KNOWLEDGE SHARING BETWEEN LOCAL WORK CONTEXTS:
A MULTI-METHOD CASE STUDY

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INTRODUCTION

An important challenge facing knowledge-intensive organizations is how to integrate knowledge that is dispersed throughout the organization (Becker, 2002; Grant, 1996). Knowledge is dispersed across departments, units, teams, individuals, specializations, practices, locations, et cetera, and is thus "not given to anyone in its totality" (Hayek, 1945, p. 520). In a similar way, Tsoukas argues that organizations are distributed knowledge systems that cannot be surveyed as a whole as they are lacking an "overseeing mind" (Tsoukas, 2003). The practice-based and context-bound nature of knowledge implies that effective knowledge creation relies on specialization by individuals or units (leading to a collection of heterogeneous knowledge assets), with the goal of the firm being to establish integration of these knowledge assets (Grant, 1996). In other words, managing knowledge involves a tension between specialization on the one hand (in order for specialized knowledge creation to occur) and integration on the other (in order for the organization to be able to benefit from the combination of the various pockets of specialized knowledge).

This paper focuses on the integration of knowledge that is dispersed across employees in two distinct (yet strongly related) organizational units in a large engineering firm. Because of their separate histories and practices, both units have created their own "local work context" (Bechky, 2003). The sharing of knowledge between these different local work contexts can be problematic because of the existence of different knowledge barriers. Our aim in this paper is to uncover and identify knowledge sharing barriers between these local work contexts. Following Nahapiet and Ghoshal's (1998) conceptualization of social capital, we distinguish three types of barriers that may play a role in this process: (1) structural barriers (related to network roles and structures), (2) relational barriers (related to the quality of relationships in terms of trust, shared identity and the like) and (3) cognitive barriers (related to differences and similarities in the kind of knowledge being created and applied in either context). Hence, the research question this paper will provide an answer to:

> *How do structural, relational, and cognitive barriers influence knowledge sharing between different local work contexts?*

This study contributes to the literature on knowledge integration in a two important ways. First, previous research has mainly focused on different types of knowledge sharing barriers (epistemological and motivational) between people that share a common practice. Less attention has been paid to knowledge sharing between people from different local work contexts within the same company (Bechky, 2003; Brown & Duguid, 1991; Hislop, 2005), which is the focus of the

current study. Second, the study answers the call put forward by Argote and Ingram (2000), who called for more research on the properties of social networks that facilitate (or impede) knowledge transfer (structural barriers), and identified the implications of the many levels of potential identification for knowledge transfer in organizations (relational barriers) as an important area for research.

We will first discuss the theoretical basis for our study, building on Bechky's (2003) concept of occupational communities and local work contexts, different conceptualizations of social capital and the concept of Transactive Memory (Wegner et al., 1985). This theoretical discussion provides the frame of reference for interpreting the findings from a multi-method case study within an engineering firm (which we will call International Engineering), in which we combined social network analysis, survey research and interviews. We will discuss findings from the different methods used to provide insight into the role of structural, relational and cognitive barriers in knowledge sharing between local work contexts, followed by a discussion section in which we will highlight the theoretical and practical implications of these findings.

THEORY

Local work contexts

The term "local work context" was coined by Bechky (2003) to refer to the differences in conceptualization of the work and product, the locus of practice, and the use of language, between different "occupational communities". These communities each have their own unique social and cognitive repertoires, and therefore have their own situated and context-specific understanding of a certain work situation (Bechky, 2003). As a consequence, occupational communities develop their own, context-specific knowledge repertoires and knowledge regimes (Howard-Grenville & Carlile, 2006). Due to social and cognitive constraints within localized contexts, knowledge becomes 'sticky' which impedes knowledge sharing between different work contexts (Bechky, 2003; Von Hippel, 1994).

The lack of a shared local work context causes what Bechky (2003) calls *decontextualization*, which refers to the context-based use of different words and concepts to talk about the same object, leading to differences in understanding of problems. Decontextualization is the result of interpretation problems between occupational groups, which result from the differences in the way knowledge is constructed within a particular social context. Consequently, the more different groups within an organization have different local work contexts, the more likely there will be differences in understanding and interpretation, and the more likely there will

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be problems in knowledge sharing between these groups. While Bechky's (2003) work provides us with very valuable insights into how the transformation of local understandings is vital to effective knowledge sharing between different work contexts, a systematic analysis of the actual barriers of knowledge sharing between local work contexts is lacking. In the following sections, we will use Nahapiet and Ghoshal's (1998) conceptualization of social capital as a basis for identifying such barriers. Before that, however, we will discuss an important precondition for effective knowledge sharing (both within and between local work contexts): the extent to which a transactive memory system or TMS exists. As we will discuss, a TMS is related to barriers on the structural, relational and cognitive level.

Transactive Memory Systems

For effective knowledge sharing to take place between local work contexts, is not required that people in different contexts have a full understanding of the knowledge that is created and applied in the other context. What *is* important though, is that there is a sufficient insight into what colleagues who are working in a different context know. This relates to the concept of a *transactive memory system*, defined as ''. . . a set of individual memory systems in combination with the communication that takes place between individuals'' (Wegner et al., 1985: 256). Transactive memory systems are built on the notion of individuals playing the role of "external memory" for other individuals who, in turn, encode "meta-memories" (i.e., memories about the memories of others). In other words, a transactive memory system refers to a collective's shared knowledge of who knows what, and the processes to retrieve, share and apply that shared knowledge. A transactive memory system is developed and maintained through three inter-related processes:

(1) Directory updating, the process by which actors create directories of meta-memories (who knows what), including information about the subject and location of the knowledge as well as perceptions about the individual's own and others' expertise on each subject (Rulke & Rau, 2000).

(2) Information allocation, the process by which actors who receive information determine which other actors in the network would find that information relevant to their respective areas of expertise, and pass the information on.

(3) Retrieval coordination, the process by which actors who are confronted with a task for which they do not possess all the necessary expertise, coordinate the retrieval of information among the experts they have identified in the directory updating process.

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These processes are more likely to effectively take place within local work contexts than across these contexts: actors will have a better insight into what actors with whom they share a work context know, and share more information with these actors, than with actors in a different context. This likely absence of an effective transactive memory system between local work contexts would contribute to structural, relational and cognitive barriers to knowledge sharing between these contexts, as will be explained below. In order to provide more insight into what these barriers entail, we will first discuss literature on social capital.

Social capital

In the literature on knowledge management, the concept of social capital is frequently discussed as a factor that facilitates knowledge sharing (Adler & Kwon, 2002; Nahapiet & Ghoshal, 1998; Van den Hooff & Huysman, 2009). Social capital refers to the sum of the actual and potential resources embedded within, available through, and derived from the network of the relationships possessed by an individual or social unit (Nahapiet & Ghoshal, 1998, p. 243).

An important distinction is made between *bonding* and *bridging* social capital (Putnam, 2000), where bonding social capital is typical for strong network ties, and is found between individuals in tightly-knit and close within-group relationships. Bonding social capital may be, by choice or necessity, inward looking and tends to reinforce exclusive identities and homogeneous groups. It also may create strong out-group antagonism (Putnam, 2000). Bridging social capital, on the other hand, is linked to weak ties, loose connections between individuals who may provide useful information or new perspectives but do not interact very frequently (Granovetter, 1982). It can generate broader identities and reciprocity (Putnam, 2000). In general, we expect to find high levels of bonding social capital *within* local work contexts, whereas bridging social capital would benefit the exchange of knowledge *between* local work contexts. We may also expect that strong bonding social capital impedes the knowledge sharing between groups.

In order to get more insight into the influence of bonding and bridging social capital on knowledge sharing between different work contexts, the distinction made by Nahapiet and Ghoshal (1998) between three different dimensions of social capital is useful. These are the (1) structural, (2) relational and (3) cognitive dimensions. The structural dimension refers to the way group members are connected through network ties: who you know, and how to reach them. Relevant aspects are the presence or the absence of network ties between actors, and an identifiable pattern of linkages in terms of density, connectivity, and hierarchy (Nahapiet &

Ghoshal, 1998 p. 244). The relational dimension refers to the kind of personal relationships people have, such as respect and friendship, that influence their behavior. Key aspects are trust and trustworthiness, norms and sanctions, obligations and expectations, and identity and identification (Nahapiet & Ghoshal, 1998: 244). Finally, the cognitive dimension of social capital refers to resources providing shared representation, interpretation, and systems of meaning among parties, such as shared language and codes and shared narratives (Nahapiet & Ghoshal, 1998). Together, these dimensions of social capital affect knowledge sharing by (1) providing access to people with relevant knowledge or needs and questions; (2) providing a common interest and an atmosphere of mutual trust and appreciation of the value of others' knowledge; (3) sharing a common ability that helps in understanding other people's knowledge and as well as correct interpretation and assessment of all knowledge (Cohen & Prusak, 2001; Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998; Van den Hooff & Huysman, 2009; Wasko & Faraj, 2005).

In light of our focus on knowledge sharing between local work contexts, however, the distinction between bonding and bridging capital should be incorporated into each of these dimensions as well: the dynamics within specific local work contexts will most often be conducive to the existence of bonding social capital (structural, relational and cognitive), but are likely to have an adverse effect on the existence of bridging social capital (structural, relational and cognitive) between different contexts, as these create their own knowledge regimes, particular repertoires, frames of reference and understandings (Brown & Duguid, 2001). In the following section, we will define concrete barriers to knowledge sharing of a structural, relational and cognitive nature, based on the discussion above.

Structural, Relational, and Cognitive Barriers

Structural barriers arise from the network structure within and between local work contexts. High levels of bonding structural social capital coincide with frequent interactions between employees about their shared context, increasing the level of density of the network within such a context. However, low levels of bridging structural social capital are likely to occur between local work contexts, as employees primarily have connections within their own context. Thus, a likely structural barrier to knowledge sharing between local work contexts is the fact that few or no connections will be found between these contexts. A lack of connections will mean that there is no "infrastructure" for a TMS either: not being connected means that it is very problematic to have insight into others' expertise, let alone allocate or retrieve information.

In terms of *relational* barriers, people are likely to primarily identify with their direct local work context, with colleagues with whom they share a common practice (Brown & Duguid, 2001). Thus, there will be a high level of bonding relational social capital within the local work context. At the same time, it is likely that relationships between different occupational communities will be characterized by in-group / out-group dynamics (preferring the "own" group to "the others") (Gefen & Ridings, 2003). This will be coupled with lower levels of trust, shared norms and expectations, leading to lower levels of bridging relational social capital. This creates a relational barrier to knowledge sharing between local work contexts. This lack of bridging relational social capital is also likely to negatively affect TMS processes (and vice versa), as insight into and use of one another's expertise is both influenced by and an influence on the quality of mutual relationships.

Finally, in terms of *cognitive* barriers, the process of decontextualization that Bechky (2003) refers to is relevant: as different local work contexts are characterized by the use of different words and concepts to talk about the same object, and to different understandings and interpretations, cognitive differences are likely to arise. Again, we would expect higher levels of bonding cognitive social capital within local work contexts, together with lower levels of bridging cognitive social capital between local work contexts. For instance, knowledge is likely to be specific to (and embedded in) a given context (Argote & Ingram, 2000), and there may be differences in complexity or tacitness of knowledge between work contexts that would hinder the transfer of such knowledge from one context to another (Simonin, 1999). The expected lack of a TMS across local work contexts is also an element of cognitive barriers, as a lack of insight into and use of one another's expertise is both a consequence of and conducive to a lack of bridging cognitive social capital.

METHODS

Case description

Data were collected from employees of one of the, in total eleven, divisions of International Engineering. International Engineering is an independent, worldwide operating, technical consultancy firm. The specific division in this study will be called Industrial Constructions and is situated in two locations in the Netherlands: Rotterdam and Dordrecht.

In 1995, International Engineering acquired an independent multi-disciplinary firm of consulting engineers operating world-wide in the transport and processing industry. This company, with 20 employees at the time, became the Rotterdam business group (RBG). The

company remained operating under its original name until the complete integration within International Engineering in 2001. Gradually after the acquisition of RBG, the former management left the firm, the volume of work decreased considerably and staff became more and more de-motivated. Currently, RBG is divided into three advisory groups (departments). In 2009, RBG employed approximately 60 employees; mainly highly educated (90%) consultants and project managers, who have a strong background in chemical, electrical, mechanical and civil engineering. There are also two international advisory groups, in Moscow and St. Petersburg, attached to this business group.

In November 2005, International Engineering acquired another Dutch engineering company, which became the Dordrecht business group (DBG), and consisted of about 200 employees. Together with RBG, they became one division within International Engineering; Industrial Constructions. DBG consists of five departments and two international advisory groups in India and Thailand. The employees of DBG, consisting of experienced engineers, designers, project managers, procurement specialists and cost controllers, also have a strong background in different fields of engineering, but their level of education is somewhat lower (about 50% higher education).

The reason for acquiring DBG was that its operational activities were viewed to be complementary to the activities of RBG. The new business combination will strengthen the market position of Industrial Constructions and aims to provide excellent advisory services in the process industry. The main challenge became to integrate and to align the business operations of the two business groups. The strategic view of the new division was the so called "client-oriented one-stop-shop model" which aims at providing a full service to the client, without disconcerting the client with complexities of internal operations.

Although both business groups were convinced about the need for organizational integration, there was no widely shared view on how to accomplish this. The business group's managers also acknowledged that their respective employees did not know how to find one another or where specific knowledge and expertise resides within Industrial Constructions. The business groups differ in many respects: history, structure, culture, protocols, IT-infrastructure etc. These differences between the local work contexts could lead to misinterpretations between the two business groups and present an indication of existing knowledge sharing barriers. Taking away the barriers of knowledge sharing between the two business groups would possibly facilitate the integration process.

Data collection and measurements

To explore and identify the knowledge sharing barriers between the local work contexts of Industrial Constructions, we conducted a social network analysis, two survey studies, and eleven interviews. The focus of the Knowledge Management (KM) survey was on the general tendency towards knowledge sharing, knowledge management, and the level of social capital within the two business groups. The Transactive Memory System (TMS) survey was aimed at understanding the level of TMS within and between the business groups.

All employees of RBG and a selection of DBG (only management and higher level employees) were asked to complete two surveys and some of them were asked for an additional interview. A request was send out to 93 selected employees to complete the online surveys. In the end, 69 (74%) respondents completed the KM survey and 74 (80%) respondents completed the TMS survey including the social network question. The majority of the respondents were located in Rotterdam (65% in KM survey and 66% in the TMS survey). For the interviews, all four managers of RBG were interviewed and seven managers of DBG were interviewed.

Social Capital Dimensions

The KM questionnaire was designed to measure each of the social capital dimensions – structural, relational, and cognitive social capital. The constructs were all measured using a 1–5 point (strongly disagree to strongly agree) Likert-type scale. We used the social capital scale that was developed by Van den Hooff and Huysman (2009) that consists of items such as "I know what knowledge could be relevant to which colleague" (structural social capital), "I feel connected to my colleagues" (relational social capital), and "Sometimes I do not understand my colleagues when they tell me something about their work" (cognitive social capital, reverse coded).

Table 1 presents the descriptives, the reliability and the correlations of the social capital scales. The table shows that all scales have a satisfactory reliability, with Cronbach's alpha values of .71 or higher. A principal components analysis with varimax rotation was performed to measure each of the three variables. The social capital scales meet the criteria of convergent as well as discriminant validity as all items loaded quite clearly on the distinguished constructs.

Table 1. Descriptives, reliabilities and correlations for all social capital scales

	Variable	Mean	SD	1	2	3
1.	Structural Social Capital	3.45	0.542	**0.71**		
2.	Relational Social Capital	4.04	0.518	0.103	**0.80**	
3.	Cognitive Social Capital	3.99	0.617	0.208	0.287*	**0.71**

Table shows Pearson correlation coefficients for all relationships. Significance indicated by: *p <.05
Cronbach's alpha shown on diagonals

Social Network Analysis

Social network analyses aim at identifying and studying patterns and/or regularities in relationships among interacting actors or units (Wasserman & Faust, 2007). A network perspective can identify the hidden barriers to collaboration (Cross et al., 2006) and hence, knowledge sharing within these collaborations.

At a global network level, we can use the density measure (Monge & Contractor, 2003), which is a concept that refers to the completeness of the relations in the network. Density is measured as the ratio of total existing links to all possible links and represents the percentage of ties being utilized in the network (Hanneman & Riddle, 2005).

The question that was asked in order to display the social network structure and to measure the density of the advice and collaboration network, both within and between the two business groups and at the divisional level, is based on the first of advisory question of Cross et al. (2001). The original survey question about the type of advice requests in the network considers those situations in which one turns to colleagues for finding a solution for a specific work related problem, when one is not able to solve this him or herself (Cross et al., 2001). Employees of Industrial Constructions were asked to mark their colleagues, out of a full employee list, with whom they discuss work related issues with a certain frequency (no contact, several times a year, monthly, several times a month, weekly, several times a week, daily).

To calculate the density metric, the social network data set is dichotomized. Contact of at least a monthly basis (i.e. daily, several times a week, weekly, several times a month or monthly contact) was given the value of 1, while responses of contact on less than a monthly basis (no contact or several times a year) was given a value of 0. This process of dichotomization led to a reduction of the total amount of ties in the network by 15%.

Transactive Memory System

The TMS questionnaire was designed to measure each of the three interrelated transactive memory processes – directory updating, information allocation and retrieval coordination. The constructs were all measured using a 1–5 point (strongly disagree to strongly agree) Likert-type scale.

We developed the transactive memory scales based on the work of Jackson & Klobas (2008) and Lewis (2003). We asked all employees TMS-questions about both their own department and business group, and about the other business group – RBG about DBG and vice versa. The scales consist of items such as "I make sure others within my department know which

knowledge I possess" (directory updating), "I notify others within RBG (the other business group from the DBG perspective) about information which might be beneficial and relevant for them, and pass this on" (information allocation) and "I know who to approach within my business group when I am facing a certain work related issue and need specific knowledge to solve that issue" (retrieval coordination).

Table 2 presents the descriptives, the reliability and the correlations of the transactive memory scales. The table shows that all scales have a satisfactory reliability, with Cronbach's alpha values of .75 or higher.

Table 2. Transactive Memory System within- and between groups

	Variable	Mean	SD	1	2	3	4	5	6
1.	Directory updating within own BG	4.02	0.718	**0.88**					
2.	Directory updating between BGs	2.57	0.895	0.612**	**0.81**				
3.	Information Allocation within own BG	4.40	0.643	0.346**	0.208	**0.89**			
4.	Information Allocation between BGs	3.39	1.039	0.133	0.351**	0.521**	**0.78**		
5.	Retrieval Coordination within own BG	4.44	0.703	0.621**	0.253*	0.302**	0.096	**0.94**	
6.	Retrieval Coordination between BGs	3.41	1.025	0.385**	0.531**	0.153	0.335**	0.535**	**0.75**

Table shows Pearson correlation coefficients for all relationships. Significance indicated by: ** $p < .01$ Cronbach's alpha shown on diagonals

Semi-structured interviews

We conducted eleven semi-structured interviews of one hour with managers of Industrial Constructions responsible for the divisional business groups and departments within the business groups. The interviews dealt with the level and sophistication of knowledge management practices and strategies within both business groups. The progress of and problems in the process of integrating the two business groups was also seriously addressed. Special attention was paid to the interrelationships and knowledge sharing activities between the two business groups. The semi-structured interviews provided relevant input for the rich picture of the organization's knowledge sharing activities, strategies and relevant data about the structural, relational, and cognitive dimensions of social capital.

RESULTS

Our multi-method approach yielded different sets of data which will be presented in this section. We start with the results from the survey on the three social capital dimensions, followed by the social network analysis, the transactive memory processes within and between the local work contexts and finally the results from the interview will be presented.

Social Capital Dimensions

The social capital dimensions are measured within Industrial Constructions. An independent-samples t-test is conducted in order to assess whether there are significant differences in the level of each of the social capital dimensions between both business groups. Table 3 presents the descriptives per business group and the results of the t-test.

Table 3. Independent samples t-test results of the Social Capital Scales

	Variable	BG	Mean	SD	t
1.	Structural Social Capital	RBG	3.30	0.5113	-3.323**
		DBG	3.74	0.5025	
2.	Relational Social Capital	RBG	4.06	0.5815	0.536
		DBG	3.99	0.3884	
3.	Cognitive Social Capital	RBG	3.92	0.5998	-1.048
		DBG	4.09	0.6511	

Significance indicated by: ** $p < .01$

Table 1 already showed that there are high levels of social capital within Industrial Constructions as a whole and this table displays the high levels of social capital within both individual business groups. This indicates that in general, employees feel they have regular contact with others who have relevant knowledge to them, view the organization as a group they belong to, have trust in their colleagues and understand each other.

Employees of RBG score significantly lower on the level of structural social capital (m=3.30), than employees of DBG (m=3.74). This significant difference could have something to do with the age of the business groups. Whereas the employees in Dordrecht are already working together for many years, Rotterdam is still a relatively new organization. Moreover RBG has grown in four years time from 20 to 60 employees.
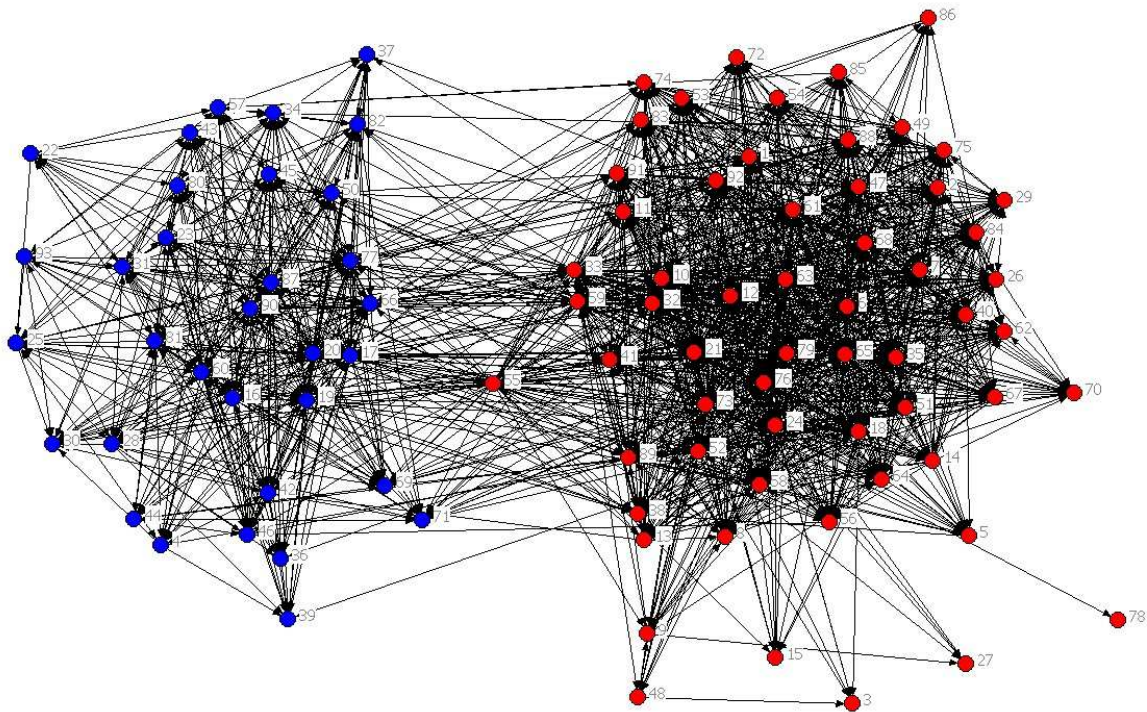
Because these social capital scales only explain the sum of the actual and potential resources embedded within, available through, and derived from the network of the relationships possessed by employees of Industrial Constructions as a whole, we will now provide a more in-depth overview of the social network structure. This structure will be studied both within and between the two business groups, providing insights in any existing barriers to knowledge sharing between the local work contexts.

Social Network Analysis

Researchers have drawn the attention to the impact of social network properties on knowledge sharing (Argote and Ingram, 2000; Yuan et al, 2005; Cross et al, 2001), to capture the richness of

organizational data and analyze the emergent patterns or structures that arise from knowledge sharing within and between organizational units (Palazzolo, 2005). We collected social network data from both business groups and used density metrics to analyze the data. First we will present the network diagram of Industrial Constructions in figure 1. This drawing was made in NetDraw[2], an application in UCINET (v6.232). The numbers of the dots in the figure correspond to the employees of the company. The red dots represent the employees of RBG and the blue dots are managers of DBG.

Figure 1. Social Network Diagram of Industrial Constructions

There is a clearly visible separation between the two business groups with only one central actor in the middle. The structure of the network diagram reflects the physical separation of the two business groups; DBG situated in Dordrecht on the left and RBG situated in Rotterdam on the right.

Within and between business group densities

Table 4 displays an overview of both the within-group (**bold**) and the between-business group densities in numbers and percentages.

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[2] NetDraw is a free program written by Steve Borgatti for visualizing both 1-mode and 2-mode social network data. It can handle multiple relations at the same time, and can use node attributes to set colors, shapes, and sizes of nodes (Borgatti, Everett and Freeman 1999).

Table 4. Within and Between Business Group Densities

	RBG	DBG
RBG	**0.410 | 41%**	0.051 | 5.1%
DBG	0.039 | 3.9%	**0.458 | 45.8%**

The table must be interpreted by reading from left to right. The number 0.051 (RBG to DBG) indicates that the proportion of ties utilized by RBG towards DBG is 5.1% – the 60 employees of RBG, on average, are connected to 3 employees of DBG. DBG has, on average, a connection with 1 employee of RBG. This is a clear indication of the degree of clustering within the two business groups, a lack of connections outside their own work context and thus the absence of a knowledge sharing infrastructure. We must acknowledge that they are both two separate entities and there is a very low degree of bridging structural social capital between the two business groups. On the other hand, there is a very high degree of bonding structural social capital within both business groups as indicated by the high density within RBG (41%) and within DBG (45.8%).

Transactive Memory System

The transactive memory processes are measured within RBG, DBG and between the two business groups. A paired-samples t-test is conducted in order to assess whether there are significant differences between the levels of TMS within and between the business groups. Table 5 presents the descriptives per transactive memory process, both within and between the business groups and the results of the t-test.

Table 5 Paired-samples t-test results of the Transactive Memory scales

	Variable	BG	Mean	SD	t
1.	Directory Updating	Within own BG	4.01	0.724	16.83**
		Between the BGs	2.56	0.894	
2.	Information Allocation	Within own BG	4.40	0.643	9.80**
		Between the BGs	3.39	1.039	
3.	Retrieval Coordination	Within own BG	4.43	0.703	9.91**
		Between the BGs	3.41	1.025	

Significance indicated by: ** $p < .01$

All results indicate a significant positive difference between the level of TMS within the business groups compared to the level of TMS between the business groups. These results give a good indication of the high level of bonding social capital, within the business groups and the very low level of bridging social capital between the two business groups. Because the differences are so large, it makes us wonder about the possible inwards looking attitude of both individual business groups, thereby creating a possible strong negative out-group antagonism.

The transactive memory processes can also be analyzed on the business group levels individually. An independent-samples t-test is conducted in order to assess whether there are significant differences in the level of each of the transactive memory processes between both business groups. Table 6 presents the descriptives per business group and the results of the t-test.

Table 6 Independent samples t-test results of the Transactive Memory System Scales

	Variable	BG	Mean	SD	t
1.	Directory updating within own BG	RBG	3.90	0.782	-2.324**
		DBG	4.25	0.512	
2.	Directory updating between BGs	RBG	2.43	0.925	-1.744*
		DBG	2.81	0.794	
3.	Information Allocation within own BG	RBG	4.39	0.671	-0.265
		DBG	4.43	0.597	
4.	Information Allocation between BGs	RBG	3.37	1.069	-0.205
		DBG	3.42	0.997	
5.	Retrieval Coordination within own BG	RBG	4.36	0.787	-1.365
		DBG	4.56	0.486	
6.	Retrieval Coordination between BGs	RBG	3.40	1.046	-0.166
		DBG	3.44	1.003	

Significance indicated by: ** $p < 0.05$; * $p < 0.10$

The two business groups significantly differ in the level of directory updating within their own business group (RBG m=3.90 and DBG m=4.25). It appears that employees of DBG, perhaps due to their longer shared history, experience more accurate perceptions about their own and others' expertise on certain subjects. DBG also scores significantly higher (m=2.81) on the level of directory updating in RBG, than RBG does in DBG (m=2.43). It might be easier for DBG to learn about the expertise in RBG, because Rotterdam is the smaller location with the lower number of employees.

Main results from semi-structured interviews

Results from the one-hour semi-structured interviews with managers from both business groups, by and large, confirm the impression we received from the surveys and the social network analysis. Managers from both business groups agreed on the need to intensify knowledge sharing activities between the business groups in order to integrate business operations into a client oriented one-stop-shop-model. We also observed high willingness and levels of trust which enhances collaboration. We did not find strong indications of out-group antagonism, as observed in the TMS survey results. However, there was no shared idea (not even within the business groups) what integration was and how it should be implemented.

Dissimilarities in the characteristics of tasks were found to be the main barrier in knowledge transfer between the business groups (Argote and Ingram, 2000). Within RBG, the main task of the employees, the engineering consultants, involves client management. Within their daily tasks they are working with abstract, and to a large extent tacit, knowledge which is personal knowledge and hard to codify. The employees of DBG on the other hand were working mainly on detailed, very concrete explicit knowledge which was codified in engineering designs, protocols, and documents that also met safety measures and other guidelines that can be partly embedded in databases, structures and guidelines.

Both business groups did not have an explicit knowledge management strategy. However, considering the emphasis put on these different types of "knowledges" within each of the business groups, the knowledge management approach in RBG can best be characterized as a personalization strategy (Hansen et al, 1999). In this KM strategy there is an emphasis on face-to-face interaction, informal meetings and a low level use of ICT repositories. DBG on the other hand, emphasized the role of ICT for sharing knowledge. Employees in Dordrecht experienced the lack of adequate and consistent information systems as the main barrier for information sharing. This approach can be characterized as a codification strategy (Hansen et al, 1999). There were no information systems in place to facilitate knowledge sharing between the two business groups.

DISCUSSION AND IMPLICATIONS

As mentioned in the previous section, all our findings present interesting insights in the way different knowledge sharing barriers impede knowledge sharing between different local work contexts. In this case study we analyzed structural, relational and cognitive barriers of knowledge sharing between two different business groups, two separate local work contexts, which were both part of one division of a large engineering company.

Structural barriers

The social network structure of Industrial Constructions clearly displays the separate local work contexts of both business groups. It appears that the physical separation, as well as the history of both individual business groups, has contributed to the separation of their work contexts. RBG and DBG have different conceptualizations of work and products, loci of practice, and use different work languages (jargon) (Bechky, 2003). These differences have emerged through situated activity over time and represent a structural barrier to knowledge sharing between the local work contexts.

The inward looking network structure, as represented by the high density level within the business groups versus the low density levels between the business groups, indicates high levels of bonding structural social capital and low levels of bridging structural social capital respectively.

The lack of connections shows there is no "infrastructure" for a TMS between the two business groups. Not being connected means that it is very problematic to have insight into others' expertise, let alone allocate or retrieve information.

Relational barriers

We observed a relatively high level of trust between the two business groups, which suggests a willingness to share knowledge and a low relational barrier. The main indications for this high level of trust were the high levels of overall relational social capital and statements in the interviews by the managers of both groups. So, in contrast to what we expected, high levels of bonding relational social capital did not automatically result in low levels of relational bridging social capital.

No initiatives were initiated to bring the two business groups closer together. Still, the level of relational social capital is high, even between the local work contexts. This indicates that even though the employees of RBG and DBG do not know each other, they do feel connected and identify themselves as being one group. Therefore, both the bonding and bridging relational social capital levels are high in terms of affiliation, but in terms of transactive memory, there is still work to be done, because the level of directory updating, and thus, level of expertise recognition among both groups is still very low.

Cognitive barriers

The one-stop-shop model in de case study was intended to create an interdependent task structure. However, this model was rather vague and therefore unable to serve as a bonding mechanism (Inkpen and Tsang, 2005). The lack of social identification processes, behavioral routines, and evolved modes of discourse, which allow different individuals to coordinate their activities over time prevented the emergence of a common understanding and common language (Posterl, 2002). Because of the task dissimilarities the managers on both sides were not able to create a task structure that connects the two separate structures of RBG and DBG. The former consisted predominantly of highly abstract, and to a large extent, tacit knowledge, while the latter mainly entailed concrete and explicit knowledge. The strength of the one-stop-shop model was that it did not aim at complete convergence of the two task structures but tried to position the

different tasks into a value chain of different tasks, varying from abstract, conceptual knowledge (grand engineering designs) to explicit and concrete knowledge (engineering drawings, detailed designs etc.). Because of a lack of macro organizational strategy for a cognitive division of labor, and therefore a lack of urgency to collaborate, cognitive social capital barriers impeded the knowledge sharing between the two business groups.

Concluding remarks

The aim of our research was to identify barriers of knowledge sharing between different local work contexts. Our case study provided us with a unique chance to apply a multi-method and multi-theoretical approach to study the intrigues of knowledge sharing between two groups that differed in many respects. Our research provides a few interesting theoretical and empirical insights. The first is that we were able to present a rich analysis of the nature of the different barriers. It was interesting to see that the different theoretical perspectives, methods and analyses resulted in a rather consistent picture of the knowledge sharing barriers.

This research contributes to Bechky's (2003) theory on knowledge sharing between local work contexts. We have developed a multidimensional framework to analyze different types of barriers, specifically on a structural, relational and cognitive level. Thereby, we have extended the social capital framework originally developed by Nahapiet and Goshal (1998) and combined this with Putnam's (2000) work on bonding and bridging social capital.

Social capital and transactive memory systems cannot be assumed in advance but develop over time. With respect to social capital, Portes (1998, p. 3) argues that social networks "are not a natural given and must be constructed through investments strategies oriented to the institutionalization of group relations, usable as a reliable source of other benefits". The lack of 'investment strategies' in our case study clearly prevented the emergence of structural and cognitive social capital, and partly relational social capital as well. At this point, social capital is potentially connected to an organization's transactive memory. As Brandon and Hollingshead (2004) argue, the heart of a functioning transactive memory system is the cognitive interdependence among group members. The authors point at two organizational mechanisms to create cognitive interdependence: reward systems and (interdependent) task structures. The absence of reward systems that stimulate between-group collaboration and the lack of interdependent task structures explain the slow ascendency of a transactive memory system.

Limitations

The research presented in this paper is based on a study conducted in one organization. Including more organizations in the survey would provide more external validity and reliability to our results (Yin 1994).

We plan to extend this research further to include more organizations in the survey, and to combine both the KM and TMS survey into one single questionnaire. Further suggestions for future research would include a longitudinal approach to establish causality between TMS and knowledge sharing barriers.

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