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Social Structure of “Coopetition” Within a Multiunit Organization: Coordination, Competition, and Intraorganizational Knowledge Sharing

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Abstract

Drawing on a social network perspective of organizational coordination, this paper investigates the effectiveness of coordination mechanisms on knowledge sharing in intraorganizational networks that consist of both collaborative and competitive ties among organizational units. Internal knowledge sharing within a multiunit organization requires formal hierarchical structure and informal lateral relations as coordination mechanisms. Using sociometric techniques, this paper analyzes how formal hierarchical structure and informal lateral relations influence knowledge sharing and how interunit competition moderates the association between such coordination mechanisms and knowledge sharing in a large, multiunit company. Results show that formal hierarchical structure, in the form of centralization, has a significant negative effect on knowledge sharing, and informal lateral relations, in the form of social interaction, have a significant positive effect on knowledge sharing among units that compete with each other for market share, but not among units that compete with each other for internal resources.

(Knowledge Sharing; Organizational Capability; Social Network Analysis)

In today's multiunit organizations, many units are forced to both compete and cooperate with each other. This paradox has become a major challenge for multiunit organizations that seek to manage their internal knowledge flows. Organizational units like to learn from each other and benefit from new knowledge developed by other units. At the same time, these units have to compete with each other for internal resources and external market share. How can a multiunit organization coordinate its units and encourage them to share knowledge with their competitors inside the organization?

Although previous research has highlighted the importance of coordination within organizations (e.g., Grant 1996, Kogut and Zander 1996), there is little systematic evidence on the use of coordination mechanisms to facilitate knowledge sharing among organizational units that are competitors. Indeed, organizational units compete with each other to gain resources and competences that are embedded in intraorganizational networks. These units may serve similar markets, and their rewards and status may depend on how they perform relative to other units in the same organization. The patterns of intraorganizational (or interunit) competition may complicate the coordination processes within a multiunit organization.

To investigate how knowledge sharing is coordinated among competing units, I conducted two major tests: (1) examined the relationship between coordination mechanisms and interunit knowledge sharing and (2) examined whether the strength of the association between coordination mechanisms and knowledge sharing depended on conditions of interunit competition. I argue that organizational units compete with each other in different forms and require different coordination mechanisms to facilitate knowledge sharing.

I begin the paper by introducing the concept of interunit “coopetition” within an organization, a concept that emphasizes simultaneously cooperative and competitive behavior among organizational units. Drawing on a social network perspective of coordination, I conceptualize the multiunit organization as a social structure of coopetition, and I propose a research model suggesting both formal and informal ways of coordinating such a social structure. I discuss the theoretical basis from which I derive specific

hypotheses and then describe the research site, operational measures, and analytical methods of this research. After reporting my methods, I present the results and evaluate my research model. Finally, I discuss the implications of the results in the context of the main theoretical concerns addressed and outlined some directions for future research.

Theory and Hypotheses

Coopetition Within an Organization: Interunit Cooperation and Competition

Coopetition refers to simultaneously cooperative and competitive behavior. A common form of coopetition is knowledge sharing among competitors. The cooperative aspect of such knowledge sharing refers to the collective use of shared knowledge to pursue common interests. The competitive aspect refers to the use of shared knowledge to make private gains in an attempt to outperform the partners (Khanna et al. 1998). While competing with each other, business players also cooperate among themselves to acquire new knowledge from each other. As Hamel et al. (1989) argued, "Using an alliance with a competitor to acquire new technologies or skills is not devious. It reflects the commitment and capacity for each partner to absorb the skills of the other."

Inside a multiunit organization, coopetition occurs among different units. To gain new knowledge and to exploit economies of scope for their business operations, organizational units have to cooperate with each other and learn from each other. At the same time, these units compete with each other in many aspects of their business operations because they are compared on the basis of their ability to achieve high rates of return. Interestingly, the extant literature tends to focus on either the cooperative aspect (e.g., Gupta and Govindarajan 1986) or the competitive aspect of interunit relationships (e.g., Williamson 1975). In this research, I examine both interunit cooperation and interunit competition. Organizational units are indeed embedded in a social structure of coopetition in which there is a need to coordinate different units so that knowledge can be effectively shared. The question is, How can a firm coordinate different units to enhance knowledge sharing among them?

Organizational Coordination and Interunit Knowledge Sharing

Coordinating different units to share their knowledge is critical to enhance an organization's capabilities (Kogut and Zander 1996). Recent research on the organizational capability view of the firm suggests multiunit organizations design a set of higher-ordered principles to coordinate diverse units, and develop the capacity to replicate

knowledge within the firm (e.g., Grant 1996, Madhok 1996, Zander and Kogut 1995). According to this view, organizational capability is the extent to which knowledge among different parts of an organization can be harnessed, shared, and integrated (e.g., Grant 1996, Kogut and Zander 1996, Spender and Grant 1996). Such internal sharing of firm-specific knowledge, though difficult for others to imitate, is an important source of competitive advantage. Given that diverse knowledge is embedded in different units, the way the firm coordinates different units significantly affects on the pattern of intra-organizational knowledge sharing.

Organizational coordination refers to integrating or linking together different parts of an organization (Van de Ven et al. 1976). The existing literature on organizational coordination suggests two generic types of coordination: (1) formal hierarchical structure and (2) informal lateral relations. For example, Martinez and Jarillo (1989) pointed out the salience of these two types of coordination based on an extensive review of the literature on coordination mechanisms in multinational corporations. In addition, Ghoshal et al. (1994) considered these two types of coordination the main influencing factors in their study of interunit communication within organizations. Drawing on these studies, I established a link between coordination and organizational capability, and argue that both formal hierarchical structure and informal lateral relations will have significant impacts on interunit knowledge sharing.

Formal Hierarchical Structure. Formal hierarchical structure is one way to coordinate a complex system comprising multiple specialized units. Analysis of hierarchical structure as a coordination mechanism has played an important role in organizational research. Previous studies identified several elements of formal structure, including centralization, formalization, and specialization (e.g., Miller and Droge 1986, Van de Ven 1976). Empirical evidence, however, indicates that these elements are not independent (e.g., Child 1972). According to Ghoshal et al. (1994), "centralization alone represents a somewhat partial but parsimonious operationalization of the structure domain." Thus, in an effort to retain parsimony, I draw on the work of Ghoshal et al., making centralization the focal aspect of formal hierarchical structure in this research.

Centralization is one of the fundamental dimensions of organizational design (Egelhoff 1988, Miller and Droge 1986). A hierarchical structure of internal organization is primarily built upon centralization of authority relations where coordination is achieved through vertically imposed bureaucratic processes. Centralization determines

whether the locus of decision-making authority lies in the higher or lower levels of a hierarchical relationship. In international management research, centralization has been studied as the dyadic relationship between headquarters and specific organizational units. It measures the relative influence or control exercised by the headquarters and the organizational unit in relevant decision-making processes. Within a multiunit (or multinational) organization where different units have different strategic priorities, centralization is likely to have a negative impact on knowledge sharing. As Grant (1996) argued, "once organizations are viewed as institutions for integrating knowledge, a major part of which is tacit and can be exercised by those who possess it, then hierarchical coordination fails." Greater centralization prevents a unit manager from exercising greater discretion in dealing with the demands of his or her relevant task environment. Centralization may cause inefficiency because the transfer of knowledge from individual unit to corporate headquarters is prone to error and thus retards decision making (Poppo 1995). Also, it is possible that centralization reduces the initiatives that a unit can take in interunit exchange. As a result, a unit in a highly centralized organization will not be interested in providing its knowledge to other units unless a higher authority requires the unit to do so. Such an inactive role reduces possible beneficial knowledge flows to other units in the same organization. Accordingly,

HYPOTHESIS 1. The level of centralization is negatively associated with the level of intraorganizational knowledge sharing.

Informal Lateral Relations. In contrast to hierarchical organizational structure, informal lateral relations comprise a more voluntary and personal mode of coordination. Given the fact that "most of the activity in an organization does not follow the vertical hierarchical structure" (Galbraith 1973), informal lateral relations become important as they coordinate activities across different organizational units and substantially improve the design of a formal organization. While informal relations often occur naturally, they can be fostered through internal social arrangements (such as cross-unit social events) that promote horizontal communications and interactions among different organizational units. Recent studies indicated that such cross-unit social interactions are effective in fostering lateral integrative processes within an organization (e.g., Ghoshal et al. 1994, Gupta et al. 1999). Hence, in this study, I focused on interunit social interaction as a manifestation of informal lateral relations.

Social interaction provides channels for information exchange among members of an organization (Homans

1950). Greater use of such channels implies increased access to peer organizational units and their resources (Gupta et al. 1999). Research on intraorganizational communication documented the importance of interunit interaction to diffuse new ideas within multiunit organizations (e.g., Ghoshal et al. 1994, Leonard-Barton and Sinha 1993). Interunit social interactions blur the boundaries between organizational units and stimulate the formation of common interests that, in turn, support the building of new exchange or cooperative relationships (Tsai and Ghoshal 1998). Indeed, social interaction is an important element of social capital that can facilitate knowledge transfer among different units of an organization (Coleman 1990). Through social interaction, organizational units gain more opportunities to share their resources or ideas and thus increase knowledge flows within the organization. Hence,

HYPOTHESIS 2. The level of social interaction among organizational units is positively associated with the level of intraorganizational knowledge sharing.

Moderating Role of Interunit Competition

While multiunit organizations encourage interunit knowledge sharing to realize economies of scope, they also allow interunit competition to achieve efficiency (Hill et al. 1992). Interunit relationships within multiunit organizations constitute a social structure of coopetition. Such a social structure represents a vehicle for cooperation (Walker et al. 1997) as well as a system for competition (Burt 1992). Simultaneous cooperation and competition may stimulate greater knowledge sharing, technological progress, and market expansion (Lado et al. 1997).

The association between coordination and intraorganizational knowledge sharing may vary with the conditions of competition within the organizations. Different organizational units not only collaborate with each other to share knowledge, but also compete with each other to maximize their own benefits. Internally, they vie for limited resources within the organization. Externally, they try to outperform other units that offer similar products or services in the marketplace. It is reasonable to expect that the effectiveness of coordination mechanisms on knowledge sharing depends upon the conditions of competition among organizational units.

Interunit competition may affect the way centralization, as a formal coordination mechanism, governs intraorganizational knowledge sharing. When organizational units are competing with each other, they are more sensitive to headquarters' control. Interunit competition makes organizational units react negatively toward headquarters' influence or interference in their own decisions. Organizational units may wonder whether headquarters

is making the best decisions for them. They may suspect that headquarters will sacrifice some units' interests and make decisions in favor of other units. When tightly controlled by headquarters, organizational units are less willing to take the initiative to share knowledge with competing units. A unit may prefer to retain profits from proprietary knowledge. These profits may be reduced if units are forced by headquarters to give knowledge to competitors. Organizational units may become more passive in providing knowledge to competing units under headquarters' influence. Put differently, centralization may have a more negative impact on knowledge sharing among competing units than among noncompeting units. Accordingly,

HYPOTHESIS 3. *Centralization is more negatively associated with knowledge sharing among organizational units that are competing with each other than among units that are not competing with each other.*

Although organizational units may resist headquarters' interference, they tend to learn from each other through informal social interactions. When organizational units are in competition, they have a strong incentive to understand each other—they want to discover what their competitors think and what their competitors know so that they can benchmark themselves and prepare for the consequences of competition. They also have a strong incentive to interact with each other to form some kind of tacit collusion without letting headquarters know. According to Smith ([1776] 1976), "People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices." In the strategy literature, research on microcompetitive behavior shows that business players with high-market overlap are more likely to voluntarily collaborate with each other than business players with low-market overlap (e.g., Baum and Korn 1999). Also, research on technology management suggests that extensive transfer of proprietary knowledge is likely to occur between competitors (e.g., Von Hippel 1987). It is important to interact with competitors and learn from them, particularly when competition is high.

Knowledge sharing among competing units within the same organization carries synergistic benefits because these units deal with similar resource constraints and market situations. For example, in General Motors, there is potential for competing units such as Buick, Cadillac, Chevrolet, Oldsmobile, and Pontiac to share their car manufacturing technology. They can benefit from the best technology developed by others. They may even design new cars together using the same engines or chassis to

reduce costs. Competition motivates these units to interact with each other to pursue common interests and benefit from the synergy of interunit knowledge sharing. To achieve synergistic benefits among competing units, informal coordination mechanisms are necessary as they can generate trust that reduces appropriation concerns (Gulati and Garguilo 1999, Gulati and Singh 1998). Social interaction allows competing units to communicate with each other and better know each other. Through interunit social interaction, organizational units are likely to have greater confidence in predicting the behaviors of the units with whom they compete and will be more willing to share knowledge with them. As a result, interunit competition may make the association between interunit social interaction and interunit knowledge sharing more salient. Accordingly,

HYPOTHESIS 4. *Social interaction is more positively associated with knowledge sharing among organizational units that are competing with each other than among units that are not competing with each other.*

Methods

Sample and Data Collection

The research was conducted in a large, multiunit company. The company started its petrochemical operations in 1954. In recent years, its total annual polyvinyl chloride (PVC) resin capacity exceeded 1.93 million metric tons, ranking the company as the largest PVC producer in the world. The company consists of 24 business units that have diversified into many businesses, including plastic raw materials, plastic secondary processing, fibers and textiles, electronic materials, and machinery equipment. In the mid-1980s, the company planned to enter the electronics and information industry, which was an unfamiliar territory for the company at that time. The company then decided to manufacture printed circuit boards, a product with few varieties, but has a long product life in the electronics industry. Through expertise and experience gained from business activities in the industry, the company expanded its operations gradually. After more than 10 years of effort, the company successfully established a fully integrated electronics raw materials operation.

In this research, I focused my investigation on how perceptions of interunit competition and coordination affect knowledge sharing behaviors within the company. To capture such perceptions and behaviors, I relied on questionnaire surveys.¹ Both interunit competition and knowledge sharing were considered asymmetric. The fact that unit *i* considers unit *j* a competitor, does not mean that unit *j* also views unit *i* as a competitor (Chen 1996).

Similarly, the fact that unit i shares its knowledge with unit j , does not mean that unit j would also share its knowledge with unit i in return. To capture such asymmetry, sociometric techniques were used in designing questionnaire items.

All questionnaire data were collected on site at two points in time. The first questionnaire survey was administered in 1996 and the second in 1998. The 1996 survey provided data for the independent variables in this study, and the 1998 survey provided data for the dependent variable. Decoupling the two surveys in time reduced concerns for common method bias and reverse causality in hypothesis testing. I asked the director and the most senior deputy director of each unit to respond to my questionnaires after consulting with top managers in the company's corporate headquarters. These directors were also interviewed after they completed in the questionnaires. During the interviews, I clarified questions and ensured that respondents provided complete information in the questionnaires. I assured respondents that their individual responses were confidential and would be used for research purposes only. In addition to questionnaire surveys, I also consulted corporate headquarters to obtain additional data (such as unit size and location) for my statistical analyses.

Interrater Agreement

Because I had multiple respondents in each unit, I calculated interrater agreement to see how responses varied within each unit. For relational data, I used the mean percentage agreement as a measure of interrater agreement. The mean percentage agreement is defined as (the number of responses selected by both respondents in a unit)/(the number of responses selected by at least one of the two respondents in a unit). The value of the mean percentage agreement can range from 0.0 (perfect inconsistency) to 1.0 (perfect consistency). In this study, the mean percentage agreement was 0.81 across all the relational measures. For nonrelational data (such as centralization), I used the methods prescribed by James et al. (1984, 1993) to calculate interrater agreement (see e.g., Kozlowski and Hatrup (1992) for a further discussion on the measure of interrater agreement).

Dependent Variable

Intraorganizational (or Interunit) Knowledge Sharing. To investigate the patterns of knowledge sharing within the organization, I asked each respondent to indicate the units from which they received technology or know-how. A "roster" and "free-choice" question format was used (see e.g., Wasserman and Faust (1994) for a discussion

of survey instruments for social network analysis). Respondents were asked to select their answers from a list containing all 24 units in the company. There was no constraint on the maximum number of selections that each respondent could make. To validate the data, I also asked the opposite question, that is, who came to them for new knowledge or expertise (see e.g., Krackhardt (1990) and Hansen (1999) for a similar cross-validation method).

Independent Variables

Centralization. Instead of considering centralization as a property of an organization as a whole, I measured centralization for each specific headquarters's subunit dyad and accessed the headquarters' influence on each subunit's decisions. Many studies used this approach to operationalize headquarter-subsidiary centralization (e.g., Birkinshaw et al. 1998, Singh 1986). In this research, I was primarily interested in each unit's decision-making power in dealing with interunit activities; therefore, several statements regarding interunit activities measured centralization: (1) "Our business transactions with other units should be approved by the headquarters"; (2) "Any agreement or dispute over the interunit activities should report to the headquarters and we should let the headquarters settle the issue"; and (3) "The headquarters has the ultimate power to decide whether or not we collaborate with other units in the company." These items were assessed on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). The Cronbach's coefficient alpha for this composite measure was 0.83 and the interrater agreement (rwg) was 0.77.

To test for construct validity, respondents were asked to indicate the frequency of communication between their units and the company's corporate headquarters for each of four modes of communication: face-to-face, over the phone, routine and periodic formal reports, and electronic or paper-based memos. These items were also assessed on a seven-point Likert scale. The average of responses to these four items represents a composite measure of headquarters-subunit communication. As expected, this composite measure of headquarters's subunit communication correlated positively with the degree of centralization ($r = 0.64$, $p < 0.01$). To transform the centralization measure for my subsequent analysis, I created a new 24x24 matrix reflecting the sum of centralization ratings for each pair of units in the company.

Social Interaction. The pattern of interunit social interaction was assessed through a sociometric question asking respondents to indicate the units with which their own unit interacted frequently during social occasions

(such as company picnics or sports clubs). Again, respondents received a list of all 24 units in the company, allowing them to easily select the appropriate units. A 24x24 matrix was created based on data collected from this sociometric question.

Interunit Competition. Two dimensions of interunit competition were identified in this research: (1) internal resource competition and (2) external market competition. Internal resource competition refers to the extent to which two units obtain resources from the same source. When two units rely on the same source for resource inputs, they are likely to compete with each other to gain preferential accesses to such resources. This idea is in line with the argument that structurally equivalent actors are substitutable and tend to be more competitive (Burt 1987). External market competition refers to the extent to which two units offer similar products or services in the marketplace. Such market competition is common in many multiunit organizations in which the reward systems are designed to take into account how each unit performs relative to other units that serve the same market (Bartlett and Ghoshal 1993).

Internal resource competition was measured by the extent to which organizational units were structurally equivalent based on internal resource flows within the company. I asked respondents to indicate from which units they acquired resources (such as input materials, components, or semiproducts) and constructed a matrix of interunit resource flows. Based on this matrix, I then identified structural equivalence among the company's 24 units. Organizational units that were structurally equivalent had similar patterns of relationships with other units. Because of the similarity of their ties, each of these units could be substituted for the other. Put differently, these units acquired resources from the same other units and competed with each other for such resources. I determined structural equivalence using an iterated correlation algorithm called CONCOR (Arabie et al. 1978, Breiger et al. 1975). I used UCINET (Borgatti et al. 1999), a network analytical program, to perform this algorithm. CONCOR identifies groups of actors with similar relationships and divides them into blocks. Applying CONCOR to the above-mentioned resource matrix resulted in four different blocks.² All units within each block were structurally equivalent. To use the results of structural equivalence for my subsequent analysis, I created a new 24x24 matrix in which cell equaled 1 if two units were structurally equivalent and 0 if they were not equivalent.

External market competition was measured by asking respondents to indicate which units compete with them in the marketplace. Like other sociometric questions reported in the study, this item was followed by a list of all

24 units from which respondents could select their answers. A 24x24 matrix was created based on data collected from this questionnaire item.

Control Variables

Unit Size. Large units tend to be more influential than small units and may dominate the knowledge-sharing processes in the company. Large units also tend to have more managerial and financial resources to develop new knowledge and may be more attractive to smaller units in search of knowledge. To control for a possible size effect, I used the logarithms of unit sales and number of employees as indicators of unit size, as suggested by Hitt et al. (1996). Because the two indicators were correlated, I averaged them to create a composite measure of unit size. The Cronbach's coefficient alpha for this composite measure was 0.94. I then created a 24x24 matrix of unit size reflecting the absolute difference of size between each pair of units in the company.

Geographic Proximity. Geographic locations provide a context for interactions and may influence the way different units share knowledge with each other. Two units operating in the same geographic area are more likely to contact each other to share local information. They may also exchange knowledge about their local operations. To account for this alternative explanation, I included a 24x24 matrix of geographic proximity in which a cell was coded 1 if two units had business operations in the same country, and 0 otherwise.

Strategic Relatedness. Two units operating in strategically related businesses are likely to share knowledge with each other. According to Markides and Williamson (1996) and Tsai (2000), two units are strategically related if they highlight the importance of the same strategic assets. To operationalize strategic relatedness, I asked respondents to assess, using a scale of high, low, or moderate, the importance of five broadly defined strategic assets to their own units: customer assets, channel assets, input assets, process assets, and market assets (see Markides and Williamson (1996) for a detailed description of these strategic assets). I aggregated responses for each unit and then compared the unit-level responses across all units in the company. Strategic relatedness was then determined based on the similarity of responses on highly important strategic assets. Two units are strategically related if they rated high on the same strategic assets. For example, if unit *i* rated high on input assets and process assets and unit *j* also rated high on those two assets, then unit *i* and unit *j* were considered strategically related. I created a 24x24 matrix of strategic relatedness in which a cell was

coded 1 if two units were strategically related, and 0 otherwise.

Analysis and Hypothesis Testing

I tested the hypotheses using the Quadratic Assignment Procedure (QAP) multiple regression technique. This approach enables the analysis of relational data (in sociomatrices) and the results of such analysis can be interpreted in a fashion similar to the results of ordinary multiple regression. Ordinary Least Square techniques are not appropriate here, because relational data are systematically interdependent and autocorrelation is an inherent problem in such data. QAP provides a better alternative as it allows direct comparison of matrix-level data and corrects the autocorrelation problem (Krackhardt 1988). QAP is a nonparametric statistical algorithm regressing a dependent matrix on one or several independent matrices. This algorithm first performs a standard multiple regression across corresponding cells of the dependent and independent matrices. Then it randomly permutes rows and columns of the dependent matrix and recomputes the regression. This permutation regression process is repeated a high number of times (in this case, 10,000 times) to estimate the standard error for the statistics of interests. This procedure determines whether the association between two matrices is a random occurrence and helps adjust for the autocorrelation problem (see e.g., Kilduff and Krackhardt (1994)).

Results

Table 1 presents the mean values, standard deviations, and correlations for all of the constructs in the study. The QAP significance test for correlations was used here because all data were converted into matrix form. As shown in the table, both centralization and social interaction are

significantly correlated with intraorganizational knowledge sharing, providing some initial evidence for my hypotheses. The correlation matrix in the table also shows that internal resource competition and external market competition are not significantly correlated with each other, suggesting that they represent different dimensions of competition.

Table 2 shows the results of QAP multiple regression analyses. Several models are estimated in this set of analyses. Model 1 includes control variables only. Model 2 reports the direct effects of both formal and informal coordination mechanisms on intraorganizational knowledge sharing. Model 3 tests the moderating effects of internal resource competition. Model 4 tests the moderating effects of external market competition.

Organizational Coordination and Interunit Knowledge Sharing

Hypothesis 1 predicts that greater centralization, as a manifestation of formal hierarchical structure, will be negatively associated with interunit knowledge sharing. The result in Model 2 reveals a significant negative relationship between centralization and knowledge sharing ($p < 0.01$). Thus, Hypothesis 1 is confirmed. Hypothesis 2 predicts that greater social interaction, as a manifestation of informal lateral relations, will be positively associated with knowledge sharing among organizational units. The result shows a significant positive relationship between social interaction and knowledge sharing ($p < 0.01$), providing support for Hypothesis 2.

For the sake of completeness, I also tested potential curvilinear effects of centralization and social interaction on interunit knowledge sharing. I squared the value in each cell of the independent matrices (the relational matrices for centralization and social interaction) and entered the squared matrices into the QAP regression equation. The results show that squared matrices are not statistically significant, suggesting no curvilinear effects.

Table 1 Means, Standard Deviations, and Correlations

Variables	Means	s.d.	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇
X ₁ Centralization	8.50	3.05							
X ₂ Social Interaction	0.32	0.47	0.09						
X ₃ Resource Competition	0.25	0.43	0.05	0.19*					
X ₄ Market Competition	0.34	0.47	-0.07	-0.09	0.00				
X ₅ Unit Size	0.48	0.39	0.14	0.05	0.04	0.03			
X ₆ Geographic Proximity	0.08	0.27	0.10	0.23**	0.23**	0.04	0.06		
X ₇ Strategic Relatedness	0.14	0.35	-0.16	0.09	0.13	0.44**	0.01	0.12	
X ₈ Knowledge Sharing	0.11	0.31	-0.19*	0.35**	0.16*	0.10	-0.05	0.17*	0.22**

* $p < 0.05$; ** $p < 0.01$

Table 2 The Effects of Coordination on Knowledge Sharing: Results of QAP Multiple Regression

Variables	Model 1	Model 2	Model 3	Model 4
Unit Size	-0.047	-0.035	-0.037	-0.037
Geographic Proximity	0.172*	0.113*	0.100 ⁺	0.107 ⁺
Strategic Relatedness	0.176**	0.126**	0.117*	0.098*
Centralization		-0.020**	-0.020**	-0.012*
Social Interaction		0.221**	0.216**	0.196**
Resource Competition			0.078	
Centralization × Resource Competition			-0.002	
Social Interaction × Resource Competition			-0.006	
Market Competition				0.209*
Centralization × Market Competition				-0.023*
Social Interaction × Market Competition				0.176 ⁺
R ² (Adj. R ²)	0.072 (0.068)	0.205 (0.199)	0.209 (0.199)	0.222 (0.212)

⁺ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$

Moderating Role of Interunit Competition

Model 3 introduces the interaction term between internal resource competition and centralization and examines whether the presence of internal resource competition moderates the influence of centralization on intra-organizational knowledge sharing. As shown in Model 3, the coefficient of this interaction term is not statistically significant, suggesting that the effect of centralization on knowledge sharing among units with resource competition is not statistically different from that among units without resource competition. Put differently, internal resource competition does not moderate the association between centralization and knowledge sharing. Model 3 also includes the interaction term between internal resource competition and social interaction. The result shows that this interaction term is not statistically significant, indicating that internal resource competition does not moderate the association between social interaction knowledge sharing. Hypothesis 3 is not supported.

Model 4 introduces the interaction term between external market competition and centralization and examines whether the effect of centralization was more salient for units with external market competition. The result shows that the coefficient for this interaction term is negative and is statistically significant at the 0.05 level, indicating that the effect of centralization on knowledge sharing becomes more negative in the face of external market competition. Model 4 also includes the interaction term between market competition and social interaction. The coefficient of the interaction term is positive as expected, but the result is only significant at the 0.10 level, suggesting that social interaction has somewhat greater impact on knowledge sharing among units that compete

with each other in the marketplace. In general, Hypothesis 4 is supported.

Discussion

The main objective of this research is to investigate the effects of different organizational coordination mechanisms on knowledge sharing among competing units within the same organization. Although previous research highlighted the importance of coordination inside multiunit organizations (e.g., Kogut and Zander 1996), few studies systematically examine the effectiveness of different organizational coordination mechanisms on intra-firm knowledge sharing. The results of this research contribute to the organizational capability view of the firm by showing how an organization's ability to transfer internal knowledge is influenced by both formal hierarchical structure and informal lateral relations.

Formal hierarchical structure represented by centralization shows a negative impact on intrafirm knowledge sharing. The more control the headquarters exercised on its subunits, the less the subunits were willing to share knowledge with other units. These findings contradict the conventional wisdom that centralization facilitates information processing within an organization (Egelhoff 1982, 1988). According to the information-processing perspective, centralization is likely to have a positive effect on intrafirm knowledge sharing because "centralization provides coordination and integration across the interdependency" (Egelhoff 1988). This perspective encompasses an implicit assumption that, in a vertical structure, most information flows are mediated by a firm's headquarters. Recent studies, however, have begun to challenge the information processing perspective, proposing that certain

flexible processes and shared values will replace the role of vertical structure in modern organizations (e.g., Bartlett and Ghoshal 1993, Ghoshal et al. 1994). In concurrence with these studies, I found that centralization served to impede knowledge flows among units. Centralization may impose certain identifiable costs on an organization. These costs include: (1) a tendency for headquarters to intervene excessively or inappropriately, (2) increased time and effort devoted to influencing activities with a corresponding reduction in organizational productivity, (3) poor decision making resulting from the distortion of information associated with activities to influence, and (4) a loss of efficiency as the organization adapts its structure and policies to enhance control activities (Milgrom and Roberts 1990). Because of such costs, centralization can become an ineffective way to coordinate. In fact, many organizations have radically decentralized sourcing, investment, and product strategy decisions to create internal markets inside their organization. The empirical evidence in this research echoes Hedlund's (1986), and Bartlett's and Ghoshal's (1993) assertions concerning the importance of decentralization in organizational design, especially in large multiunit organizations.

Informal lateral relations manifested in interunit social interaction show a significant positive effect on interunit knowledge sharing. Organizational units that interact with each other socially are likely to share knowledge with each other. The results confirm the importance of interunit social interaction as an effective coordination mechanism in a multiunit organization. Social interaction allows individual units to accumulate social capital that can help them gain access to new knowledge or new information. The flows of information or knowledge through interunit networks require social interaction to promote trust and to reduce perceived uncertainty about providing new knowledge to other units (or acquiring new knowledge from other units). Knowledge sharing involves a complex social process that demands collaborative efforts. Social interaction is indispensable in this process as it can create trust and foster cooperation.

This research extends the organizational capability view of the firm by examining how interunit competition moderates the association between coordination and intrafirm knowledge sharing. Two forms of interunit competition were examined in this study: (1) internal resource competition and (2) external market competition. The results confirm the moderating role of external market competition. The association between coordination and intrafirm knowledge sharing was significantly strengthened by external market competition. Centralization reduces interunit knowledge sharing when market competition exists between units. Social interaction enhances interunit

knowledge sharing when market competition exists between units. The results suggest that decentralization and social interaction are particularly important in encouraging knowledge flows among organizational units that compete with each other in the marketplace. This finding is interesting, as it implies that market competition among organizational units can facilitate integration of a decentralized organization (through interunit knowledge sharing) if the units interact with each other socially. The results of this research; however, do not support the moderating effect of internal resource competition. The association between coordination and intrafirm knowledge sharing was not significantly different when there was internal resource competition. A possible reason for this insignificant association is that, in a highly diversified company, business units may not find knowledge of their internal resource competitors relevant. Even though two units obtain resources from the same sources, they may develop very different applications and operate with very different knowledge. In contrast, knowledge of market competitors tends to be more relevant, as it comes from units facing similar external environmental dynamics. Cooperation and competition between units may occur in different arenas of their activities. It is important to examine how cooperation or competition in one arena affects cooperation or competition in another arena. Given that the results confirm the importance of coordinating competition with respect to externally oriented arenas but not internally oriented arenas, the implication is that multiunit organizations (particularly for those highly diversified) have to pay more attention to coordinating external market competition than to coordinating internal resource competition. The results provide a clear direction in response to my research question about how coordination among competing units affects interunit cooperation through knowledge sharing: multiunit organizations have to use appropriate coordination mechanisms under various conditions of interunit competition to stimulate knowledge sharing.

Note that the dependent variable for this research is reported behaviors of intrafirm knowledge sharing, rather than performance outcomes. Although not a performance indicator, intrafirm knowledge sharing is an interesting variable contributing to recent developments in strategy that conceptualize the firm as a bundle of resources and knowledge linked together through firm-specific routines that are the source of competitive advantage (e.g., Barney 1991, Madhok 1996) and as a unique shared context that enables knowledge sharing to facilitate productive activities (Kogut and Zander 1992). Several studies considered intrafirm knowledge sharing as an indicator of organizational capability and used it to predict various performance outcomes. For example, Tsai and Ghoshal (1998)

showed that intraorganizational knowledge sharing affected business unit product innovation, and Hansen (1999) showed that intraorganizational knowledge sharing affected project completion time. It is likely that intraorganizational knowledge sharing is actually a mediating variable between coordination and these performance outcomes. Future studies can explore this potential mediation effect.

Examining knowledge sharing among organizational units offers important implications for research on organizational learning. Inside a multiunit organization, learning involves the social processes through which one unit is affected by the knowledge of another (Tsai 2001). While many studies elaborated the concept of organizational learning, there is much less systematic understanding of the social processes that underlie how organizational units learn from each other. The results of this research contribute to the organizational learning literature by providing evidence that organizational learning is a social concept requiring social interactions among organizational units.

Using social network analysis, this research represents one of the first attempts to provide a structural view of coopetition and to explore the role of such coopetition in the context of a multiunit organization. By conceptualizing a multiunit organization as a social structure of coopetition, this research examined networks of collaborative and competitive ties within an organization in which different units collaborate with each other through knowledge sharing and compete with each other for resources and market share. Such a social structure of coopetition contains useful information for research on networks inside organizations. Social network research has provided many insights concerning how structural relations affect important outcomes (e.g., Burt 1987, Walker 1985, Walker et al. 1997). My results advance this stream of research by showing how the structure of social interaction and the structure of competition jointly determine an organization's ability to transfer knowledge internally.

This research also contributes to our understanding of intraorganizational competition, a topic that received little attention in organizational research (Kohn 1992). Scholars have studied the patterns of competition across firms (e.g., Baum and Korn 1999, Chen 1996), but have yet to carefully examine the structure of competition within firms. By examining both market and resource competition among organizational units, this research provides an initial step toward studying the role of intraorganizational competition. The results show that external market competition rather than internal resource competition influences interunit knowledge sharing, suggesting that organizational units are more interested

in getting knowledge from other units with whom they compete in the marketplace than from units with whom they compete for internal resources. The relative importance of external market competition versus internal resource competition; however, may vary in different organizations depending on their histories and strategic priorities. Future research can further examine this issue.

The results should be considered in light of several limitations. Of particular concern, is the potential sampling bias due to the fact that I only surveyed unit directors in the company. Although I had sought a larger number of respondents for each unit, the company approved the study on the condition that I restricted the survey to two respondents per unit. According to the company, the unit directors were the most informed individuals regarding interunit activities. These directors were also the key decision makers and their perceptions (regarding centralization) could influence major decisions in their units. These directors' responses were useful given that prior research suggested that managerial interpretation is critical to organizational learning (Lant et al. 1992). Another important concern is the external validity of this research, as I only focused on a single organization for my data collection. Although such a one-site sampling scheme is common in social network research, findings may not generalize to other samples, as we are not sure whether the phenomena we observed here will also hold in other organizations. In addition, the way I operationalized organizational coordination represents another limitation. I focused only on two dimensions of organizational coordination: centralization and social interaction. There are clearly other organizational coordination mechanisms (such as formalization and specialization) that warrant discussion. Future research can explore how these coordination mechanisms affect intraorganizational knowledge sharing. Future studies can also extend the theoretical propositions of this research to study knowledge sharing in strategic alliances and other interfirm arrangements. The structural view of coopetition proposed in this research has potential to bridge the research on strategic alliances and the research on interfirm rivalry, and to offer important implications for organizational theories.

Conclusion

The results of this research allow conclusions at two levels. First, it appears that both formal and informal coordination mechanisms influence intrafirm knowledge sharing. At a second level, the results indicate that the organizational capability view of the firm should be extended to include a moderating role for intraorganizational competition. The findings of this research

are particularly noteworthy given that interunit knowledge sharing can enhance overall organizational capabilities through collective learning and synergistic benefits generated from the processes of exchanging information, know-how, or local expertise among competing units. By examining the social structure of coopetition and internal knowledge sharing within a multiunit organization, this research suggests possible ways for coordinating organizational units to achieve synergy that is valuable to the organization as a whole. Knowledge is distributed asymmetrically across different units inside an organization. Without effective coordination, knowledge may not spread evenly across units within the same organization. Reducing hierarchical constraints and increasing interunit social interaction are the directions that managers may pursue to encourage internal knowledge flows and enhance the capabilities of their organizations.

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Endnotes

¹Archival data such as interunit workflows and transfer price are available, but unable to fully capture the behaviors of sharing tacit knowledge, which is not always embodied in workflows, nor priced in interunit transactions.

²The usual practice of applying CONCOR is to partition the full set of network actors into two blocks and then partition these two blocks again separately. Thus, n partitions will result in 2^n blocks. To determine the number of partitions and the number of blocks in CONCOR analysis, I analyzed intra- and interblock correlations (e.g., Shah (1998) for a discussion of this analysis). Two partitions (resulting in four blocks) were considered appropriate here in this case with a high average intrablock correlation of 0.19 and a low average interblock correlation of -0.03 . When three partitions were used (resulting in eight blocks), 50% of the blocks consisted of only singular and dyadic actors.

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