EXPLORING KNOWLEDGE MANAGEMENT USING NETWORK THEORIES: QUESTIONS, PARADOXES AND PROSPECTS

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ABSTRACT

This paper investigates knowledge management (KM) activities in communities and networks of practice and information and communication technologies' role and use in these knowledge networks. We develop five research questions based on network models and the existing literature. We then investigate these research questions using a case study of a university information technology (IT) department. While our findings confirm extant KM understandings, we also develop several new insights and contradictions. Our study reveals several KM research and practice paradoxes and proposes a pluralistic/paradoxical view of KM and its related concepts such as networks, knowledge sharing, learning, and information and communication technologies. We suggest that recognizing simultaneous opposites and contradictions can improve an organization's KM efforts and can explain conflicting research findings.

INTRODUCTION

When knowledge management (KM) came into vogue, many organizations began KM initiatives and the information systems (IS) field saw the emergence of titles like Chief Knowledge Officer (59). Some of the first attempts at managing knowledge involved codifying knowledge into computer systems for future retrieval. Some of these efforts were helpful but others consisted of much data entry and little use. Today's KM initiatives focus more on enabling knowledge flow between those that need it.

Researchers have drawn on a variety of disciplines and theories to help organizations understand how to better manage knowledge. Adopting a network perspective, this paper views organizations as social networks (3) composed of interlocking CoPs (communities of practice) or knowledge systems (7, 33, 75, 92). In this view, organizational action occurs through the management of knowledge or a collection of knowledge processes such as constructing, organizing, storing and distributing in social networks (75).

The overall purpose of the study is to review a broad spectrum of knowledge management-related literature and assess the consistency of the propositions and conclusions that exist in that literature. This paper draws from the network perspective and relevant KM literature to develop five research questions. The paper then employs a retroduction research strategy to investigate each question. The retroduction strategy includes a case study of KM within a university's information technology (IT) department and empirical findings from previous research.

The study confirms much of the current KM literature, develops several new insights, and identifies contradictions. We call these contradictions KM paradoxes. They include paradoxes of belonging, knowledge, organizing, networking and KM systems. The research suggests a pluralistic/paradoxical view of KM. Research and practice must be more sensitive and positive to the presence of simultaneous opposites (or apparent contradictions) in effective KM and organizational behavior.

This paper is organized as follows. The next section discusses the research strategy. This is followed by a review of network research. We then identify five research questions and discuss the KM motivating each question. The following sections discuss each research question based on the case study and a review of KM-related organizational and IS literature. The conclusion offers implications and suggestions for future research.

RESEARCH STRATEGY: RETRODUCTION

This paper uses retroduction to develop and investigate five research questions. Retroduction "posits a theory or substantive hypothesis to explain previously observed patterns (79, p. 115). This method was appropriate because it helps us develop new insights about KM while exploring extant understanding (see Ladyer (53) for further discussion of retroduction).

A retroductive research strategy combines inductive and deductive strategies to capitalize on their strengths and minimize their weaknesses (80). Retroduction assumes that almost all research has at least an element of deduction; it is impossible to do research without some initial ideas (80). Retroduction is cyclical and moves toward the emergence of new ideas or theory by integrating existing theory and emergent data.

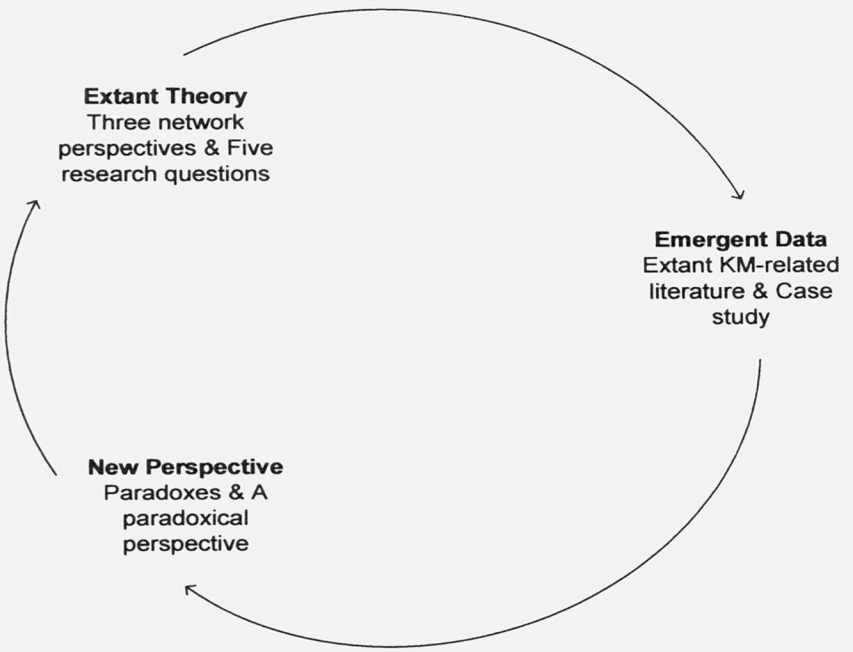
Figure 1 presents our retroductive research approach. First, we consider three theories and related KM literature to develop five research questions. We then answer the questions using

extant KM literature and a case study. This process resulted in identifying several KM paradoxes in research and practice.

EXTANT THEORY: PRIOR CONCEPTUAL SCHEME

This paper uses three network theories and relevant KM literature to understand organizational KM. These theories are the social-practice perspective (Brown 10), social network theory (35) and actor network theory (15). Network theories form an appropriate foundation for the study since the study's focus is KM in organizations. In line with KM research (48, 64, 88), this study's network orientation assumes social interaction is the basis of social life and social networks provide the mechanisms through which individuals learn about, come to understand and attempt to handle difficulties (76).

FIGURE 1
Retroductive Research Approach (adapted from Layder (53)



Social-Practice Perspective

The social-practice perspective deals with distributed cognition (9). Cognition has traditionally been viewed as a localized phenomenon best explained in information processing terms at the individual level. Theories of practice maintain cognition is better understood as a situated and distributed phenomenon, further suggesting knowledge and learning are situated and distributed.

Lave (51, p. 1) notes that "what we call cognition is a complex social phenomenon. The point is not so much that arrangements of knowledge in the head correspond in a complicated way to the social world outside the head, but that they are socially organized in such a fashion as to be indivisible." She further points out that cognition observed in everyday practice is distributed over mind, body, activity and cultural settings. Studying a navigation team, Hutchins (46) shows a long journey's knowledge held in bits and pieces by many people of the team. Tsoukas (92) sees organizations as distributed knowledge systems and argues most of their knowledge is tacit and resides not in the heads of individuals, but in teams of individuals sharing common experiences continually reconstructed through everyday activities.

The social-practice perspective draws attention to active knowing and an epistemology of practice (84, Chapter 2), rather than static knowledge and an epistemology of knowledge (21). Practice is central to understanding work and abstractions detached from practice distort or obscure that practice's intricacies (9). In this light, learning, working and innovation are interrelated and compatible and thus potentially complementary, not conflicting forces.

Social Network Theory

Social network theory emphasizes social processes and social milieu in understanding individual behavior. Firms are embedded in complex networks of social relations such as professional associations, corporate memberships and trade association memberships (34). Granovetter argues most behavior is closely embedded in networks of interpersonal relations. This argument avoids the extremes of under- and over-socialized views of human action.

Social network theory includes the theory of strong and weak ties (35) and social capital theory (13, 14). Social network

theory defines a tie's strength as "a combination of the amount of time, the emotional intensity, the intimacy and the reciprocal services characterizing the tie." The literature is primarily concerned with relationships between two or more social actors, as well as the relationship's effect on their information sharing activities (34, 35, 37, 38). Social capital theory investigates relationships' significance as a resource for social action (70). Social capital's central proposition is that "networks of relationships constitute a valuable resource for the conduct of social affairs, providing their members with collectively-owned capital" (70, p. 243). Thus, relationship networks encourage knowledge sharing and creation, since they give individuals access to other people from whom they can acquire knowledge. Most social capital studies link social capital accumulation to positive and proportionate performance effects (25).

Authors propose two network structures creating social capital. Structural whole theory describes social capital as a function of network brokerage opportunities (14). Coleman (19) argues closed or dense networks are sources of social capital since they make it easier for people in the network to trust one another.

Actor Network Theory

Actor network theory (ANT) sees the world as full of hybrid entities containing both human beings and nonhuman actors such as technological artifacts (15). The theory assumes general symmetry between technical and social entities. Agency in ANT includes humans and artifacts with built in human purposes. As such, ANT uses heterogeneity to describe a collection of different human and non-human entities.

In this theory, organizations, departments and groups are actor networks. One of the main differences between actor network theory and other social network theories is that non-human actors can shape actor networks. An actor network may include many other heterogeneous elements including texts (e.g., documents, reports and articles) and technical artifacts (e.g. machines and technology). These elements are intermediaries connected to one another in actor networks.

RESEARCH QUESTIONS

The previous section shows social practice perspective, social network theory and actor network theory share commonalities and present differences in understanding knowledge sharing, learning and human behaviour. Based on complementary and conflicting perspectives in the three theories and related literature, this section identifies five research questions.

Research Question #1: The following studies in the social practice perspective and social network theory motivate research question one. While studies (9, 29) presume CoPs and NoPs are different, they provide conflicting conceptualizations.

The literature describes CoPs in several ways. CoPs are: tight networks within the organization (9), tight-knit groups of actors who know each other and work together directly (11), "a set of relations among persons, activities and worlds, over time and in relation with other tangential and overlapping CoPs" (52, p. 98). Research considers CoPs an intrinsic condition for the existence of knowledge.

Relations among NoP members are significantly looser than those within a CoP (9). NoPs are occupational communities (93) or social worlds that have practice and knowledge in common. NoPs are loose communities across organizational boundaries (9). Most community members are unknown to one another with more indirect than direct links. NoPs have extensive reach, but little reciprocity as network members have minimal interaction with one another. Research (91, 94) shows NoPs are sources of information and knowledge for corporate competitiveness and adaptation.

In terms of the above description, the strong and weak ties (35) may also delineate CoPs and NoPs. Strong ties may characterize CoPs. Weak ties may characterize NoPs. The literature provides some conflicting conceptualization of NoPs. One study (29) uses the term electronic CoPs. However, the study's context describes NoPs. Studies (9, 29) indicate NoPs are electronic communities but do not indicate whether CoPs are also electronic communities. Studies have not clearly identified differences between CoPs and NoPs. This leads to research question (RQ) 1: Is there a difference between Communities of Practice (CoPs) and Networks of Practice (NoPs)?

Research question #2: The following studies from social network theory and the social-practice perspective motivate research question two. The studies discuss strong and weak ties in knowledge sharing but do not discuss knowledge creation or clarify each community's role in knowledge sharing and creation. One exception is the social-practice perspective that posits that knowledge within a community or tie tends to be sticky and does not flow out to others well (9). Several studies explain weak and strong ties in knowledge transfer. The findings show weak ties facilitate searching for information in other subunits, can speed up projects when knowledge is not complex (38), and are useful for transferring codified knowledge (95). The findings show weak ties inhibit complex (38), non-codified or tacit knowledge sharing (95). Weak ties can slow projects when knowledge is complex (38).

Research shows strong ties facilitate complex (38) and tacit (90) knowledge transfer. Research (90) suggests tacit knowledge transfer to some extent depends on the intimacy of the overall relationship between the source unit and the recipient unit.

The limited discussion of communities in knowledge sharing and knowledge creation motivates RQ 2: What is each community's or tie's role in knowledge sharing and knowledge creation?

Research question #3: The following studies from the social-practice perspective and ANT motivate research question three. The studies provide conflicting evidence regarding how managing CoPs and NoPs affect KM. CoPs and NoPs play important roles in knowledge sharing, knowledge creation and learning (11). Some studies suggest organizations should not manage CoPs (4). Along these lines one study finds that current IS do not serve CoPs. Additionally, promotion systems often overlook community contributions and reward structures may discourage collaboration (100). Some studies find that managers play a key role in constructing, aligning and supporting CoPs (99). Other studies are mixed. One study (10) contends that communities cannot be created in a top-town fashion, but organizational structures and procedures should preserve their healthy autonomy. Another study (100) suggests a cultivation strategy. This involves managers bringing the right people together, providing an infrastructure in which communities can thrive and measuring the communities' value in nontraditional ways. On the other hand, ANT (15) posits that managers and/or other key individuals in an organization can attempt to develop an actor network by translating their interests and enrolling other actors in the network. Yet, the outcome is unknown and they have no full control over its formation and development.

The conflicting evidence regarding managing CoPs and NoPs and the affect on KM leads to RQ 3: How does managing networks or CoPs and NoPs affect KM?

Research question #4: The following studies from social network theory, actor network theory and the social practice perspective motivate research question four. The studies discuss how strong and weak ties affect KM. In the social network theory literature, weak ties' and strong ties' enabling and constraining aspects are well accepted (54). Granovetter (35) demonstrates weak ties' power in information diffusion. Weak ties are beneficial because they provide access to non-redundant information and novel knowledge. Weak ties reduce search costs. People obtain information at lower search costs and can therefore dedicate more time and energy to completing the focal project (38). Examinations studying participants' knowledge bases indicate that they adhered to Granovetter's (35) weak-tie theory (61). Granovetter posits distant and infrequent relationships (weak ties) are more efficient for knowledge sharing as they bridge previously unconnected groups, develop broader access to more organizations and are less prone to redundant knowledge (35, 38). Weak ties are not ideal for complex knowledge sharing (38).

Strong ties provide timely access to information circulating in the network. Information shared within a dense network tends to be of high quality (19). Coleman emphasizes that network closure facilitates sanctions making it easier for people in the network to trust one another. Strong ties or dense networks enable the transfer of complex or tacit knowledge between people and units (38). Strong ties may constrain flows of new knowledge and inhibit the search for new knowledge outside established channels. Thus, strong ties may lead to redundant information because they tend to occur among a small group of actors in which everyone knows what the others know.

Given that CoPs and NoPs are emergent social structures and social theories indicate structures enable and constrain human action (31), CoPs and NoPs will affect KM. While the above studies offer an understanding of how strong and weak ties affect KM, they do not investigate how CoPs and NoPs affect KM. One study notes CoPs are effective at transmitting hard-to-express tacit knowledge (98). Many organizations are moving away from KM activities codifying explicit knowledge and are cultivating CoPs and NoPs (63). This leads to RQ 4: How do CoPs and NoPs enable or constrain human activity in a KM context?

Research question #5: The following studies, primarily from ANT, motivate research question five. The studies show conflicting views regarding IT's role and use in knowledge networks. KM studies favor and disfavor (1, 44, 45, 61, 86) technology's use in supporting KM activities.

Adopting the social-practice perspective or social network theory, researchers have investigated IT's role and use in supporting CoPs and NoPs or social networks. Early studies (87) were optimistic about information communication technologies' (ICTs') role and use in electronically connecting people. Recent studies (39, 40, 64, 78, 82) are more cautious. These studies argue IT cannot build CoPs. Robey et al. argue that virtual teams, as CoPs, may be more effective if they are not constrained by technology, "no matter how elegant or powerful it might be" (82, p. 63). Hara and Kling (39) argue, "Research on CoPs should be built on social theory."

Network models also have conflicting conceptualization of IT's role and use in networks. Social-practice perspective and social network theory only consider people in a network. They explain technology as a "black-box" (55). ANT includes artifacts, including ICTs and gives them active roles in holding networks together. For example, Murphy (69) shows digital documents play roles as objects of practice, reifications of practice, and boundary objects. This leads to RQ 5: What is IT's role and use in knowledge networks?

This section outlined five research questions based on conflicting perspectives in the three network theories and the related KM research. The next sections use a case data and recent organizational IS literature to provide insights to the 5 questions.

EMERGENT DATA

We investigated the five research questions identified in the previous section using the emergent data that came from a case study of Texas A&M University's Mays Business School's IT group and a review of recent organizational and IS studies. We chose a case study method since it allows investigating KM within a real world setting. We chose the Mays Business School's IT group because of their small size and close proximity. The small size allowed investigating the entire group. Its close proximity facilitated a long-term relationship. Data collection included structured interviews, semi-structured interviews, electronic communication, and internal document reviews.

We took several steps to enhance the case data's validity. Between four and six researchers conducted each interview. Each researcher then prepared and shared interview notes and perceptions with the other researchers. We corroborated interview data with the group's internal documentation. Follow-up interviews, electronic communication, and review by members of the IT department clarified issues.

Texas A&M University's Mays Business Schools' IT department was formed in early 1996. The department maintains the business school's computing infrastructure. The department is organized into a flat organizational hierarchy with three full-time employees who report directly to the associate dean and one full-time employee who reports indirectly to the associate dean. The associate dean is responsible for a number of other programs within the college; in his role as the IT department's administrative head he determines and enables the school's computing resources direction. Two senior systems analysts, a web master and a building security/computer equipments specialist comprise the department.

A key theme from the case study analysis was that personal relationships and networking are central components to daily work. The department's work relies heavily on different kinds of networks. In the next section we discuss the case study's findings and show that they confirm existing CoPs, NoPs, and KM understandings and reveal several new insights and contradictions in the literature.

NEW PERSPECTIVES: EMERGENCE OF NEW IDEAS

This section presents insights to the five research questions. The investigation reveals five paradoxes in KM contexts (Table 1). Table 1 links each paradox and its related contradictions to the five research questions.

RQ 1: Is there a difference between CoPs and NoPs?

The case study reveals a difference between CoPs and NoPs. However, organizational boundaries do not explain the difference. The study shows that communities of practice exist within the IT department, across the university, and across the university's boundaries. The study shows close proximity established through past interactions distinguishes CoPs from NoPs.

There is a CoP within the IT department where they share

new problems and answers. The group's common office space, overlapping performance objectives, and weekly meetings with the associate dean enable the CoP.

There are CoPs across the university composed of people from IT departments in other colleges and staff from computer information services. The computer information services department is responsible for campus-wide computer networking and security. Since both computer information services and the Mays Business School IT department work together to support the university network, members of both groups meet and share information. The two system administrators within the college's IT department believe that IT people in other colleges within the university are their most valuable source of information. Both face-to-face meetings and technology such as e-mail and listservs enable the university-wide CoPs.

TABLE 1
Paradoxes in KM Contexts

Research Question	Paradox	Exemplary Contradictions
1	Belonging paradox	Boundary / No boundary Cooperation / Competition Community interest / Self-interest
2	Knowledge paradox	Know-what / Know-how Explicit / Tacit
3	Organizing paradox	Formal / Informal Design / Emergent
4	Network paradox	Control / Autonomy Integration / Differentiation
5	KM systems paradox	Social / Technical

The IT department engages in CoPs crossing organizational boundaries. These communities include suppliers (e.g., Dell, Microsoft, Microstrategy) and clients (students, staff and faculty). The associate dean is part of a CoP to stay abreast of new information technologies and market trends. The community includes: practitioners, faculty, and other university administrators. An array of communication media including telephone, e-mail and face-to-face meetings help maintain CoPs across universities.

Each IT department member belongs to several CoPs. The building security/computer equipment specialist participates in CoPs with other college's IT staff and the university's IT staff. He is involved in CoPs with the physical plant staff and university police for building security issues. Every IT member also relies on NoPs. The system administrators participated in the Internet Security Forum, a networking listserv and technical seminars. The building facilitator regularly reads catalogues and two magazines to stay abreast of market trends and the latest technology. He also obtains information by attending trade shows like Infocomm, attending quarterly University facility manager meetings and subscribing to facility issue listservs.

Pickering and King (77) suggest that organizational members are likely to belong to several NoPs. People reside in multiple social realms or epistemic worlds (102). Because IT department members have multiple roles and responsibilities, they join multiple NoPs to acquire knowledge for each role and responsibility. Periodically, IT department members attend the Strictly Business Expo, ITEC Expo, Networld-Interop conference and the Comdex Expo. IT department members also attend audio/visual and Microsoft Windows trade shows. In addition to World Wide Web responsibilities, the web technician's responsibilities include backing up the two system administrator roles. The web technician belongs to several NoPs through information server training seminars, trade journals, white papers, mailing lists, newsgroups and news on the web.

Paradoxes of Belonging

Our effort to distinguish CoPs from NoPs reveals paradoxes of belonging. These include: boundary vs. no boundary, cooperation vs. competition, and community interest vs. self-interest. The analysis shows that while organizations are separate entities, in KM and organizational learning, organizational boundaries are blurred and transcended. Learning and knowledge sharing occur within and between organizations. Researchers should consider a firm's changing boundaries in studying KM and organizational learning (18).

Boundary vs. No Boundary: The following studies corroborate the boundary vs. no boundary paradox. Studies (5, 11) suggest organizations need to go beyond their organizational boundaries, beyond the perspective of an individual organization, and conceive of themselves as interlocking communities of knowing (7) or part of business networks (36). Another study views an organization as a collection of overlapping knowledge systems (CoPs), each of which may correspond to a larger epistemic community, or to some functional or geographical area (75).

In this sense KM practice and research must reach beyond the current intraorganizational learning process themes dominating the organizational learning literature (43). We must recognize how CoPs and NoPs presuppose each other through intra- and interorganizational learning. Intraorganizational learning (or CoPs) creates conditions for interorganizational learning (or NoPs). Interorganizational learning (or NoPs) creates conditions for intraorganizational learning (or CoPs). Organizations must cultivate both types of learning (intra and inter) and work units (CoPs and NoPs). For researchers, studying such a co-evolutionary process provides valuable insights to KM research and practice. In line with this, Lyytinen, Rose and Yoo's (60) empirical study implies knowledge is constantly re-created though dialectic interlacing of intra- and interorganizational learning.

Cooperation vs. Competition: The case study data identifies the paradox of cooperation vs. competition. After our data collection, two members of the IT department accepted new jobs. This shows that CoPs and NoPs simultaneously cooperate and compete.

The system administrator found a new job with an IT consulting company in California. In the interviews, the other IT group members commented that this system administrator made a significant contribution to their CoP and was the group's high achiever. The associate dean accepted a position as business school dean in another state. His departure was significant because he had an IT background, but his replacement did not. Upon their departure, communication between the IT group and the departing members ceased.

This demonstrates that cooperation and competition can exist simultaneously within CoPs and NoPs. Universities and consulting firms were part of the IT groups' NoPs. At the height of the IT boom, the NoPs were competing for skilled personnel. This manifested in the system analyst and associate dean accepting other positions within their NoPs. Prior research corroborates this finding positing that CoPs and NoPs compete fiercely for the appropriation of resources, jobs, prestige and other consequences of social legitimacy (8).

Community Interest vs. Self Interest: The community interest vs. self interest paradox deals with what motivates people to participate in CoPs and NoPs. Research (29, 96) shows that community interest drives CoPs and NoPs. Participants see knowledge as a public good and participation a way to improve the good. Our case study shows that community interest and self-interest motivate and coexist in CoP and NoP participation. The IT department was interested in obtaining knowledge to facilitate their work. However, after becoming participants they felt an obligation to give back to the community. This obligation was partly self-interest. They were building social capital for departmental and personal needs.

RQ 2: What is the role of each community or tie in knowledge sharing and knowledge creation?

The case study shows that NoPs facilitate knowledge sharing and CoPs facilitate knowledge creation and knowledge sharing. NoPs enable sharing know-what whereas CoPs enable sharing know-how. This partially supports the current understanding (38, 49, 95) that a difference exists in the relationships/types of knowledge exchanged in different networks. The study reveals NoPs are new knowledge sources, particularly for abstract domain knowledge or know-what knowledge (83). Weak ties or NoPs are likely sources of novel information. Strong ties or CoPs are usually connected to others who are close to the knowledge seeker and therefore are likely to traffic in information the seeker already knows (35).

The study shows NoP's role in acquiring know-what knowledge. The pace of emerging technology pressures IT professionals to stay abreast of the latest developments. They repeatedly indicate, "It is not an 8 to 5 job." The web technician notes that he relies heavily on NoPs for new knowledge. He spends at least one-hour daily reading different kinds of electronic resources such as mailing lists, newsgroups and news on the web. He also reads trade journals, white papers and vendor websites to acquire the latest product information such as software patches. He notes "keeping an eye on new things is part of his job." The web technician heavily relies on NoPs or weak-ties for new knowledge because web-based technology changes faster than server or operating system technology. Therefore, this knowledge does not exist in the IT department.

The study shows CoP's role in know-how exchange and creation. Know-how (83) knowledge embraces putting know-what into practice. Dispositional knowledge is brought out in practice. Know-how is acquired by doing and is critical in making knowledge actionable and operational. One example is the study's system administrator's problem solving resources. The department and close personal contacts are resources for 95% of their problems; in town technical support is a resource only 4% of the time. IT vendors/manufacturers are resources for 1% of the department's problems. The IT department relies more on CoPs, which tend to have closer proximity, than NoPs for local and tacit-like problem solving knowledge. This finding fits with several studies (24, 68) indicating that geographical proximity facilitates tacit knowledge exchange.

Our field data indicate knowledge creation occurs within CoPs. The following interview excerpts show IT members learn primarily from one another and from their daily activities.

- "The primary training is on-the-job. We learn from actually doing."
- "Technology is changing so rapidly that documentation is often not applicable."
- "We are too busy to document work."
- "We can solve almost every problem together. If we cannot, we call suppliers. But this case is rare."
- "Even though I read three to four trade magazines to keep updated with the rapid pace of technological changes, the best way of learning is from contacting my colleagues in academia and industry. I confirm my decisions with them"

The comments show situated learning's importance in accomplishing work. This study finds that situated learning is local. It occurs in CoPs by integrating novel knowledge gained from NoPs. Several authors (10, 52, 82) discuss situated learning.

The case study reveals a number of insights and further questions with respect to relationships between this type of knowledge and networks. First, in addition to codified and noncodified knowledge (38), transactive memory influences knowledge sharing, knowledge creation and learning. Transactive memory (97) is an important source for knowledge acquisition and sharing of know-what and know-how in CoPs. Transactive memory is knowledge that tells group members "who is good at what, who is doing what and who knows who." This type of knowledge is neither purely explicit nor tacit. It has both dimensions. The following quote from the group's web technician shows transactive memory is critical in the IT department.

> Sok and Bill (the system administrators) are the key sources for the current IT environment. Jimmy (a student worker) knows about ASP. Matt (another student worker) knows about SQL server.

Transactive memory is also important in NoPs. In NoPs active members have transactive memory. Active NoP members place more value on information from people at the center of the network with managerial resources and a hierarchical status (20).

The case study reveals the existing knowledge and social ties typology's (38) simplicity. Existing studies address knowledge inertia with knowledge properties (9). In this literature, complex (tacit or know-how) knowledge is difficult to transfer between weak ties (38) or within NoPs.

However, this study had difficulty operationalizing the knowledge type and network relationship. Determining whether particular knowledge is tacit or explicit is difficult. Our study shows the relationship between network type and knowledge is more complex and dynamic than what it is currently presumed

(38, 72). Eisenhardt and Santos (27) discuss this problem noting that inconsistent conceptualization and measurement of knowledge in the literature (38, 90) creates confusion in studying and comparing different findings. A different way of explaining this phenomenon may be needed. We discuss this in the knowledge paradox.

Knowledge Paradox

Research question two's findings identify knowledge paradoxes: know-what vs. know-how and explicit vs. tacit. The findings indicate the relationship between knowledge type and network needs further investigation. The current understanding of the relationship between knowledge type and network type in terms of inherent properties of knowledge offers limited explanation of knowledge use in practice. Three explanations illustrate this.

First, fully explicit, codifiable knowledge does not exist. The tacit-explicit dichotomy is misguided (42, 92). Our study suggests when individuals have know-how, know-what is used more effectively. In our study the building facilitator and system administrators find web application development and technology knowledge complex even though it is written in white papers. The building facilitator's audio and classroom technology knowledge appears simple but is complex to other IT members. Explicit knowledge is always grounded in a tacit component and tacit knowledge is the necessary component of all knowledge (92). Without tacit knowledge, individuals cannot understand and utilize simple mathematical formulas, which are considered simple explicit knowledge. Therefore, know-how is necessary for acquiring and utilizing know-what. Know-what is a precondition for developing know-how. These two types of knowledge are deeply interlaced. Understanding the dialectic relationship between know-how and know-what requires not emphasizing one over the other.

Second, a tacit component is grounded on shared practice or epistemic work (21) rather than the nature of knowledge (9) or the network. From a social-practice perspective, Brown and Duguid (9) recognize that knowledge within organizations and between networks and communities can be either leaky or sticky. They explain that knowledge depends on whether or not people share the same practice.

Finally, practice (9, 21) alone does not explain knowledge leakiness, knowledge stickiness or the type of knowledge exchanged. Practice needs to incorporate several other dimensions: a psychological dimension such as trust (57) and a capability dimension such as absorptive capacity (103).

For example, Levin et al. (57) argue that complex or difficult-to-understand knowledge requires the knowledge seeker trust that the knowledge source knows what he or she is talking about. Their study shows the positive effect of strong ties is due to the existence of trust between individuals within such strong ties, rather than the tie itself. Hence, trust is a mediator between strong ties and receipt of useful knowledge. Weak ties with competence-based (e.g., rationality, competence, professionalism) rather than benevolence-based (e.g., caring, emotionality) trust is even more important to the receipt of useful knowledge when knowledge is tacit or complex than when it is explicit. This finding fits well with the argument of transactive memory and Constant et al.'s (20) work. Thus, it would be presumed that trusted NoPs might be useful for the receipt of useful and even complex knowledge as much as CoPs are. Following the argument of absorptive capacity, we can presume that individuals, groups and organizations with more absorptive capacity or tacit-like, experiential knowledge would be better in knowledge acquisition, transformation and exploitation (103).

RQ 3: How is KM affected by managing networks or CoPs and NoPs?

The case study suggests that there is little effort expended in formally managing knowledge network, but mundane activities including management support, leadership, regular meetings and others influence knowledge creation and sharing. Our case data indicates the IT group members are unaware of CoP and NoP concepts. In addition, there is no formal effort to manage knowledge or CoPs and NoPs. The IT members feel the department achieves its goal by helping the college achieve its goal of becoming a leader in business education and an academic leader in using IT. The associate dean is satisfied with the IT department's efforts in supporting the college to achieve its goal.

Our study also shows that the college and the university do not formally manage knowledge, CoPs, or NoPs. Existing college and university CoPs are emergent and spontaneous. They are not planned and designed. Our finding is consistent with the social-practice perspective (9). This perspective proposes that practice or epistemic worlds are important in forming CoPs and NoPs.

In addition to shared practice, task interdependency facilitates CoP and NoP formation. Our study shows that strong task interdependencies exist between IT department members, the university IT department and other IT-related divisions. The IT department is controlled by, coordinated by, and cooperates with the university IT department and other IT-related divisions across the university. Cross, Rice and Parker (23) show task interdependency strongly and consistently predicts information seeking. Task interdependency facilitates knowledge of and access to those who might have useful information. Independent jobs usually involve similar task information, technical processes and both covert and overt knowledge (23). As such, people in interdependent jobs and tasks are more likely to form CoPs and NoPs.

While there is no attempt to manage CoPs and NoPs in the department, our study shows that managerial influences affect how KM transpires within the IT department and across its networks. The IT department's managerial influences come from the associate dean and include infrastructure, control, and leadership.

Our case study reveals several ways infrastructure influences the IT departments CoPs, NoPs, and effective KM. The IT department links performance appraisal to shared and interrelated job responsibilities. This encourages a teamwork culture supporting knowledge sharing. In addition, the IT department's infrastructure does not promote competition between employees; this encourages knowledge sharing and discourages knowledge hoarding. IT infrastructure mechanisms discouraging knowledge hoarding include a flat organization, not force ranking employees and not apportioning salary increases.

The IT department's management influence encourages using financial resources to acquire knowledge by linking employee performance appraisal (infrastructure knowledge resource) to knowledge acquisition activities such as continuing education (e.g., IT-related conferences, workshops and training).

Control is an ever-present issue within the IT department. Control involves ensuring knowledge resources are available in sufficient quantity and quality, subject to required security (44). One dimension of control is protection, in terms of how the IT

department protects existing knowledge resources. Management influences the methods the IT department uses to protect its knowledge resources. These include protecting culture and infrastructure with hiring practices that recruit employees that fit into the existing department.

Management also influences mechanisms for controlling knowledge quality within the IT department. Personal feedback, surveys and experimentation are the primary mechanisms for evaluating the quality of internalized knowledge within the IT department. These evaluating mechanisms resemble the convincing practices that knowledge workers use in Schultze's (85) work.

The managerial influence activity of leadership is defined as "creating conditions that allow participants to readily exercise their knowledge manipulation skills, to contribute their own individual knowledge resources to the organization's pool of participant knowledge and to have easy access to relevant knowledge resources" (44). Leadership values that seem to promote KM within the IT department include: desire for teamwork and encouragement of open communication, supporting learning, and tolerating failure.

This case study also reveals formal structures do not necessarily hinder CoPs and NoPs, but enable their formation and maintenance. Regular formal meetings and communication channels within the department and college and across the university support CoPs. For example, within the IT department a weekly formal IT staff meeting facilitates knowledge sharing and learning. The meeting helps bring out problems and new ideas and discuss work plans. When members return from conferences or training they share their knowledge at these meetings. These meetings build cognitive and affective trust and relationships between building members, thus enabling and supporting the members rather than constraining them. The university's listserv is a formal, regular communication channel among IT-related division members. Members stay informed and maintain their relationships though this channel network.

Paradox of Organizing

Research question three's analysis indicates two organizing paradoxes: formal vs. informal and design vs. emergent. The case study suggests not treating the formal and the informal as separable opponents but rather as complement and enabler of one another. The case study also suggests CoP and NoP management might be possible and necessary.

Contrary to existing beliefs (10, 74), structure is not necessarily negative for CoPs and NoPs. It can empower them. In fact, neither too much nor too little formal/informal structure is desirable for successful KM. Similarly things must not be either too tightly controlled or too loosely coupled in order to have successful KM. In short, too little structure makes coordination difficult and creates chaos. Too much structure creates gridlock and inhibits creativity and change (12). Minimal structures (6) or semistructures (12) allowing maximum flexibility, diversity, autonomy and creativity are needed. In this case, IT staff meetings, listservs and managerial influences exemplify minimal structures that enable CoPs and NoPs. To increase knowledge integration and knowledge sharing, organizations should develop simple structures and formal interventions. Research (73) shows simple structuring mechanisms, interruptions and time pacing are central to group flexibility. By not constraining what occurs during interruptions, these mechanisms promote flexibility in approaches to change. These interruptions are central to group flexibility. Groups facing ambiguous and/or novel tasks benefit from the flexibility that interruptions provide. Structures such as the IT staff meetings and other regular university meetings are channels for knowledge flows among individuals and also provide a platform for changing and improving these flows (73). Effective KM strategy requires organizations focus on both formal and informal and design and emergence. These two apparent contradictions must coexist in KM contexts.

RQ 4: How do CoPs and NoPs enable or constrain human activity in a KM context?

Since our study has the IT department as the unit of analysis, it provides information on how CoPs enable and constrain KM but only limited data on NoPs. Our study conceptualizes NoPs as similar to weak ties (35) in that they both promote generation of new ideas and opportunities. This is partly because NoPs include large numbers of people with diverse expertise and ideas. The strong-ties argument presumes CoPs are more likely to provide useful knowledge to tackle technical problems. As noted earlier, people within the University and the local community help the IT department solve most technical problems.

Several authors (9, 89) explain that CoPs constrain organizational performance and KM. Communities may inhibit knowledge flow to other communities. Many authors suggest that knowledge integration across networks is the major issue. Knowledge characteristics driving innovative problem solving within a function hinder problem solving and knowledge creation across functions (17). Our study supports this argument and shows knowledge exchange barriers between CoPs.

The quotes below indicate the IT department as a CoP has tacit knowledge regarding faculty technology adoption.

"Do not tell faculty what to use."

"Wait till faculty asks for something so we avoid the dictator impression of telling people what to use."

These quotes illustrate that even though IT members may have some useful information about advanced technologies and computer tools for classroom teaching and IT-related courses, they do not share such information with the faculty. This tacit knowledge is a barrier for sharing knowledge between CoPs and also illustrates CoP's power issues. This finding agrees with several authors' (7, 56, 89) work. Fox (30) finds that power inequalities between communities and the larger organization can jeopardize the free exchange of knowledge.

Network Paradox

Research question four identifies two network paradoxes. These include: control vs. autonomy and integration vs. differentiation. These paradoxes deal with maintaining order and autonomy and differentiation and integration within organizations.

Etzioni (28) identifies two opposing forces in communities: centripetal forces and centrifugal forces. Centripetal forces seek to pull in members' commitments, energies, time and resources for what the community endorses as its notion of the common good. In this sense, communities are anti-individualistic. Centrifugal forces seek autonomy and undermine the communal bonds and culture. These forces pull toward higher levels of differentiation, individualization, self-expression and subgroup liberty.

Etzioni discusses three premises in understanding the paradoxical situation between the simultaneous needs of control and autonomy.

1. All social entities are subject to both centrifugal and centripetal forces. Communities have social formations protecting the community from being pulled off balance by either of these forces.
2. Centripetal and centrifugal forces vie with one another continually, pulling the community in opposite directions.
3. Authentic communities require the two basic forces be in balance, as opposed to allowing one force to gain a decisive upper hand.

Etzioni's premises illustrate that conflict between CoPs may be a natural phenomenon. Etzioni explains that as communities develop particular identities, boundaries between members and nonmembers evolve. Even communities that are responsive and well balanced will be particularistic, having identities that separate and a sense of sociological boundary that distinguishes members from nonmembers. These features render even these communities potentially hostile, if not dangerous, to nonmembers or other communities.

Brown and Duguid (9) discuss a similar situation with NoPs. They point out that NoPs inhibit knowledge flow. Professional networks will occasionally work to resist the spread of ideas felt to be harmful to network members' interests. Opposing forces exist in both CoPs and NoPs. When we understand CoP knowledge relies on NoP knowledge, knowledge boundaries between NoPs become a challenge as well as a perpetual necessity for social capital. The simultaneity of integration for knowledge sharing and differentiation for knowledge creation is necessary.

Going back to our discussion in research question #3, dealing with this paradoxical situation and managing the two opposing forces requires a new set of design tools for managing CoPs and NoPs. In addition to the concepts discussed in research question #3, layered loyalties (28) may be useful. Layered loyalty occurs when members see themselves as and act as members of more than one community. Etzoni explains a common mistake is viewing order and autonomy either as antagonistic (a zero-sum relationship, so that the more we have of one the less we have of the other) or as mutually enhancing. Order and autonomy are complementary through the idea of overarching communities. Overarching communities can maintain order among communities without suppressing autonomy.

Groups must foster layered loyalties to reduce the potential conflict between CoPs and NoPs. Layered loyalties are allegiances to multiple communities and discourage exclusivity and tribal wars. When normative conflicts between community layers arise, loyalty to the overarching community must take precedence over loyalty to the immediate community. This ensures the community of communities will be responsive to member community's needs.

Finally, researchers must study CoPs and NoPs dark side. Most studies focus on CoPs and NoPs enabling aspects. These studies provide a one-sided view of social networks in knowledge integration and organizational innovation. This misleads organizations and management.

RQ 5: What is ICTs' role and use in knowledge networks?

The previous discussions illustrate how CoPs and NoPs use ICTs. The literature offers two opposing views of ICTs use in KM. Many (32, 44) are optimistic about ICTs use in KM, while others (42) are not. Our study does not support either view. ICTs themselves do not have deterministic power over KM practice. However, our data reveals ICTs' significant roles in CoP's and NoP's formation and maintenance. We must consider ICTs within and around knowledge networks to explain, predict and understand knowledge networks and their behaviors (16).

In contrast to existing beliefs that CoPs rely more on direct interactions through physical meetings and hallway talk and less on ICTs, our study demonstrates ICT's role in CoPs. ICTs such as e-mail support weak ties in interpersonal and group relations. ICTs mediated and extended boundaries of the CoPs in our study. Whitaker's (101) work may explain this. Whitaker finds mediated communications' effect is task dependent. Use of ICTs as opposed to face-to-face interaction may not affect cognitive tasks' outcomes, especially those that do not require access to a shared physical environment. Cognitive tasks engage this study's IT department. Several other studies discuss the relationship between CoPs and ICTs. Hara and Kling (39) show the correlation between CoPs and ICTs use is not necessarily positive. High IT use does not necessarily make a strong CoP. In their study, there was no link between frequent IT use and strong ties among CoP members.

While ICTs such as listservs may not provide much cultural knowledge (39), they facilitate sharing technical knowledge among IT department members. ICTs may be suitable for certain tasks, but not all tasks. Hence, online CoPs are not a substitute for, but are rather a complement to, face-to-face CoPs (39).

The IT group's use of information technologies to participate in NoPs further confirms that ICTs play an important role in connecting people and maintaining NoPs. NoPs heavily rely on various kinds of technical artifacts for their existence. ICTs ease the difficulties strangers have with contacting individuals across hierarchical, geographical and organizational boundaries (20). It may be presumed that ICTs tend to increase structural holes (13) and minimize network closure, while the opposite case would be possible.

Paradox within KM Systems

Research question five identifies the social vs. the technical as a KM system paradox. Existing studies emphasize either the social or technical side of KM (22, 42, 66, 88). Our study suggests a balanced approach with an understanding that CoPs and NoPs are not built on IT, but they are built with IT. In this sense, technologies are part of a social network and a KM system is likely to include not only technology but also social and cultural infrastructures and human agents. Also KM systems should be neither loose nor tight, but rather loosely-tight (64).

The intermediaries' concept in ANT explains ICT's role and use in our study. Callon (15) brings together the economic and the social, explaining intermediaries link network poles: text (reports, journals and software); technical objects (telephone, fax machines, computers and vehicles); and skills (ability to mobilize a social network as well as technical skill required to use a computer). Technologies are intermediaries linking people and simultaneously people are intermediaries linking technologies. In our case study, people link a vendor's web page to a listserv and a listserv to an email message and other technologies. The boundary between social and technical is blurred (47). We should pay more attention to combining the social and the technical so they complement rather than hinder one another. In socio-technical networks, humans and ICTs work together to perform individual, group, intraorganizational, and interorganizational tasks (47). This congruence or compatibility contributes to the success of overall KM strategy (2).

The ecological (64) model highlights the technical vs. social paradox. In this model, the effect of technical elements

such as ICTs and social elements such as culture or trust is indeterminate and dynamic. The effect of one cannot be adequately understood or predicted without understanding the other and the mixed effect of both. This model helps explain contradictory organizational ICT impacts (81) in KM.

CONCLUSION

Using a retroduction research strategy, this paper assesses the consistency of the propositions and conclusions in the social interaction KM literature. The findings confirm several existing studies, offer new insights and bring forth some contradictions. The research identifies five paradox categories in belonging, knowledge, organizing, network, and KM systems. This contrasts with most KM research, which typically assumes a single perspective.

The research has some limitations. The study used only one case study to provide insight to the research questions. The IT group studied is small and works in an academic setting. While the study combined with existing literature offers a new way to conceptualize knowledge management, generalizing the findings to the broad population of information technology groups is still premature. Still, we believe this analysis provides a foundation and motivation for examining these research questions in more KM settings. The study also takes a predominantly western view of knowledge, paradox and other concepts. Eastern philosophies and epistemologies could be applied in future studies of KM. They would offer a more dynamic and fluid view of those concepts and ideas presented in this paper.

Our study is one of the first taking a pluralistic/ paradoxical view of KM and its related concepts. Effective management and organizational behavior requires KM research and practice increase organization's sensitivity to simultaneous opposites and apparent contradictions. Recent organizational theory (26, 58) and IS (81) studies suggest an increased pervasiveness of paradoxes in and around organizations and IT. Ignoring paradoxes will mislead KM research and practice and weaken KM strategy. Formal, rational logic cannot deal with paradox (58). The duality of coexisting tensions creates an edge of chaos (26). This paper offers a pluralistic/paradoxical view of KM.

We are not the first to frame management strategies in terms of paradoxes. Mitroff and Linstone (67) have observed that managing complex problem situations often involves paradox management. They note that complex problems often require management strategies at the boundaries of the problem – where one complicated situation interacts with another. However, we believe a fruitful extension of this work will be investigating how decision makers work in the paradoxical areas we have identified. How do they balance cooperation and competition? From a KM perspective, this involves managing what you know about your affiliates and managing what you don't know about your competitors. Another potential question is what factors do decision makers consider when they balance social issues and technological capabilities? This can involve managing the knowledge one has about social norms and technological potential in light of what the general public may not know about that potential. Another interesting question is at what point does informal design (e.g., brainstorming) benefit from formal methodology? This is an examination of the transition of an idea from informal KM to formal KM.

Researchers and practitioners need to recognize that the opposites we have identified exist simultaneously. We feel that successful KM depends on viewing KM as a process that requires understanding where one stands in terms of these paradoxes. Researchers and practitioners should identify ways of cultivating both forces in the paradox. This paper suggests researchers examine apparent contradictions through a retroduction lens. This will help determine whether the contradictions may be two sides of the same coin. Organizations should consider adopting the proposed paradoxical view of KM and its related concepts. This will lead to better performance of individuals, groups, organizations and IT.

REFERENCES

1. Alavi, M. and D. Leidner. "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," **MIS Quarterly,** 25:1, 2001, pp. 107-136.
2. Almashari, M., M. Zairi, and A. Alathari. "An Empirical Study of the Impact of Knowledge Management on Organizational Performance," **Journal of Computer Information Systems,** 42:5, 2002, pp. 74-82.
3. Araujo, L. "Knowing and Learning as Networking," **Management Learning,** 29:3, 1998, pp. 317-336.
4. Ardichvili, A., V. Page, and T. Wentling. "Motivations and Barriers to Participation in Virtual Knowledge-sharing Communities of Practice," **OKLC 2002,** Athens, Greece, 2002.
5. Bahrami, H. and S. Evans. "Flexible Re-cycling and High-technology Entrepreneurship," **California Management Review,** 37:3, 1995, pp. 62-89.
6. Barret, F. "Creativity and Improvisation in Jazz and Organizations: Implications for Organizational Learning," **Organization Science,** 9:5, 1998, pp. 605-622.
7. Boland, R. and R.V. Tankasi. "Perspective Making and Perspective Taking in Communities of Knowing," **Organization Science,** 6:4, 1995, pp, 350-372.
8. Bouchikhi, H. "Living with and Building on Complexity: A Constructivist Perspective on Organizations," **Organization,** 5:2, 1998, pp. 217-232.
9. Brown, J.S. and C.P. Duguid. "Knowledge and Organization: A Social-Practice Perspective," **Organization Science,** 12:2, 2001, pp. 198-213.
10. Brown, J.S. and C.P. Duguid. "Organizational Learning and Communities-of-practice: Toward a Unified View of Working, Learning and Innovation," **Organization Science,** 2, 1991, pp. 40-57.
11. Brown, J.S. and P. Duguid. **The Social Life of Information.** Boston: Harvard Business School Press, 2000.
12. Brown, S.L. and K.M. Eisenhardt. "The Art of Continuous Change: Linking Complexity Theory and Time-paced Evolution in Relentlessly Shifting Organizations," **Administrative Science Quarterly,** 42, 1997, pp. 1-34.
13. Burt, R. **Structural Holes.** Cambridge, MA: Harvard University Press, 1992.
14. Burt, R. "The Contingent Value of Social Capital," **Administrative Science Quarterly,** 42, 1997, pp. 339-365.
15. Callon, M. "The Sociology of an Actor Network: The Case of the Electric Vehicle. In Callon, M., J. Law and A. Rip (Eds.). **Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World.** Basingstoke: Macmillan, 1986, pp. 19-34.
16. Carey, K. "Intraorganizational Complexity and Computation." In Baum, J. (Ed.). **Companion to Organizations.** New York: Blackwell Business, 2002.
17. Carlie, P.R. "A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development," **Organization Science,** 13:4, 2002, pp. 442-

455.
18. Child, J. and R.G. McGrath. "Organizations Unfettered: Organizational Form in an Information-intensive Economy," **Academy of Management Journal,** 44:6, 2001, pp. 1135-1148.
19. Coleman, J.S. "Social Capital in the Creation of Human Capital," **American Journal of Sociology,** 94, 1988, pp. S95-S120.
20. Constant, D., L. Sproull, and S. Kiesler. "The Kindness of Strangers: The Usefulness of Electronic Weak Ties for Technical Advice," **Organization Science,** 7:2, 1996, pp. 119-135.
21. Cook, S.D. and J.S. Brown. "Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing," **Organization Science,** 10:4, 1999, pp. 381-400.
22. Cross, R. and L. Baird. "Technology is not Enough: Improving Performance by Building Organizational Memory," **Sloan Management Review,** Spring 2000, pp. 69-78.
23. Cross, R., R. Rice, and A. Parker. "Information Seeking in Social Context: Structural Influences and Receipt of Information Benefits," **IEEE Transactions on Systems, Man and Cybernetics,** 31:4, 2001, pp. 438-448.
24. Desrochers, P. "Geographical Proximity and the Transmission of Tacit Knowledge," **Review of Austrian Economics,** 14:1, 2001, pp. 25-46.
25. Edelman, L.F., M. Bresnen, S. Newell, H. Scarbrough, and J. Swan. "The Darker Side of Social Capital," **3rd European Conference on Organizational Knowledge, Learning and Capabilities,** Athens, Greece, 2002.
26. Eisenhardt, K. "Paradox, Spirals, Ambivalence: The New Language of Change and Pluralism," **Academy of Management Review,** 25:4, 2000, pp. 703-705.
27. Eisenhardt, K.M. and F. Santos. "Knowledge-based View: A New Theory of Strategy?" In Pettigrew, A., H. Thomas and R. Whittington (Eds.). **Handbook of Strategy and Management.** London: Sage, 2002, pp. 139-164.
28. Etzioni, A. "The Responsive Community: A Community Perspective," **American Sociological Review,** 61, 1996, pp. 1-11.
29. Faraj, S. and M. Wasko. "The Web of Knowledge: An Investigation of Knowledge Exchange in Networks of Practice," **Working Paper,** 2002.
30. Fox, S. "Communities of Practice, Foucault and Actor Network Theory," **Journal of Management Studies,** 37:6, 2000, pp. 853-867.
31. Giddens, A. **The Constitution of Society: Outline of the Theory of Structure.** Berkeley, CA: University of California Press, 1984.
32. Goodman, P.S. and E.D. Darr. "Computer-aided Systems and Communities: Mechanisms for Organizational Learning in Distributed Environments," **MIS Quarterly,** December 1998, pp. 417-440.
33. Gottschalk, P. and V.K. Khandelwal. "Inter-organizational Knowledge Management: A Comparison of Law Firms in Norway and Australia," **Journal of Computer Information Systems,** 42:5, 2002, pp. 50-58.
34. Granovetter, M. "Economic Action and Social Structure: The Problem of Embeddedness," **American Journal of Sociology,** 91:3, 1985, pp. 481-510.
35. Granovetter, M. "The Strength of Weak Ties," **American Journal of Sociology,** 78:6, 1973, pp. 1360-1380.
36. Hakansson, H., V. Havila, and A. Pedersen. "Learning in Networks," **Industrial Marketing Management,** 28, 1999, pp. 443-452.
37. Hansen, M. "Knowledge Networks: Explaining Effective Knowledge Sharing in Multiunit Companies," **Organization Science,** 13:3, 2002, pp. 232-248.
38. Hansen, M. "The Search-transfer Problem: The Role of Weak Ties in Sharing Knowledge Across Organization Subunits," **Administrative Science Quarterly,** 44, 1999, pp. 82-111.
39. Hara, N. and R. Kling. "IT Support for Communities of Practice: An Empirically-based Framework: **WO-92-02,** Center for Social Informatics, Indiana University, 2002.
40. Harrison, S. and P. Dourish. "Re-placing Space: The Roles of Peace and Space in Collaborative Systems," **Proceedings of Computer Supportive Cooperative Work, ACM,** 1996, pp. 67-76.
41. Hicks, R.C., R. Dattero, and S.D. Galup. "A Verification-based Conflict Resolution Strategy for Knowledge Management Systems," **Journal of Computer Information Systems,** 43:2, 2003, pp. 36-42.
42. Hislop, D. "Mission Impossible? Communicating and Sharing Knowledge via Information Technology, **Journal of Information Technology,** 17, 2002, pp. 165-177.
43. Holmqvist, M. "A Dynamic Model of Intra- and Interorganizational Learning," **Organization Studies,** 24:1, 2003, pp. 95-123.
44. Holsapple, C. and K.D. Joshi. "Knowledge Management: A Threefold Framework," **The Information Society,"** 18, 2002, pp. 47-64.
45. Huber, G.D. "Transfer of Knowledge in Knowledge Management Systems: Unexplored Issues and Suggested Studies," **European Journal of Information Systems,** 10, 2001, pp. 72-79.
46. Hutchins, E. "The Technology of Team Navigation." In Galegher, J., R.E. Kraut, and L. Egido (Eds.). **Intellectual Teamwork: Social and Technological Foundations of Co-operative Work,** Lawrence Erlbaum Assoc., 1990.
47. Kling, R., G. McKim, and A. King. "A Bit More to IT: Scholarly Communication Forums as Socio-Technical Interaction Networks," **Journal of the American Society for Information Science and Technology,** 2003.
48. Koch, H., D. Paradice, B.S. Chae, and Y. Guo. "An Investigation of Knowledge Management Within a University IT Group," **Information Resources Management Journal,** 15:1, 2002, pp. 13-21.
49. Kogut, B. "Joint Ventures: Theoretical and Empirical Perspectives," **Strategic Management Journal,** 9, 1988, pp. 319-332.
50. Lai, H. and H. Chu. "Knowledge Management: A Review of Industrial Cases," **Journal of Computer Information Systems,** 42:5, 2002, pp. 26-39.
51. Lave, J. **Cognition in Practice: Mind, Mathematics and Culture in Everyday Life.** Cambridge: Cambridge University Press, 1988.
52. Lave, J. and E. Wenger. **Situated Learning: Legitimate Peripheral Participation.** Cambridge: Cambridge University Press, 1991.
53. Layder, D. **Sociological Practice: Linking Theory and Social Research.** London: SAGE, 1998.
54. Lazzarini, S. and T. Zenger. "The Strength of Churning Ties: A Dynamic Theory of Interorganizational Relationships," **Academy of Management Conference,** 2002.
55. Lea, M., T. O'Shea, and P. Fung. "Constructing the Networked Organization: Content and Context in the Development of Electronic Communications,"

Organization Science, 6:4, 1995, pp. 462-478.
56. Leonard, D. and S. Sensiper. "The Role of Tacit Knowledge in Group Innovation," **California Management Review,** 40:3, 1998, pp. 112-131.
57. Levin, D.Z., R. Cross, and L.C. Abrams. "The Strength of Weak Ties You Can Trust: The Mediation Role of Trust in Effective Knowledge Transfer," **Academy of Management Conference,** 2002.
58. Lewis, M.W. "Exploring Paradox: Toward a More Comprehensive Guide," **Academy of Management Review,** 25:4, 2000, pp. 760-776.
59. Liebowitz, J. "A Knowledge Management Strategy for the Jason Organization: A Case Study," **Journal of Computer Information Systems,** 44:2, 2004, p. 5.
60. Lyytinen, K., G. Rose, and Y. Yoo. "Learning in High Gear: Hyper-learning and Dynamic Capability in Seven Software Firms," **Sprouts: Working Papers on Information Environments, Systems and Organizations,** 2, 2002, pp. 1-35.
61. Majchrzak, A., O. Neece, and L. Cooper. "Knowledge Reuse for Innovation," Working Paper, University of Southern California, 2001.
62. Majchrzak, A., R.E. Rice, N. King, A. Malhotra, and S. Ba. "Computer-mediated Inter-organizational Knowledge-sharing: Insights from a Virtual Team Innovation Using a Collaborative Tool," **Information Resources Management Journal,** 13:1, 2000, pp. 44-53.
63. Malhotra, A. "Integrating Knowledge Management Technologies in Organizational Business Processes: Getting Real Time Enterprises to Deliver Real Business Performance," **Journal of Knowledge Management,** 4:1, 2004, pp. 1-24.
64. Malhotra, Y. "Why Knowledge Management Systems Fail? Enablers and Constraints of Knowledge Management in Human Enterprises." In Holsapple, C.W. (Ed.). **Handbook on Knowledge Management 1: Knowledge Matters.** Heidelberg, Germany: Springer-Verlag, 2002, pp. 577-599.
65. Martensson, P. and A.S. Lee. "Dialogical Action Research at Omega Corporation," **MIS Quarterly,** 28:3, 2004, pp. 507-536.
66. Meso, P. and R. Smith. "A Resource-based View of Organizational Knowledge Management Systems," **California Management Review,** 41:4, 2000, pp. 103-117.
67. Mitroff, I.I. and H.A. Linstone. **The Unbounded Mind: Breaking the Chains of Traditional Business Thinking.** New York: Oxford University Press, 1993.
68. Monge, P., L.W. Rothman, E.M. Eisenberg, K. Miller, and K. Kirste. "The Dynamics of Organizational Proximity," **Management Science,** 31:9, 1985, pp. 1129-1141.
69. Murphy, L. "Digital Documents in Organizational Communities of Practice: A First Look," **Hawaii International Conference on Information Systems,** 2001, pp. 980-989.
70. Nahapiet, J. and S. Ghoshal. "Social Capital, Intellectual Capital and the Organizational Advantage," **Academy of Management Review,** 23:2, 1998, pp. 242-266.
71. Nardi, B.A., S. Whittaker, and H. Schwarz. "It's Not What You Know, It's Who You Know: Work in the Information Age," **First Monday,** 4:2, 2000, pp. 15-28.
72. Nonaka, I. and H. Takeuchi. **The Knowledge Creating Company.** New York: Oxford University Press, 1995.
73. Okhuysen, G.A. "Structuring Change: Familiarity and Formal Interventions in Problem-solving Groups," **Academy of Management Journal,** 44:4, 2001, pp. 794-808.
74. Orlikowski, W. "Knowing in Practice: Enacting a Collective Capability in Distributed Organizing," **Organization Science,** 13:3, 2002, pp. 249-273.
75. Pentland, B.T. "Information Systems and Organizational Learning: The Social Epistemology of Organizational Knowledge Systems," **Information and Organization,** 5:1, 1995, pp. 1-21.
76. Pescosolido, B.A. "Beyond Rational Choice: The Social Dynamics of How People Seek Help," **American Journal of Sociology,** 97:4, 1992, pp. 1096-1138.
77. Pickering, J.M. and J.L. King. "Hardwiring Weak Ties: Interorganizational Computer-mediated Communication, Occupational Communities and Organizational Change," **Organization Science,** 6:4, 1995, pp. 479-486.
78. Poitou, J. "Building a Collective Knowledge Management System: Knowledge-editing Versus Knowledge-eliciting Techniques." In Bowker, G., S. Star, W. Turner, and L. Gasser (Eds.). **Social Science, Technical Systems and Cooperative Work.** Lawrence Erlbaum Assoc., 1997, pp. 235-256.
79. Poole, M.S., A. Van de Ven, K. Dooley, and M.E. Holmes. **Organizational Change and Innovation Processes.** Oxford University Press, 2000.
80. Ragin, C.C. **Constructing Social Research.** London: Pine Forge Press, 1994.
81. Robey, D. and M. Boudreau. "Accounting for the Contradictory Organizational Consequences of Information Technology: Theoretical Directions and Methodologies Implications," **Information Systems Research,** 10:2, 1999, pp. 167-185.
82. Robey, D., H.M. Khoo, and C. Powers. "Situated Learning in Cross-functional Virtual Teams," **IEEE Transactions on Professional Communication,** February/March 2000, pp. 51-66.
83. Ryle, G. **The Concept of Mind.** New York: Barnes and Noble, 1949.
84. Schon, D. **The Reflective Practitioner: How Professionals Think in Action.** New York: Basic Books, 1983.
85. Schultze, U. "A Confessional Account of an Ethnography about Knowledge Work," **MIS Quarterly,** 24:1, 2000, pp. 3-41.
86. Schultze, U. and D. Leidner. "Studying Knowledge Management in Information Systems Research: Discourses and Theoretical Assumptions," **MIS Quarterly,** 26:3, 2002, pp. 30-45.
87. Sproull, L. and S. Kiesler. **Connections: New Ways of Working in the Networked Organization.** London: MIT Press, 1991.
88. Swan, J., S. Newell, and M. Robertson. "Knowledge Management: When Will People Management Enter the Debate?" **Proceedings of the 33rd Annual Hawaii International Conference on System Sciences,** IEEE Computer Society Press, Maui, 2000.
89. Swan, J., H. Scarbrough, and M. Robertson. "The Construction of Communities of Practice in the Management of Innovation," **Management Learning,** forthcoming.
90. Szulanski, G. "Exploring Internal Stickiness: Impediments to the Transfer of Best Practice Within the Firm," **Strategic Management Journal,** 17, 1996, pp. 27-43.
91. Tsai, W. and S. Ghoshal. "Social Capital and Value Creation: The Role of Intrafirm Networks," **Academy of Management Journal,** 41:4, 1998, pp. 464-476.
92. Tsoukas, H. "The Firm as a Distributed Knowledge

System: A Constructionist Approach," **Strategic Management Journal,** 17, 1996, pp. 11-25.
93. Van Maanen, J. and S.R. Barley. "Occupational Communities: Culture and Control in Organizations." In Staw, B.M. and L.L. Cummings (Eds.). **Research in Organizational Behavior.** Greenwich, CT: JAI, 1984, pp. 287-365.
94. Von Hippel, E. **The Sources of Innovation.** New York: Oxford University Press, 1988.
95. Von Hippel, E. "Sticky Information and the Locus of Problem Solving: Implications for Innovation," **Management Science,** 40:4, 1994, pp. 429-439.
96. Wasko, M. and S. Faraj. "It is What One Does: Why People Participate and Help Others in Electronic Communities of Practice," **Journal of Strategic Information Systems,** 9, 2000, pp. 155-173.
97. Wenger, D.M. "Transactive Memory: A Contemporary Analysis of the Group Mind." In Mullen, B. and G. Goethals (Eds.). **Theories of Group Behavior.** 1986, pp. 185-208.
98. Wenger, E. **Communities of Practice: Learning, Meaning, and Identity.** New York: Oxford University Press, 1998.
99. Wenger, E. "Communities of Practice and Social Learning Systems," **Organization,** 7:2, 2000, pp. 225-246.
100. Wenger, E. and W. Snyder. "Communities of Practice: The Organizational Frontier," **Harvard Business Review,** Jan/Feb 2000, pp. 139-145.
101. Whittaker, S. "Theories and Methods in Mediated Communication." In Graesser, A. (Ed.). **The Handbook of Discourse Processes.** MIT Press, In Press.
102. Whittington, R. "Sociological Pluralism, Institutions and Managerial Agency." In **Towards a New Theory of Organizations.** London & New York: Routledge, 1994.
103. Zahra, S.A. and G. George. "Absorptive Capacity: A Review, Reconceptualization and Extension," **Academy of Management Review,** 27:2, 2002, pp. 185-203.