countries of origin in order to confirm and enhance their generalizability. The second limitation is related to the selection of patent data to measure GKS. Future studies can measure GKS more directly with different types of data.

Despite its limitations, this article has made the following contributions. First, we shed light on the effect of internal embeddedness on sourcing of external knowledge, which has received less attention in the literature. Building on the work of Meyer et al. (2011), we showed the multidimensionality of internal embeddedness and "opened the black box" to sharpen our conceptual

understanding of cross-border embeddedness within MNCs and its effects on GKS.

Second, this article highlighted the two sides of HQ involvement and their paradoxical impact on GKS: VAE hampers subsidiaries' GKS, whereas VKE facilitates GKS. This is among the first empirical studies to focus on the determinants of vertical knowledge and administrative embeddedness on knowledge sourcing by overseas R&D subsidiaries, highlighting the paradoxical nature of internal embeddedness.

Third, the article reveals a moderating role of geographic distance between HQ and its subsidiaries. We found that geographic distance weakens the effect of VKE, while it does not influence the impact of VAE. This implies that a subsidiary geographically more distant from HQ is less likely to take advantage of invaluable knowledge from HQ due to the barriers involved in communicating across distances. In contrast, even a subsidiary geographically distant from HQ is less likely to escape from HQ's constraints as manifested by VAE, which impedes GKS by the subsidiary.

Last but not least, our results also have some implications for managers. HQ managers must be consistent in sending out messages to their overseas subsidiaries in order to encourage GKS by subsidiaries. HQ managers should also avoid giving mixed messages based on the differing logics of VKE and VAE.

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ABOUT THE AUTHORS

Kazuhiro Asakawa is a Mitsubishi Chaired Professor at Graduate School of Business Administration, Keio University. He received his PhD at INSEAD. His research focuses on global innovation and global R&D management. He is an AIB Fellow and president of the Japan Academy of Multinational Enterprises. He served as an Associate Editor of Global Strategy Journal and Asia Pacific Journal of Management.

YeonJin Park is a researcher of Economics of Technology Research Division in Future Technology & Strategy Research Laboratory at Electronics and Telecommunications Research Institute (ETRI). She received her PhD at the Seoul National University (SNU). She is interested in management of technology and innovation of multinational corporations in high-tech industries.

Jaeyong Song is an AMOREPACIFIC Professor at Seoul National University. He was elected as an AIB Fellow and served as an editor of JIBS. He received his PhD at Wharton and was a professor at Columbia. His papers were published in *Management Science*, *Harvard Business Review*, *Strategic Management Journal*, *Organization Science*, *Journal of Management*, *JIBS*, *California Management Review*, and *Research Policy*.

Sang-Ji Kim a PhD in Strategic Management at Seoul National University, is now working for Samsung Economic Research Institute as a research fellow specialized in strategic consulting for Samsung Electronics. Her consulting area covers semiconductor, smartphone, and cloud industries. Also, her research interests are firms' mid- and long-term strategies including technology innovation, new product development, and new market creation.

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