Formal Boundary Spanning and Informal Boundary Spanning in Cross-Border Knowledge Sharing: A Case Study

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Abstract

The paper expands theoretical and empirical understanding of the interaction between formal boundary spanning mechanism (i.e. individuals formally nominated to span boundaries for knowledge sharing) and informal boundary spanning mechanism (i.e., informal seeking of information via social ties crossing boundaries) in a far-flung operation of a global company. Through a case study of engineering groups at a U.S. based manufacturing plant, we found that both formal and informal boundary spanning mechanisms had a positive effect on the ability of dispersed groups to identify and transfer remotely situated knowledge from other sites. However, we also found that the formal boundary spanning mechanism may have a suppressing effect on the informal boundary spanning mechanism when jointly pursued in certain circumstances. The findings call into question the implicit view of the boundary spanner and virtual team literatures that has largely portrayed the effects of both mechanisms on cross-boundary knowledge transfer as independent or complementary.

1. Introduction

"We had a major incident last week, which caused a huge performance loss. Our counterpart group at Plant M had a similar problem a couple of months earlier. Our incident could have been eliminated if we had better communication. We never heard of their incident even though we regularly have a videoconference with them. I don't even know where the communication breakdown was. Maybe JK, who is the expatriate manager from the headquarters campus to our group, had too much information to process or did not see the potential similarities between Plant M and our plant. Perhaps others in our group should have more regular informal contact with Plant M counterparts" (American engineer at a U.S. plant of an Asian based high tech company).

Cross-boundary knowledge sharing refers to searching, identifying, and transferring knowledge across functional and geographic boundaries [15]. It is well accepted that in a dynamic environment, the firm's competitiveness significantly depends on the effective transfer of best practices across locations and functions [27]. Yet, the identification and transfer of best practices is not simply a "plug and play" process but rather involves "a protracted iterative process" [33] as the knowledge source is likely ambiguous, hard to locate, and ever evolving.

Cross-boundary knowledge sharing is further challenged when the identification and transfer occurs virtually; that is, where units are geographically dispersed, heavily dependent on information and communication technology (ICT), and diverse in national culture [11]. Individuals at one site are not likely to be aware of the remote knowledge "grounded in site-specific work practices" in another site [31]. Sole and Edmonson [31] observe dispersed teams having difficulty recognizing the relevance between locally and remotely situated knowledge and therefore miss opportunities to transfer relevant work practices.

To promote effective cross-boundary knowledge sharing in the context of geographically dispersed operations, several research streams suggest a formal structural mechanism: an appointment of boundary spanners. The knowledge management literature [e.g., 7, 10] suggests that a far-flung operation might bring in individuals for technical advising and knowledge brokering from a more experienced site to serve the role of boundary spanners. The boundary spanning literature refers to these boundary spanners as technically competent individuals who are well-connected internally as well as externally, influencing how new information enters the organization (or the group) [3, 34]. Empirical studies found formally designated boundary spanners greatly influence local groups in successfully gaining information from outside the groups [10, 29].

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Parallel but rather independent of the boundary spanner literature, the virtual teams and social networks literatures have promoted social ties as a mechanism for facilitating cross-boundary knowledge sharing. Research on social networks shed light on the importance of ties crossing boundaries for effective intrafirm knowledge sharing [6, 15, 32]. Similarly, the virtual team literature demonstrates that technologically mediated knowledge activities are largely shaped by the relational characteristics associated with the interactions between communicating parties [26]. Social ties facilitate informal boundary spanning in the form of frequent cross-boundary communication and knowledge sharing [20, 26]. The literature advocates a number of technological and managerial initiatives such as providing rich and spontaneous communication tools [25] and facilitating face-to-face socialization [26] to ensure the individuals of far-flung sites build the necessary social ties for accessing and utilizing knowledge resources at the larger sites.

While it is suggested that each boundary spanning mechanism (formal and informal) positively affect the ability of dispersed groups (i.e., groups in a far-flung operation) to identify and transfer relevant knowledge residing in remote sites, no studies, to our best knowledge, have yet explored how the formal and informal boundary spanning mechanisms might interact with each other. Understanding the interaction between the two is important because many far-flung operations pursue these different mechanisms simultaneously without understanding how and why one might be positively or negatively affected by another.

Based on interviews with 8 engineering groups at the U.S. plant, we explore the interaction in a qualitative exploratory case study. The case site is a U.S. based manufacturing plant of an Asian-based high tech company. Formal boundary spanners refer to expatriate technical advisors sent from the headquarters sister plants to the same functional groups at the U.S. plant for technical advising and knowledge brokering. We first explore how the formal and informal boundary spanning mechanisms are perceived to affect dispersed groups. We further investigate the interactions between the two mechanisms; more specifically, how the activities of formally nominated boundary spanners (sent from the remote site) might suppress the informal boundary spanning activities of dispersed groups in certain situations.

2. Literature

2.1. Formal Boundary Spanners

Early boundary spanning literature portraits boundary spanners as individuals whose job roles place them in the position to engage in significant transactions with external agents [1]. In this study, we focus on the "knowledge brokering" role of boundary spanners [4, 16, 28], acting as both information filters and knowledge transfer facilitators [2] in the context of geographically dispersed operations. In distributed organizations, formally nominated boundary spanners are often sent from a more experienced site to a less experienced remote site for effective cross-boundary collaboration [7, 10]. In this paper, *we define formal boundary spanners as expatriates assigned from a larger site to a smaller far-flung site for technical advising and knowledge brokering.*

Competent formal boundary spanners develop a good understanding of contextually attuned languages, coding schemes, and perspectives on both sides of the boundary, which enables them to discern what information is relevant, or not, to what or whom in their groups. Through external networks, they are able to seek for and identify remotely situated relevant information [2, 34]. As a result, local groups are able to gain information from outside the groups with the help of their formal boundary spanners [10, 29]. For instance, it is found that the knowledge recipient unit is more likely to succeed in transferring core knowledge when the source unit nominates personnel as boundary spanners and send them to the recipient site to assist the process [10]. From the social capital perspective, the rest of the boundary spanner's group benefit from the social capital of the boundary spanner as they can "'tap into' the resources derived from social relationships [between the boundary spanner and the external agents] without necessarily having participated in the creation of those relationships" [20, p. 30].

What is less clear is how the literature conceptualizes information needs. From the customer-need-fulfillment perspective, the local information needs might be understood as consisting of two types: expressed needs and latent needs [23]. Expressed information needs here refer to local information needs of which a group is aware, and thus able to express in an articulate way. In contrast, latent information needs concern information needs of which a group is currently unaware, but will benefit once have it fulfilled (e.g., remotely situated best practices). A boundary spanner who is able to "proactively" scan the environment will be likely to find new best practices situated in remote sites than one who is merely "responsive" to the expressed information needs.

However, not all formal boundary spanners meet the

role expectation [21, 24]. They may have no ability and/or motivation to realize the expectation. Instead, people who are not originally nominated to be boundary spanners may emerge as "boundary spanners in practice" [21] and effectively perform the role of a boundary spanner through informal boundary spanning activities [24].

2.2. Informal Boundary Spanning

Research on social networks underscores the importance of social ties crossing boundaries. Such ties provide local individuals with access to knowledge resources residing beyond the boundaries [6, 20, 32]. Social ties refer to intimate interpersonal relationships developed through a history of interactions [13]. Ties provide several information benefits such as access to information, timely response, and referrals to third-party experts or expertise [5]. Individuals can improve their performance with unique information and diverse perspectives when spanning organizational and physical boundaries [6]. We view informal boundary spanning as the informal cross-boundary communication between individuals who are not formal boundary spanners, with the purpose of knowledge sharing through their interactions.

Similarly, the importance of building social ties for effective cross-boundary knowledge sharing has been acknowledged in the virtual team literature [19, 26]. Numerous studies have explored how ICT mediated intermediaries affect unprecedented cross-boundary communication and knowledge sharing [14, 25]. What really shapes these technologically enabled knowledge activities is the relationships between the communicating parties [26]. Without having a relational ground, distributed collaborators will be less engaged in communication [17] while facing more conflicts [18].

The stronger the social ties are, the more motivated they are to help and become more approachable [13]. Thus, they are open for iterative knowledge exchanges involving trials, errors, and feedback [15]. Through the history of interactions, social ties develop a good understanding of each other's situations and needs. As a result, social ties in the remote site will be more likely to be able to determine whether their knowledge resources including new best practices might be of relevance to the dispersed group as well as motivated to help inform and transfer the practices.

The disadvantage of social ties is that they can be economically costly to create and or emotionally costly to maintain across boundaries between remote sites [26]. Social ties may also lead to sharing knowledge that is sensitive, incomplete, or incorrect, all of which can harm the company [22]. Nevertheless, social ties are an important conduit for increasing cross-border knowledge sharing. Thus, it is suggested that managerial and technological efforts should be made to ensure that individuals of far-flung sites establish a relational ground with the remote colleagues through socialization mechanisms such as face-to-face (FtF) meetings before and/or during collaboration and maintain a social touch through ICT [18, 26].

2.3. Research Gap

While these different bodies of research highlight the importance of formal boundary spanning mechanisms (i.e., activities of the formal boundary spanner) and informal boundary spanning mechanisms (i.e., communication and information sharing through social ties), no studies, to our best knowledge, have yet explored how these boundary spanning mechanisms would interact with each other when jointly pursued. The underlying assumption of the literature portrays the effects of the two mechanisms as independent or complementary. A tension between nominated boundary spanners and the emergence of alternative boundary spanners in-practice was observed in the context of inter-firm IS development project [21]. However, the negative interaction has not been explored in the context of our study where we are looking at groups of far-flung operations relying on other sites for accessing larger knowledge resources.

3. Methodology

We conducted a longitudinal case study to explore the research questions. We selected a case study since we did not find relevant theory or empirical studies that had examined the interactions of formal and informal boundary mechanisms. Our study site provides a unique opportunity to study these interactions at multiple groups of a far-flung operation. The study site regularly transfers technologies from the headquarters sites that instigate many local technical problems, which have already been addressed in those sites. The transfer of technologies also makes it paramount that in addition to expressed local technical problems, latent issues related to best practices are shared across sites. This opportunity allows us to "sharpen existing theory by pointing to gaps and beginning to fill them." [30, p.21].

3.1. Site Description

The organization featured in this case study (hereafter, TechCo) is an advanced manufacturing plant

located in the U.S., the only overseas plant of its Asian conglomerate owner. The other plants, considered to be more advanced than TechCo, are all colocated side by side at the headquarters campus. TechCo employs around a thousand employees, half of which are equipment and process engineers. At Techo, there are 8 engineering groups and each has 1- 3 expatriate managers. The use of expatriate managers, called "coordinators," originates from the early days of the TechCo operation. The coordinators are assigned from the sister plants at the headquarters campus to the same functional group at TechCo. A coordinator's main job includes technical advising and knowledge brokering. An overseas tenure is two years on average. The organizational structure is the same across plants such that each plant has 8 engineering groups. All groups are closely monitored and compared (ranked) in terms of group performance; any technical problems usually degrade group performance. In addition, Plant M, one of the sister plants, has been formally appointed as the mentor plant for TechCo. Thus, each group at TechCo has its own official communication partner (i.e., a mentor group) at Plant M.

TechCo management had launched several managerial and technological initiatives to improve the cross-border communication. Early managerial initiatives included the headquarters visiting program. Select new engineers were given opportunities to get trained and work at the sister plants for several months. A more recent initiative in late 2005 included the transformation of hierarchical group structure into self-managed team structure, which had been already adopted by the other sites for several years, such that the standardization helped creating a higher sense of shared work culture and organizational identity. In summer 2006, TechCo also completed new IT projects aimed to provide advanced ICT-mediated cross-border communication channels.

3.2. Data Collection and Analysis

We focused on the eight engineering groups because each group had at least one coordinator. By doing so, we could examine the different effects of boundary spanners across groups without the confounding of the organizational culture and structure. Each group represents an embedded case study [35].

The data was collected from site visit interviews and follow-up email exchanges, beginning in February 2006 and ending in February 2007. Semi-structured face-to-face interviews were conducted in the mother tongue of the interviewee by the first author, who was bilingual in both English and the Asian language. Each interview lasted from one hour to one and a half hours. A half of the interviews were not tape-recorded, but notes were taken during and shortly after the interviews. Non-English interviews were later transcribed in English by the interviewer. In total, 30 individuals were interviewed from 8 manufacturing groups and 2 administrative groups: 16 coordinators (who served as expatriate technical advisors), 12 American engineers or managers, one HR manager, and one IT manager. To reduce the bias associated with impression management and retrospective sensemaking [9], first, the interviews involved various and knowledgeable informants who provided diverse perspectives on cross-border knowledge sharing. The HR manager cooperated in carefully selecting the interviewees such that we could have representatives from different functional areas, groups, and organizations (local vs. headquarters). In particular, 2-3 individuals were selected from each manufacturing group, who were known to be highly connected to the members of their group, thus could give a holistic view of the activities within the group. We acknowledge, however, that a bias might exist in the interviewees' perspectives because most interviewees were in the managerial or senior engineer position. Second, the interviews focused on recent and current knowledge sharing events allowing us to have both a retrospective and a real time view. Additional data was gathered from project reports containing information on organizational and technological initiatives regarding cross-border communication.

Data collection and analysis were done through iteration [12]. As for the interview protocol, early interviews asked interviewees a broad question of how their groups access and appropriate the knowledge resources residing in the sister plants. Later interviews focused more on specifically emerged themes, such as formal boundary spanner's scanning efforts, interpersonal network and relationships, group members' cross-border communication, and the use of technical intermediaries (e.g., email, IM, VC, phone, KMS). Since the data collection was longitudinal, the data analysis was ongoing. When a new, uncovered theme emerged in later interviews, the earlier interviewees were contacted via email for feedback. The two researchers met biweekly to make sense of the interview data. The data was analyzed by initial codes drawn from the research question and literature review (e.g., types of information request, the breadth and strength of one's social network, etc.) added by newly found codes as the interviews proceeded. The codes were grouped into fewer themes (e.g., proactive scanning, responsive scanning, etc.). The other researcher played a role of "devil's advocate" against

what were conceived of as findings by the interviewer. The sensemaking sessions helped explore emergent themes and refine future questions. An individual case description was written for each of the 8 groups at TechCo, illustrating the emergent conceptual themes. For each team, a theme was assessed into nominal categories to build a foundation for cross-case comparison analyses (e.g., the breadth of coordinator's external network: narrow – somewhat narrow – med – somewhat broad – broad). Based on the ratings associated with the emergent themes, the researchers examined within-group similarities coupled with intergroup differences. Table 1 summarizes the analysis.

4. Findings

4.1. Formal Boundary Spanners and Cross-Boundary Knowledge Transfer

The coordinators were instrumental in identifying and transferring remote knowledge for solving locally identified problems. Each TechCo group and their counterparts at Plant M held a monthly (at times a biweekly) videoconference (VC) to discuss technical issues at TechCo. In between VCs, communications occurred via phone, IM, and email between coordinators and their counterparts at Plant M. Coordinators also reached official contact points in other plants. Most knowledge sharing activities with the formal contacts centered on solving locally situated problems at TechCo. An American equipment engineer acknowledged the critical role of a coordinator in searching for and finding relevant information in other plants on request of group members concerning immediate technical issues.

"A problem occurs any time around some kind of change point. We can't let our equipment run forever. We need to stop it and do some stable maintenance like cleaning the chambers, changing parts that have gone weary… When we restart the process, we often run into problems. Parts were misplaced or misconnected, the chambers or robot arms fail after a week or so, a film is not uniform, etc. If we can not figure out the problem, we summarize what we've got and give it to DB, and he'll send it to a person who he feels is most knowledgeable in that area…lot of times, they've seen the problem and may give us some suggestions where else we can check and test."

Coordinators frequently reached other official contacts (i.e., official contact points in other sister groups including Plant M mentor group) for information. The official contacts, however, functioned mainly as technical advisors for expressed needs (i.e., merely responding to articulated information requests) rather than as means for proactive scanning of the current remote site practices. A coordinator noted,

"Unless officially reported, there is no way I would know about ongoing improvements or issues occurring in other plants. Because the other plants are all next to each other, the engineers across the campus have many opportunities to talk to each other about what's going on in their groups. A lot of information gets exchanged over cigarette smoking, coffee, or at the cafeteria. They casually talk about little accidents they had, issues they are dealing with, or work in progress. Being far from such interaction, I have to make an effort to keep myself updated as much as I can by bugging my colleagues."

As revealed in the coordinator's comment, the coordinators had to use their own informal information seeking networks established in the sister plants to proactively scan external activities.

The 8 TechCo groups could be categorized into three different levels based on their coordinator's scanning ability and the nature of remote knowledge the local groups received as a result. Three groups were at the low level, with their coordinators mostly focusing on finding information to resolve locally identified problems. There were four groups at the high level, with their coordinators focusing on proactively scanning site-specific activities through their social ties to find new opportunities for improvement while also finding information needed for current problems. As such, the cross-boundary scanning activities of the coordinators in the high group were not only responsive but also proactive, exploring solutions for latent needs. Lastly, one group was rated as the mid level, with the coordinator engaged in periodic, but not consistent proactive scanning activities. Next, we illustrate two cases that highlight the contrast between the low group and the high group. Such "polar" cases can help identify contrasting patterns in the data [9].

4.1.1. C Group- Responsive Boundary Spanning

The C Group coordinator had spent his entire career in R&D before he was assigned to TechCo in late 2004. He had no previous experience and no social ties in manufacturing. As a result, his main contact was limited to Plant M mentor group contacts and the official contacts in other groups, and his boundary spanning activities centered on finding information for expressed local information needs. He acknowledged the lack of social ties as a barrier to effective communication.

"Because my network is very limited, I pretty much rely on the C Group contact point at Plant M whenever I need information. I contact them, on average, 5-6 times a week. Because people there are busy the feedback often gets delayed, which I totally understand…."

The coordinator did not have the relational luxury of reaching the official contacts for non-urgent tasks in busy times; neither did he expect them to voluntarily send him useful information about best practices or locally experienced technical issues that could be relevant to his group practices.

"It is hard to expect that they [the formal contacts] voluntarily send me any useful information first. Because I already keep them busy with getting me information related to issues here and because I am not personally close enough to contact them just to say hi and chat and see what's going on these days in their groups, the interactions are strictly limited to data transfer related to our urgent needs."

4.1.2. V Group- Proactive Boundary Spanning

JH, the V Group coordinator, was very comfortable getting help from his social ties in the other V Groups. He had close ties in every V Group. They used to be in the same group for years until the group was dissolved.

"In every V Group, I have former colleagues of mine who I can rely on for help. We are friends. Because they know who is in charge of what in their group, they can go straight to the source. To be honest with you, I sometimes even think that the information benefit I draw from the meetings with Plant M mentor group is marginal because I find them often redundant."

Through his social ties, JH was not only able to find information relevant to the current local problems in his group, but be aware of new activities at the sister groups via casual phone conversation and interest group email circulation. Sometimes, his friends even sent JH information first, which they believed might be of interest and relevance to JH's group at TechCo. A process engineer recalled how his group was able to greatly benefit from relevant best practices used in other groups, with the help of their coordinator, JH.

"JH is the key for us. He is doing a good job in terms of overviewing what improvements are happening in other plants and picking what works for us…(illustrating an episode of his team having a new practice transferred that resulted in a huge improvement on yield) JH saw the diffusion of an innovation that helped optimizing a few steps in the dry etch process and made the transfer happen."

JH also benefited from accessing an electronic knowledge repository which functioned as a central repository that maintained information on activities of every V Group. Repositories were designed to store information concerning plant-specific group activities, each run by a community of the same functional groups across plants for better inter-plant knowledge sharing. Only a few communities like V Groups regularly updated their repositories with new information.

To recap, formal boundary spanners were perceived to play a critical role in seeking and transferring useful and relevant knowledge residing in other sites to serve the needs of their local groups, using official contacts at the sister plants as well as their informal networks (e.g., social ties). The groups varied with respect to the perceived ability of the formal boundary spanners to discover remotely situated new best practices for innovation and transfer them to their groups. What appeared to explain the difference was the boundary banner's social ties at the remote sites. Although rare, one could also benefit from well-maintained electronic knowledge repositories.

4.2. Informal Boundary Spanning and Cross-Boundary Knowledge Transfer

In contrast to formal boundary spanning activities, informal boundary spanning by group members were rare in every group. Only a few engineers in each group directly exchanged email with their social ties in the sister plants. Information concerning urgent technical issues or new best practices was rarely exchanged. Rather, most inquires concerned non-urgent technical information. For instance, one interviewed senior engineer who had been with TechCo for ten years named only three to four individuals at the sister plants as acquaintances but were not in contact with most of them. He maintained one contact, who was an ex-coordinator and currently a VC counterpart. He occasionally reached the contact for getting him technical documents. Most group members lost contact with their ex-coordinators once the coordinators were returned to their home sites.

Despite several managerial and technological initiatives implemented by the management, aimed at promoting informal boundary spanning, the TechCo group members rarely used the technological intermediaries for informal communication, nor did they make an effort to cultivate new social ties with the remote colleagues.

"Last year, we took several IT initiatives like switching the groupware to the headquarters' such that people have the same email system and use features like intranet instant messaging, e-communities and company directory. We built a KM system. We also built videoconference rooms for richer semi-face-to-face communication. By far, videoconference is the only thing that seems to be working fine." (HR manager)

While each TechCo group maintained regular formal communication with its mentor group at Plant M through VC and its coordinator(s), most group members rarely had direct communication with their remote colleagues in any form. Even email exchanges between regular VC participants were rare in between meetings. The underuse of ICT was at least partially due to the lack of social ties. ICT including VC helped maintain relationships or revitalize dormant relationships, but rarely created new relationships. For instance, about the role of VC for creating new social ties, an American engineer commented,

"Create? No. Strengthen? Yes. Face time helps. However, in almost all cases, I had met them prior to the videoconference when I traveled to the headquarters."

Once in a while, engineers from other groups visited a TechCo group for short-term knowledge transfer, but such a site visit hardly transcended into new social tie-building. Interestingly, those who had traveled to the sites at the headquarters formed most social ties, but rarely exploited them once they returned to their group at TechCo. A senior American engineer said,

"Most of my contacts were established through trips to sister groups and a few are former coordinators. TechCo engineers who have traveled there have the most contacts… Having counterparts at the remote site as contacts can make your trip much easier and more efficient… For things that are small, specific, and mundane, I email directly to my contacts. But for [anything] else, I ask YN [a coordinator] to get me information."

The engineer thought of his social ties as assisting him with simple questions rather than as information ties that could feed him periodically with valuable know-how or new best practices undertaken in their sites.

TechCo built an advanced knowledge management system (KMS) in summer 2006 to leverage expertise residing in the other plants. KMS was an email-based discussion forum through which knowledge seekers could get their information inquiries answered by domain experts in the sister groups. Once a seeker described his or her inquiry and posted it on the forum, a pool of accredited experts whose areas of expertise most closely matched the domain of the inquiry was automatically notified via email. Once an expert voluntarily answered the question, the answer was stored and publicly shared on the forum. This system provided TechCo engineers, even if they did not have many social ties at the remote site, an opportunity to make use of the best available knowledge resources in the company. Yet, only a few engineers were using the system. Most interviewees agreed that the failure was largely attributed to having coordinators and VC as more familiar and efficient alternatives to the system. One American engineer commented,

"*Probably no one in my group has used it. We don't have a habit of using it. I kind of have my paths of getting information already from the coordinator and often from videoconference."*

The IT manager commented on the failure of KMS,

"Unfortunately, we were wrong… It takes time to prepare data, and people on both sides are hesitant to invest that time when the return is questionable, either due to differences in the way the plant runs or misunderstanding of the question. This problem is amplified when using a text-based communication channel. Using coordinators and videoconference can mitigate such uncertainty."

What appeared to curtail group members' information boundary spanning were the formal boundary spanners. The group members had been accustomed to getting information from the sister sites through the coordinators. The knowledge brokering role of the coordinators had become a routine of the way the group tap into the knowledge resources in the sister plants.

American engineers acknowledged that although having social ties would help them getting information they need, they perceived coordinators as the most effective and efficient information channel to rely on, especially for urgent matters.

"DB [a coordinator] knows who to talk to, who to contact in Plant J, K, L, M, and N. He explains the problem to someone who knows what to do. If we have a really bad problem, DB usually gets back to us within a day. It's really quick."

Table 1. Summary of the key characteristics of TechCo groups

Group	Group Size	Coordinator's social ties (breadth / strength)	Joint group knowledge repository	KMS use	Coordinator's proactive scanning of remote plants	Interpersonal cross-border comm.	Group's transfer of knowledge from remote plants (occurrence)
P	70	Somewhat broad / med	Little useful	None	Low	Little	Somewhat frequent
V	55	Broad / very strong	Useful	Little	High	Little	Very frequent
I	21	Broad / strong	Somewhat useful	Little	High	Little	Frequent
C	28	Narrow / weak	Little useful	Little	Low	None	Somewhat infrequent
S	31	Somewhat broad / med	Little useful	None	Low	Little	Somewhat frequent
E	84	Broad / strong	Somewhat useful	Little	High	Some	Frequent
D	41	Somewhat broad / med	Useful	Little	Medium	Little	Frequent
M	11	Broad / strong	Somewhat useful	Little	High	Moderate	Frequent

"It is true that once you establish contacts in a particular site it is easier to contact them directly for information; however in this business things change very quickly. It may be that within 6 months the existing contact may not be the best person to get information from and the coordinator is now the best person to go through to get the right information. The coordinator is always going to be more aware of what is going on in other sites and who is responsible for what."

The coordinators' attitude toward informal communication between engineers across the sites might have negatively influenced the informal boundary spanning mechanism. Although agreeing that more interpersonal communication between TechCo engineers and the engineers in the other plants would ease their job burden and help engineers finding information for their own tasks, the coordinators were concerned with group member's direct social ties rendering mixed, including non-qualified, information from different sources, resulting in confusion, and perhaps even performance loss. Additionally, site-specific best practices could sometimes be even detrimental to TechCo. A coordinator commented on the necessity of limiting direct information flow to a certain level,

"Direct interpersonal communication between the engineers here and the headquarters' engineers is something the management wants to promote. That's why TechCo has recently adopted MyExch [the headquarters' groupware] for better communication. However, it needs to be controlled. I think it is most effective if communication can occur down at the section leader level who knows what issues are needed to be answered in the group. Section leaders can avoid mixed interpretations by filtering in and out information at an appropriate level."

Several coordinators reported that when a TechCo engineer contacted someone at another plant for information, the remote contact almost always included the group's coordinator as an email recipient. Sometimes, the remote contact asked a coordinator for clarification instead of directly asking the original knowledge seeker. Moreover, it was not uncommon that a reply was sent instead to a coordinator in the source's native language. Then, the coordinator had to translate the received message in English. One coordinator commented,

"I think it will be very useful if people have more contacts and can exchange information with their contacts. But, I need to know what information flows between my engineers and others. I need to make sure no one receives wrong information from his own contact and applies it where it should not be applied. I tell my group members to let me know and include me in their email when they contact people there."

The key characteristics of the 8 TechCo groups are summarized in Table 1. The table shows that the ability of groups to identify and transfer remotely situated knowledge largely depended on their coordinators' proactive scanning ability. Such ability was determined by the coordinator's social ties. TechCo engineers in most groups rarely communicated with their remote colleagues.

5. Discussion

In this study, we found that the formal boundary spanning mechanism was perceived to have a positive effect on the ability of dispersed groups to identify and transfer remotely situated knowledge as similarly suggested and found in the previous literatures. Formal

boundary spanners were generally perceived to be able to meet the expressed information needs for locally identified, immediate technical problems. The groups varied in terms of the perceived ability of the formal boundary spanners to discover and transfer remotely situated new best practices for innovation. The differences appeared to be explained by the boundary spanner's social network at the remote sites. The informal boundary spanning mechanism was also perceived to be important for cross-boundary knowledge sharing, but, despite organizational efforts to promote it, informal boundary spanning was rare, thus had a very weak effect on the group's cross-boundary knowledge sharing. The lack of group members' participations in boundary spanning is a puzzling but interesting finding which has been overlooked in the previous literatures. What might explain this is that the formal boundary spanning mechanism suppresses the informal boundary spanning mechanism in certain circumstances.

We believe that the crowding-out concept of cognitive evaluation theory [8] might provide an explanation for the negative relationship between the mechanisms of formal boundary spanning and informal boundary spanning. The crowding-out concept was extended to knowledge transfer literature by Osterloh and Frey [27]. The cognitive evaluation theory suggests that one's intrinsic motivation is shaped by one's perceived locus of control [8]. When one is forced by an external influence to behave in a certain way, one's perceived locus of control is likely to diminish, which, in turn, affects the intrinsic motivation. Specifically, one's perceived locus of control is influenced by the controlling aspect and the informing aspect of an external actor. The stronger the external actor's control power (i.e., controlling aspect) as well as his/her competence (i.e., informing aspect) are perceived by the focal person, the more the focal person's perceived locus of control is diminished and, consequently, intrinsic motivation is reduced. This negative influence is called a "crowding-out" effect [27].

This effect suggests that the motivation of group members to cultivate social ties for informal boundary spanning is likely to be suppressed, or "crowded-out," when the formal boundary spanner is perceived to be more competent in finding and bringing in knowledge from the remote site and more powerful in deciding what information the group should accept or not. As a result, we might see no salient informal boundary spanning efforts in the group. As hinted in the finding section, the engineers perceived their coordinators as the most effective and efficient information channel. Although the findings reveal differences in the coordinators' ability to meet latent needs (i.e., identify and transfer new best practices for unexpected improvement), the groups seemed to perceive their coordinator's boundary spanning ability as competent because the coordinators had managed to meet the groups' expressed information needs (i.e., bringing in information that solves current issues). In addition, the formal position of the coordinators as to handling the mainstream information flows in and out of the groups might have induced a perceived legitimacy on the coordinators' control power. We can speculate this notion from the example of a coordinator receiving cc-ed email from the email exchange between a group member and his remote contact.

Another circumstance we should not overlook is that the formal boundary spanning mechanism has been used since the foundation of TechCo. While knowledge brokering was not the only role they had to play, this role had become a routine and hardly evoked a change in the way groups handled their information needs. The management provided the group members new ways to create and maintain their own social ties as well as to get information without even building personal ties. Nevertheless, the habit of relying on the formal boundary spanners, even though not every one was capable of bringing in new best practices, was so institutionalized that it had become taken for granted, no other practices were conceived. In our speculation, if the firm had put an early effort in promoting the informal boundary spanning mechanism in parallel to the formal boundary spanning mechanism, the suppressing effect would not be so salient, or perhaps we might have even observed a synergistic interaction between the two.

All in all, we make a theoretical as well as an empirical contribution to the boundary spanner and virtual team literatures as the findings call into question the implicit view of the literatures that portrays the effects of the two boundary spanning mechanisms as independent or complementary. We also call for extended investigation into the circumstances in which one suppresses the other.

Our findings also have practical applications. First, before deciding to transfer personnel to far-flung operations, firms should assess the social ties of expatriate candidates at the knowledge source site. Second, firms should be aware that dispersed groups might be "satisficed" as long as their immediate short-term information needs are fulfilled. A narrow focus on short-term efficiency might overlook the latent needs and opportunities for further innovation. Third, firms should assess how formal and informal boundary spanning mechanisms would co-exist, complement,

and/or compete with each other before they invest in any form of boundary-spanning initiatives.

Because our findings are based on a case study of eight groups in an organization, the study has well known limitations such as the generalizability of the results. In addition, we had no data on the group performance or behavioral motivations that would further validate the findings. We also did not explicitly address language and culture issues. Nevertheless, we believe that despite these limitations, our exploratory findings provide important contributions to the boundary spanner and virtual team literatures. The limitations identify promising areas for future research. Future research could also look at in what circumstances the formal boundary spanner-led knowledge sharing is more effective than that enabled through informal boundary spanning, or vice versa, by using group performance measures.

6. References

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