

MIS Quarterly

SPECIAL ISSUE

WHY SHOULD I SHARE? EXAMINING SOCIAL CAPITAL AND KNOWLEDGE CONTRIBUTION IN ELECTRONIC NETWORKS OF PRACTICE¹

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butor, and free-riders are able to acquire the same knowledge as everyone else. To understand this paradox, we apply theories of collective action to examine how individual motivations and social capital influence knowledge contribution in electronic networks. This study reports on the activities of one electronic network supporting a professional legal association. Using archival, network, survey, and content analysis data, we empirically test a model of knowledge contribution. We find that people contribute their knowledge when they perceive that it enhances their professional reputations, when they have the experience to share, and when they are structurally embedded in the network. Surprisingly, contributions occur without regard to expectations of reciprocity from others or high levels of commitment to the network.

Abstract

Electronic networks of practice are computer-mediated discussion forums focused on problems of practice that enable individuals to exchange advice and ideas with others based on common interests. However, why individuals help strangers in these electronic networks is not well understood: there is no immediate benefit to the contri-

Keywords: Electronic networks of practice, knowledge management, online communities, social capital

Introduction

Knowledge has long been recognized as a valuable resource for organizational growth and sustained competitive advantage, especially for organizations competing in uncertain environments (Miller and Shamsie 1996). Recently, some

¹V. Sambamurthy and Mani Subramani were the accepting senior editors for this paper.

researchers have argued that knowledge is an organization's most valuable resource because it represents intangible assets, operational routines, and creative processes that are hard to imitate (Grant 1996; Liebeskind 1996). However, most organizations do not possess all required knowledge within their formal boundaries and must rely on linkages to outside organizations and individuals to acquire knowledge (Anand et al. 2002). In dynamic fields, organizational innovation derives from knowledge exchange and learning from network connections that cross organizational boundaries (Nooteboom 2000). Organizational members benefit from external network connections because they gain access to new information, expertise, and ideas not available locally, and can interact informally, free from the constraints of hierarchy and local rules. Even though the employing organizations may be direct competitors, informal and reciprocal knowledge exchanges between individuals are valued and sustained over time because the sharing of knowledge is an important aspect of being a member of a technological community (Bouty 2000).

One way to create linkages to external knowledge resources is through electronic communication networks. Electronic networks make it possible to share information quickly, globally, and with large numbers of individuals. Electronic networks that focus on knowledge exchange frequently emerge in fields where the pace of technological change requires access to knowledge unavailable within any single organization (Powell et al. 1996). Electronic networks have been found to support organizational knowledge flows between geographically dispersed coworkers (Constant et al. 1996) and distributed research and development efforts (Ahuja et al. 2003). These networks also assist cooperative open-source software development (Raymond 1999; von Hippel and von Krogh 2003) and open congregation on the Internet for individuals interested in a specific practice (Butler 2001; Wasko and Faraj 2000).

However, as management in many organizations has discovered, the availability of electronic communication technologies is no guarantee that knowledge sharing will actually take place (Alavi

and Leidner 1999; Orlikowski 1996). One of the problems with accessing knowledge from acquaintances and unknown others is that it requires depending upon the "kindness of strangers" (Constant et al. 1996). Despite the growing interest in online cooperation and virtual organizing, there is surprisingly little empirical research into the communication and organization processes of electronic networks, and how participation in these networks relates to sharing knowledge (Lin 2001; Monge et al. 1998). The goal of our research is to better understand knowledge flows by examining why people voluntarily contribute knowledge and help others through electronic networks.

This paper is organized as follows. First, we introduce the concept of an electronic network of practice and discuss the key issues for understanding knowledge contribution in these networks. Then, we apply theories of social capital to develop a model for examining how individual motivations and social capital foster knowledge contribution. We test this model empirically through survey and objective data collected from one electronic network of practice focused on the exchange of legal advice between lawyers. Finally, we discuss how our empirical findings contribute to theory development and improve our understanding of how information technologies support cross-organization knowledge exchange.

Knowledge Contribution in Electronic Networks of Practice

Brown and Duguid (2001) suggest that knowledge flows are best understood by examining how work is actually performed and thinking about knowledge and learning as an outcome of actual engagement in practice. When individuals have a common practice, knowledge readily flows across that practice, enabling individuals to create social networks to support knowledge exchange (Brown and Duguid 2000). Brown and Duguid suggest that there are two practice-related social networks

that are essential for understanding learning, work, and the movement of knowledge: communities of practice and networks of practice. These researchers conclude that the key to competitive advantage is a firm's ability to coordinate autonomous communities of practice internally and leverage the knowledge that flows into these communities from network connections (Brown and Duguid 2000, 2001).

A community of practice consists of a tightly knit group of members engaged in a shared practice who know each other and work together, typically meet face-to-face, and continually negotiate, communicate, and coordinate with each other directly. In a community of practice, joint sense-making and problem solving enhances the formation of strong interpersonal ties and creates norms of direct reciprocity within a small community (Lave 1991; Lave and Wenger 1991; Wenger 1998). In contrast, networks of practice consist of a larger, loosely knit, geographically distributed group of individuals engaged in a shared practice, but who may not know each other nor necessarily expect to meet face-to-face (Brown and Duguid 2001). Networks of practice often coordinate through third parties such as professional associations, or exchange knowledge through conferences and publications such as specialized newsletters. Although individuals connected through a network of practice may never know or meet each other face to face, they are capable of sharing a great deal of knowledge (Brown and Duguid 2000).

With recent advances in computer mediated communications, networks of practice are able to extend their reach using technologies such as websites, electronic bulletin boards, and e-mail listservs. Building upon Brown and Duguid's (2000) general description of networks of practice, we define an electronic network of practice as a special case of the broader concept of networks of practice where the sharing of practice-related knowledge occurs *primarily* through computer-based communication technologies. While many networks of practice are increasingly using electronic communication to supplement their traditional activities, electronic networks of practice differ from networks of practice due to the impact

of technology on communications, which may result in different dynamics (DeSanctis and Monge 1999). More formally, we define an electronic network of practice as a self-organizing, open activity system focused on a shared practice that exists primarily through computer-mediated communication.

This definition highlights some key aspects of an electronic network of practice. First, the network is generally self-organizing in that it is made up of individuals who voluntarily choose to participate. Second, the term open activity denotes that participation is open to individuals interested in the shared practice, and who are willing to mutually engage with others to help solve problems common to the practice. While many electronic networks of practice reside outside organizations (e.g., on the Usenet or the Web), our definition includes networks that are sponsored by a specific organization or professional association as long as they exist primarily through computer-mediated communication.

However, because participation is open and voluntary, participants are typically strangers. Knowledge seekers have no control over who responds to their questions or the quality of the responses. Knowledge contributors have no assurances that those they are helping will ever return the favor, and lurkers may draw upon the knowledge of others without contributing anything in return. This sharply contrasts with traditional communities of practice and face-to-face knowledge exchanges where people typically know one another and interact over time, creating expectations of obligation and reciprocity that are enforceable through social sanctions. Prior studies consistently find that knowledge sharing is positively related to factors such as strong ties (Wellman and Wortley 1990), co-location (Allen 1977; Kraut et al. 1990), demographic similarity (Pelled 1996), status similarity (Cohen and Zhou 1991), and a history of prior relationship (Krackhardt 1992), all factors that are not readily apparent in electronic networks of practice. This begs the question: Why do people spend their valuable time and effort contributing knowledge and helping strangers in electronic networks of practice? In

order to investigate this question, we turn to theories of collective action and social capital.

Collective Action, Social Capital, and Knowledge Contribution ■

Contributions of knowledge to electronic networks of practice seem paradoxical. Previous research argues that giving away knowledge eventually causes the possessor to lose his or her unique value relative to what others know (Thibaut and Kelley 1959), and benefits all others except the contributor (Thorn and Connolly 1987). Therefore, in the context of an electronic network of practice, it seems irrational that individuals voluntarily contribute their time, effort, and knowledge toward the collective benefit, when they can easily free-ride on the efforts of others. However, if everyone chose to free-ride, the electronic network of practice would cease to exist. Theories of collective action help explain why individuals in a collective choose *not* to free-ride, and suggest that individuals forego the tendency to free-ride due to the influence of social capital (Coleman 1990; Putnam 1993, 1995a). Social capital is typically defined as "resources embedded in a social structure that are accessed and/or mobilized in purposive action" (Lin 2001, p. 29). In recent years, social capital concepts have been offered as explanations for a variety of pro-social behaviors, including collective action, community involvement, and differential social achievements that the concept of individual-based capital (such as human or financial capital) is unable to explain (Coleman 1990). The key difference between social capital and other forms of capital is that social capital is embedded in the social realm. While other forms of capital are based on assets or individuals, social capital resides in the fabric of relationships between individuals and in individuals' connections with their communities (Putnam 1995b).

Some researchers have suggested that social capital will have difficulty developing in or transferring to electronic networks of practice because social capital is more likely to develop in collec-

tives characterized by a shared history, high interdependence, frequent interaction, and closed structures (Nahapiet and Ghoshal 1998; Nohria and Eccles 1992). It has also been argued that electronic networks cannot support significant knowledge outcomes because knowledge is often tacit and highly embedded, requiring high-bandwidth communication that is difficult to sustain through technology (Brown and Duguid 2000; Nonaka 1994). Thus, current theory and research seems to suggest that significant levels of social capital and knowledge exchange will not develop in electronic networks of practice. This study attempts to address the question of why people nevertheless contribute knowledge to others in electronic networks of practice. Based on the theoretical model proposed by Nahapiet and Ghoshal (1998), we develop a series of hypotheses to examine how individual motivations and three forms of social capital (cognitive, structural, and relational) relate to knowledge contribution in electronic networks of practice.

Hypotheses ■

Nahapiet and Ghoshal (1998) presented social capital as an integrative framework for understanding the creation and sharing of knowledge in organizations. They argued that organizations have unique advantages for creating knowledge over more open settings such as markets because organizations provide an institutional environment conducive to the development of social capital. They suggested that the combination and exchange of knowledge is facilitated when (1) individuals are motivated to engage in its exchange, (2) there are structural links or connections between individuals (structural capital), (3) individuals have the cognitive capability to understand and apply the knowledge (cognitive capital), and (4) their relationships have strong, positive characteristics (relational capital). Each of these forms of social capital constitutes an aspect of the social structure and facilitates the combination and exchange of knowledge between individuals within that structure.

Although Nahapiet and Ghoshal's model focuses on group level social capital factors to explain the creation of intellectual capital within organizations, we suggest that social capital is also relevant for explaining individual-level knowledge contribution in electronic networks of practice.² We propose that electronic networks of practice are sources of learning and innovation because mutual engagement and interaction in the network creates relationships between individuals and the collective as a whole. These individual relationships are a primary source for the generation of social capital, which influences how individuals behave in relation to others and promotes knowledge creation and contribution within the network.

For instance, Nahapiet and Ghoshal refer to structural capital at the organizational level, which assesses the network density and centralization of the overall organization. We adapt this to the individual level, suggesting that an individual's position in the network influences his or her willingness to contribute knowledge to others. Similarly, the Nahapiet and Ghoshal framework examines the cognitive capital of the organization, suggesting that organizations whose members share common understandings and language are better suited for the creation of new intellectual capital. At the individual level, we examine how an individual's cognitive capital affects his or her level of knowledge contribution to the network. We also adapt the concept of relational capital from the organizational level to the individual level, examining how an individual's perception of relational capital influences his or her participation in the network. Figure 1 presents the model of our hypotheses. We describe each of the constructs and their relationships to knowledge contribution in the following sections.

²Social capital is widely recognized as exhibiting a duality: at the group level, it reflects the affective nature and quality of relationships, while on the individual, it facilitates an actor's actions and reflects their access to network resources (see Coleman 1990; Lin 2001; Putnam, 2000).

Individual Motivations

Knowledge contribution in an electronic network of practice primarily occurs when individuals are motivated to access the network, review the questions posted, choose those they are able and willing to answer, and take the time and effort to formulate and post a response. Although knowledge contribution may take on a variety of forms, the focus here is on two key aspects: the volume of knowledge contributed through the posting of response messages, and the average helpfulness of those responses in directly answering the questions posed.

In order to contribute knowledge, individuals must think that their contribution to others will be worth the effort and that some new value will be created, with expectations of receiving some of that value for themselves (Nahapiet and Ghoshal 1998). These personal benefits or "private rewards" are more likely to accrue to individuals who actively participate and help others (von Hippel and von Krogh 2003). Thus, the expectation of personal benefits can motivate individuals to contribute knowledge to others in the absence of personal acquaintance, similarity, or the likelihood of direct reciprocity (Constant et al. 1996).

Social exchange theory (Blau 1964) posits that individuals engage in social interaction based on an expectation that it will lead in some way to social rewards such as approval, status, and respect. This suggests that one potential way an individual can benefit from active participation is the perception that participation enhances his or her personal reputation in the network. Reputation is an important asset that an individual can leverage to achieve and maintain status within a collective (Jones et al. 1997). Results from prior research on electronic networks of practice are consistent with social exchange theory and provide evidence that building reputation is a strong motivator for active participation (Donath 1999). In an organizational electronic network, the chance to improve one's reputation provided an important motivation for offering useful advice to others (Constant et al. 1996), and in extra-organizational electronic networks, individuals perceived that they

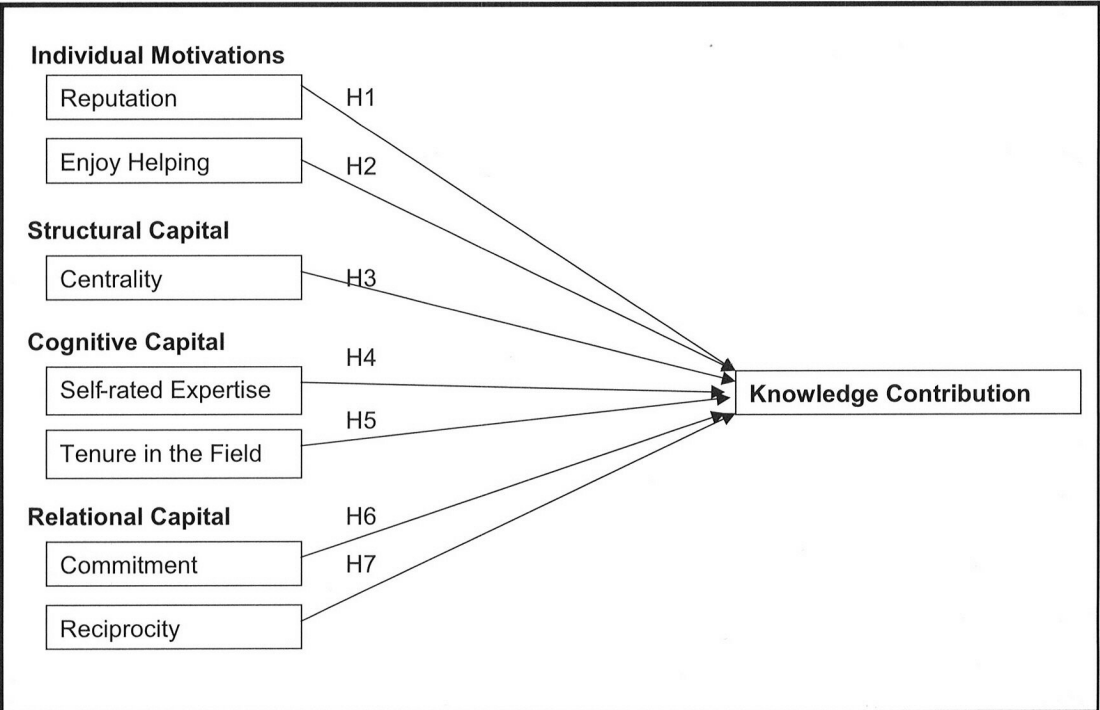


Figure 1. Individual Motivations, Social Capital, and Knowledge Contribution

gained status by answering frequently and intelligently (Lakhani and von Hippel 2003). Moreover, there is some evidence that an individual's reputation in online settings extends to one's profession (Stewart 2003). Thus, the perception that contributing knowledge will enhance one's reputation and status in the profession may motivate individuals to contribute their valuable, personal knowledge to others in the network. This leads to the first set of hypotheses.

- H1a: Individuals who perceive that participation will enhance their reputations in the profession will contribute more helpful responses to electronic networks of practice.*
- H1b: Individuals who perceive that participation will enhance their reputations in the profession will contribute more responses to electronic networks of practice.*

In addition to enhancing their reputations, individuals may also receive intrinsic benefits from contributing knowledge. Knowledge is deeply integrated in an individual's personal character and identity. Self-evaluation based on competence and social acceptance is an important source of intrinsic motivation that drives engagement in activities for the sake of the activity itself, rather than for external rewards (Bandura 1986). Thus, individuals may contribute knowledge in an electronic network of practice because they perceive that helping others with challenging problems is interesting, and because it feels good to help other people (Kollock 1999). Prior research in electronic networks suggests that individuals are motivated intrinsically to contribute knowledge to others because engaging in intellectual pursuits and solving problems is challenging or fun, and because they enjoy helping others (Wasko and Faraj 2000). Therefore, the second set of hypotheses predicts the following:

H2a: Individuals who enjoy helping others will contribute more helpful responses to electronic networks of practice.

H2b: Individuals who enjoy helping others will contribute more responses to electronic networks of practice.

Structural Capital

In addition to individual motivations, theories of collective action and social capital propose that the connections between individuals, or the structural links created through the social interactions between individuals in a network, are important predictors of collective action (Burt 1992; Putnam 1995b). When networks are dense, consisting of a large proportion of strong, direct ties between members, collective action is relatively easy to achieve (Krackhardt 1992). The more individuals are in regular contact with one another, the more likely they are to develop a "habit of cooperation" and act collectively (Marwell and Oliver 1988). Therefore, collectives characterized by high levels of structural capital (dense connections in the collective) are more likely to sustain collective action.

Structural capital is also relevant for examining individual actions, such as knowledge contribution, within a collective. Individuals who are centrally embedded in a collective have a relatively high proportion of direct ties to other members, and are likely to have developed this habit of cooperation. Furthermore, such individuals are more likely than others to understand and comply with group norms and expectations (Rogers and Kincaid 1981). Thus, an individual's structural position in an electronic network of practice should influence his or her willingness to contribute knowledge to others.

Prior research suggests that one way to measure an individual's embeddedness in an electronic network of practice is to determine the number of social ties the individual has with others in the network (Ahuja et al. 2003). Social interaction in these networks is similar to a conversation that

occurs through the posting of messages. Posting and responding to messages creates a social tie between individuals. Therefore, a social tie or structural link is created when one person responds to another's posting. How many such ties any one individual creates determines his or her centrality in the network, which leads us to the following hypotheses:

H3a: Individuals with higher levels of network centrality will contribute more helpful responses to electronic networks of practice.

H3b: Individuals with higher levels of network centrality will contribute more responses to electronic networks of practice.

Cognitive Capital

Cognitive capital refers to those resources that make possible shared interpretations and meanings within a collective. Engaging in a meaningful exchange of knowledge requires at least some level of shared understanding between parties, such as a shared language and vocabulary (Nahapiet and Ghoshal 1998). Language is the means by which individuals engage in communication. It provides a frame of reference for interpreting the environment and its mastery is typically indicated by an individual's level of expertise. Individuals must also understand the context in which their knowledge is relevant (Orr 1996). An individual's cognitive capital develops as he or she interacts over time with others sharing the same practice and learns the skills, knowledge, specialized discourse, and norms of the practice. This understanding may be gained either through hands-on experience or through narratives told over time. These narratives, sometimes called war stories or workarounds, provide insights into how other members have faced and resolved problems (Brown and Duguid 1991). In short, cognitive capital consists of both individual expertise, or mastery of the language within the practice, as well as experience with applying the expertise.

In an electronic network of practice, even if an individual is motivated to contribute knowledge to others within the network, contribution is still unlikely unless he or she has the requisite cognitive capital—that is, unless he or she has knowledge to contribute. Researchers have found that individuals with higher levels of expertise are more likely to provide useful advice on computer networks (Constant et al. 1996). At the same time, individuals are less likely to contribute when they feel their expertise to be inadequate (Wasko and Faraj 2000). Therefore, individual expertise, or the skills and abilities possessed by an individual, should increase the likelihood he or she will contribute knowledge. Cognitive capital also consists of mastering the application of expertise, which takes experience. Individuals with longer tenure in the shared practice are likely to better understand how their expertise is relevant, and are thus better able to share knowledge with others. This leads to the following hypotheses:

- H4a: Individuals with higher levels of expertise in the shared practice will contribute more helpful responses to electronic networks of practice.*
- H4b: Individuals with higher levels of expertise in the shared practice will contribute more responses to electronic networks of practice.*
- H5a: Individuals with longer tenure in the shared practice will contribute more helpful responses to electronic networks of practice.*
- H5b: Individuals with longer tenure in the shared practice will contribute more responses to electronic networks of practice.*

Relational Capital

In addition to motivations, structural capital, and cognitive capital, knowledge contribution is also facilitated by the affective nature of the relationships within a collective, referred to as relational

capital (Nahapiet and Ghoshal 1998). Relational capital exists when members have a strong identification with the collective (Lewicki and Bunker 1996), trust others within the collective (Putnam 1995b), perceive an obligation to participate in the collective (Coleman 1990), and recognize and abide by its cooperative norms (Putnam 1995a). Coleman (1990) suggests that the main function of this relational aspect of social capital is to facilitate actions for individuals within the structure, and that relational capital is an important asset that benefits both the community and its members. Members are willing to help other members, even strangers, simply because everyone is part of the collective and all have a collective goal orientation (Leana and Van Buren 1999). We examine here two dimensions of relational capital that prior research indicates may be relevant to electronic networks of practice: commitment and reciprocity.

Commitment represents a duty or obligation to engage in future action and arises from frequent interaction (Coleman 1990). Although commitment is often described as direct expectations developed within particular personal relationships, it can also accrue to a collective. Commitment to a collective, such as an electronic network of practice, conveys a sense of responsibility to help others within the collective on the basis of shared membership. Prior research finds that in an organizational electronic network, individuals posting valuable advice are motivated by a sense of obligation to the organization (Constant et al. 1996). In addition, findings from extra-organizational electronic networks suggest that individuals participate in networks due to a perceived moral obligation to pay back the network and the profession as a whole (Wasko and Faraj 2000). Therefore, individuals participating in an electronic network of practice who feel a strong sense of commitment to the network are more likely to consider it a duty to assist other members and contribute knowledge. This leads to the following hypotheses:

- H6a: Individuals who are committed to the network will contribute more helpful responses to electronic networks of practice.*

H6b: Individuals who are committed to the network will contribute more responses to electronic networks of practice.

H7b: Individuals guided by a norm of reciprocity will contribute more responses to electronic networks of practice.

In addition to commitment, many researchers suggest that trust is a key aspect of relational capital and facilitator of collective action (Coleman 1990; Fukuyama 1995). In general, trust develops when a history of favorable past interactions leads to expectations about positive future interactions. Trust is a complex phenomenon, and several dimensions of trust operating at multiple levels of analysis exist in organizational settings (McAllister 1995; McKnight et al. 1998; Ring and Van de Ven 1994; Tsai and Ghoshal 1998). Trust has been studied in a variety of online settings, and results indicate that trust in others' ability, benevolence, and integrity is related to the desire to give and receive information (Ridings et al. 2002) and improved performance in distributed groups (Jarvenpaa 1998). Another aspect of social trust that has not been investigated relates to expectations that an individual's collective efforts will be reciprocated (Putnam 1995b).

A basic norm of reciprocity is a sense of mutual indebtedness, so that individuals usually reciprocate the benefits they receive from others, ensuring ongoing supportive exchanges (Shumaker and Brownell 1984). Even though exchanges in electronic networks of practice occur through weak ties between strangers, there is evidence of reciprocal supportiveness (Wellman and Gulia 1999). Prior research indicates that knowledge sharing in electronic networks of practice is facilitated by a strong sense of reciprocity—favors given and received—along with a strong sense of fairness (Wasko and Faraj 2000). Thus, when there is a strong norm of reciprocity in the collective, individuals trust that their knowledge contribution efforts will be reciprocated, thereby rewarding individual efforts and ensuring ongoing contribution. This leads to the final hypotheses:

H7a: Individuals guided by a norm of reciprocity will contribute more helpful responses to electronic networks of practice.

Method

Sample

Data were collected from members of a national legal professional association in the United States. This association sponsors and maintains an electronic network of practice as part of its website. All members (approximately 7,000) have access to the electronic network of practice as part of their membership benefits and participation in the network is voluntary. The electronic network of practice, referred to within the association as the Message Boards, is supported by a Web-based system similar to a bulletin board where exchanges are visible to everyone and related messages are structured into discussion threads. Participation in the electronic network of practice is not anonymous, so knowledge contribution to the electronic network could influence perceptions of professional reputation. Participants have to log into the system in order to participate, and the first and last names of the participants are visible as part of the message header.

The professional association sponsored this study and provided access to the electronic network of practice. In addition, the association provided demographic information about its members. We observed and collected all message postings during a four-month period (February through May 2001). This time period was divided into two phases. In the first phase (February and March), messages were collected to examine an individual's centrality in the network. In the second phase (April and May), messages were collected and examined to identify survey participants and determine knowledge contribution. At the end of the second phase, we looked up each individual who participated in the electronic network of practice in the association's membership database to collect demographic data and postal addresses. Each individual was assigned a random number

identifier to ensure anonymity. We then sent each individual a paper survey with the random number identifier. Completed surveys were matched to individual participation on the message boards and demographic data from the membership database. Demographic data, survey data and the observed message postings to the electronic network of practice served as input for the data analysis.

Measures

The survey measures for the study were derived from previously published studies. The scales measuring the motivations of reputation and enjoy helping others were adapted from Constant et al. (1996). Commitment was adapted from Mowday et al. (1979). Reciprocity measures were adapted from Constant et al. The actual items used in the survey are presented in Table 2 (see the "Results" section).

Structural capital was assessed by determining each individual's degree of centrality to the network. In electronic networks of practice, a dyadic link is created between two individuals when one responds to another's posting (Ahuja et al. 2003). To determine individual centrality, these links were recorded in a square social network matrix such that if there was a link (one or more messages) between two individuals, a 1 was placed in that cell. A zero was placed in the cell if the two individuals were not linked. This measure of centrality assesses to how many unique individuals (alters) a focal individual (the ego) is connected, independent of the total number of messages posted. For example, an individual who exchanges 20 messages with 15 unique individuals has a high centrality (degree = 15), while an individual exchanging 20 messages with only one individual has a low centrality (degree = 1). One possible threat to validity when measuring network centrality (derived from the pattern of messages) concurrently with knowledge contribution (derived from the frequency and content of messages) is their joint dependence on the same messages. To remedy this potential threat, we derived network centrality from messages collected during the two

months *prior* to the period during which the content of messages was analyzed to evaluate knowledge contribution. This temporal separation between the assessment of centrality and the dependent variables guarantees independent measurement and allows a stronger claim of causality in our model.

Centrality was calculated using the UCINET 6 program (Borgatti et al. 1999). There were 3,000 messages posted by 604 participants in the network during this time frame, indicating a vibrant, active network. To reduce skewness, the variable was transformed using a log transformation.³

Cognitive capital was assessed by self-rated expertise and tenure in the field (a proxy for experience). Expertise was self-rated as part of the survey. The association domain covers one of the recognized federal legal specializations (e.g., patent, environmental, or immigration law), and, according to the senior staff members of the professional association, there are nine relevant legal subspecialties within the association's specialized domain. Survey respondents were asked to indicate their level of expertise (from novice = 1 to expert = 5) in each of these nine areas. The self-rated expertise score was assessed by taking the average for each individual across the nine areas. Tenure in the field was taken from the association's member database, indicating the number of months an individual has been a member of the professional association, representing how much experience he or she has in the association's legal specialty. These measures of expertise and tenure were considered the most relevant for assessing cognitive capital at the individual level, and were chosen over others, such as tenure as a lawyer and tenure in the electronic network of practice. This is because not all of a lawyer's skills and experience come from either a general understanding of law (required to pass the bar exam) or solely through participation

³Of the 604 participants, 91 individuals (15%) had a centrality score of zero; 168 individuals (28%) had scores of one; 108 individuals (18%) had scores of two; and 237 individuals (39%) had scores greater than or equal to three.

in the electronic network of practice. Although the electronic network of practice may have developed social cognitive capital, such as a language specific to the network as a whole, this was not a focus of our study.

The dependent variable in this study is knowledge contribution. To accurately assess this, we examined two independently measured dependent variables based on message postings: (1) the helpfulness of contribution and (2) the volume of contribution. First, content analysis was performed on all of the messages to determine whether the message was a question, a response to a question, or some other type of post (i.e., thank you, announcements, or spam). The "other" category was used to reduce the confounding of the content analysis, recognizing that some messages do not contribute knowledge. For example, "thank you!" or "me too!" messages are primarily social in nature compared to messages that provide answers. As a result, we did not consider these to represent a knowledge contribution, which we defined as a response to a question. One implication of this coding is that general announcement postings were not considered knowledge contribution in this study.

Response messages were then reviewed to assess the extent to which the content actually addressed and answered the posted questions. The responses were rated as very helpful, helpful, somewhat helpful, and not helpful, using the following guidelines:

- **Very Helpful** (received a score of 4). The response directly answered the question posted, and also provided a knowledge source or meta-knowledge for the seeker (pointers to the actual law, statute, website, etc.).
- **Helpful** (received a score of 3). The response directly answered the question posted.
- **Somewhat Helpful** (received a score of 2). The response did not directly answer the question, but provided a valuable insight into

how the issue was resolved elsewhere, information relevant to the problem at hand, a partial answer, or meta-knowledge.

- **Not Helpful** (received a score of 1). This rating indicates that the response was not helpful to the knowledge seeker.

One of the authors and a domain expert (a staff member of the association with extensive legal background) independently coded a subset of 100 messages. There was agreement on 92 of the 100 messages. Inter-coder reliability using Cohen's kappa (Cohen 1960) was .84, indicating adequate agreement. Message coding discrepancies were reviewed and given the rating by the domain expert. Given the accuracy of the inter-coder reliability on the first 100 messages, only one of the authors continued coding the rest of the messages. Once the helpfulness of the messages was assessed, an individual's helpfulness score was calculated by taking the mean helpfulness of their response messages.

The second measure of knowledge contribution assessed the total volume of an individual's knowledge contribution. This was the total number of response messages (messages that addressed a question) posted by each individual during the study's period.

Respondents

During the second phase (April and May, 2001), 2,555 messages were posted to the network by 597 unique individuals. Of these 2,555 messages, 1,156 were seeds, 1,181 were responses addressing questions, and the average thread length was 2.21 messages. Of the 597 unique individuals posting messages, we identified 593 valid addresses, and sent each of these individuals a paper-based survey. We received 173 responses, for a response rate of 29 percent. In order to assess response bias, we compared the participation rates in the electronic network of practice for respondents with the participation rates of non-respondents. The participation rate of individuals who responded to the survey was not significantly

different from that of non-respondents ($F = .823$, $n.s.$). The total of female respondents was 43 percent (compared to 41 percent in the association), and the mean age of respondents was 41 years (compared to 38 in the association). Respondents had an average of 11 years of overall legal experience (vs. 9.6 in the association), of which 8.5 years was spent on the legal specialty of the professional association (vs. 6.9 in the association as a whole). The total of respondents who worked for themselves as private practitioners (typically a one-lawyer firm) was 45 percent, while the rest worked in larger law firms. Comparative information was not available from the association member database, but the association director thought that the respondents' employment pattern was similar to that of the association members as a whole. Respondents were, therefore, typical in terms of gender and employment status, but they had a higher overall level of experience than average association members. We also compared the centrality scores between phase 1 and phase 2 to ensure that participation in the electronic network of practice was stable over time. The correlation between centrality in phase 1 and centrality in phase 2 is .88.

Results

We chose partial least squares (PLS) structural equation analysis to test the hypotheses. PLS is a structural equation modeling technique that simultaneously assesses the reliability and validity of the measures of theoretical constructs and estimates the relationships among these constructs (Wold 1982). PLS can be used to analyze measurement and structural models with multi-item constructs, including direct, indirect, and interaction effects, and is widely used in IS research (Ahuja et al. 2003; Chin and Todd 1995; Sambamurthy and Chin 1994). PLS requires a sample size consisting of 10 times the number of predictors, using either the indicators of the most complex formative construct or the largest number of antecedent constructs leading to an endogenous construct, whichever is greater. Although the measurement and structural parameters are

estimated together, a PLS model is analyzed and interpreted in two stages: the assessment of the reliability and validity of the measurement model, and the assessment of the structural model.

Measurement Model

The first step in PLS is to assess the convergent validity of the constructs by examining the average variance extracted (AVE). The AVE attempts to measure the amount of variance that a latent variable component captures from its indicators relative to the amount due to measurement error. AVE values should be greater than the generally recognized .50 cut-off, indicating that the majority of the variance is accounted for by the construct. In addition, individual survey items that make up a theoretical construct must be assessed for inter-item reliability. In PLS, the internal consistency of a given block of indicators can be calculated using the composite reliability (ICR) developed by Werts, Linn, and Joreskog (1973). Acceptable values of an ICR for perceptual measures should exceed .70 (Fornell and Larcker 1981) and should be interpreted like a Cronbach's coefficient. All ICR and AVE values meet the recommended threshold values. Table 1 summarizes the measurement model results.

Discriminant validity indicates the extent to which a given construct is different from other constructs. The measures of the constructs should be distinct and the indicators should load on the appropriate construct. One criterion for adequate discriminant validity is that the construct should share more variance with its measures than with other constructs in the model (Barclay et al. 1995). To evaluate discriminant validity, the AVE may be compared with the square of the correlations among the latent variables (Chin 1998). The diagonal of Table 1 contains the square root of the AVE. All AVEs are greater than the off-diagonal elements in the corresponding rows and columns, demonstrating discriminant validity.

A second way to evaluate convergent and discriminant validity is to examine the factor loadings of

Table 1. Descriptive Statistics, Correlation of Constructs,^a ICRs, and Square Root of AVE Values^b

	Mean	Std Dev	Range	VIF	ICR	1	2	3	4	5	6	7	8	9
1 Reputation	2.60	1.02	1-5	1.22	.91	.88								
2 Enjoy Helping	4.08	.77	1.7-5	1.45	.88	.33**	.84							
3 Centrality ^c	4.46	12.9	0-147	1.20	n/a	.09	.28**	1.00						
4 Self-rated Expertise	3.21	.94	1-5	1.27	n/a	-.02	.01	.07	1.00					
5 Tenure in Field – months	69.3	62.0	2-267	1.35	n/a	.02	-.15	.01	.44**	1.00				
6 Commitment	3.91	1.00	1-5	1.75	.90	.33**	.36**	.32**	-.19*	-.29**	.86			
7 Reciprocity	3.67	.90	1-5	1.62	.90	.26**	.45**	.12	-.16*	-.23**	.54**	.90		
8 Helpfulness of Contribution	2.43	1.27	0-4	n/a	n/a	.20**	.21**	.33**	.11	.11	.004	.04	1.00	
9 Volume of Contribution	2.17	8.05	0-92	n/a	n/a	.19*	.13	.50**	.15*	.26**	.11	-.12	.28**	1.00

^aCorrelations > .15 significant at the .05 level and > .20 significant at the .01 level (two-tailed).

^bSquare root of the AVE are the bolded diagonal values.

^cDescriptive statistics of centrality are based on active participants (N = 600) in the two month period preceding the main data collection.

Table 2. Factor Analysis, Constructs, and Item Wording

	Reputation	Enjoy Helping	Centrality	Self-rated Expertise	Tenure	Commitment	Reciprocity	Helpfulness of Contribution	Volume of Contribution
I earn respect from others by participating in the Message Boards	0.90	0.33	0.09	0.06	0.02	0.33	0.25	0.25	0.18
I feel that participation improves my status in the profession	0.90	0.26	0.06	-0.06	-0.03	0.31	0.25	0.16	0.15
I participate in the Message Boards to improve my reputation in the profession	0.83	0.27	0.08	-0.05	0.05	0.30	0.19	0.14	0.16
I like helping other people	0.20	0.79	0.15	0.00	-0.15	0.23	0.30	0.18	0.05
It feels good to help others solve their problems	0.29	0.86	0.26	0.02	-0.14	0.31	0.42	0.16	0.13
I enjoy helping others in the Message Boards	0.34	0.86	0.27	0.01	-0.09	0.37	0.39	0.19	0.13
Centrality	0.09	0.27	1.00	0.07	0.01	0.32	0.11	0.33	0.50
Self-rated Expertise	-0.01	0.01	0.07	1.00	0.44	0.18	-0.15	0.11	0.15
Tenure in the Field – months	0.02	-0.15	0.01	0.44	1.00	0.27	-0.22	0.11	0.26
I would feel a loss if the Message Boards were no longer available	0.28	0.31	0.26	-0.22	-0.29	0.82	0.44	0.02	0.07
I really care about the fate of the Message Boards	0.19	0.28	0.28	-0.12	-0.27	0.85	0.44	-0.05	0.07
I feel a great deal of loyalty to the Message Boards	0.39	0.34	0.29	-0.15	-0.19	0.92	0.51	0.03	0.14
I know that other members will help me, so it's only fair to help other members	0.27	0.42	0.08	-0.13	-0.17	0.49	0.95	0.01	-0.14
I trust that someone would help me if I were in a similar situation	0.20	0.39	0.14	-0.15	-0.26	0.52	0.85	0.05	-0.07
Helpfulness of contribution (content analysis)	0.22	0.21	0.33	0.11	0.11	0.01	0.03	1.00	0.28
Volume of contribution (total number of responses)	0.19	0.13	0.50	0.15	0.26	0.12	-0.12	0.28	1.00

each indicator. Each indicator should load higher on the construct of interest than on any other factor (Chin 1998). Factor loadings and cross-loadings for the multi-item measures were calculated from the PLS output and are presented in Table 2. Inspection of loadings and cross-loadings confirms that the observed indicators demonstrate adequate discriminant and convergent validity.

Hypothesis and Model Testing

The theoretical model and hypothesized relationships were estimated using 200 iterations of the bootstrapping technique in PLS Graph 2.91 (Chin and Frye 1996). The explanatory power of the structural model is evaluated by looking at the R^2 value in the final dependent construct. Because we measure knowledge contribution in two ways, we present two sets of results, one for each dependent variable. We first present results for helpfulness of contribution (per content analysis of the messages). Next, we present results for volume of contribution (the number of responses posted by each individual). To examine the specific hypotheses, we assessed the t-statistics for the standardized path coefficients and calculated p-values based on a two-tail test with a significance level of .05. Table 3 presents the results of the PLS analysis used to test the model.

Links to Helpfulness of Contribution

The R^2 for the helpfulness of knowledge contribution model was .19. We proposed direct links between perceptions of enhanced reputation (H1a), enjoy helping (H2a), and the helpfulness of contribution. Only the path between perceptions of enhanced reputation and helpfulness was positive and significant ($\beta = .21, p < .01$). The path between enjoy helping and helpfulness approached significance ($\beta = .13, p < .10$). Hypothesis 3a proposed a link between an individual's network centrality and the helpfulness of contribution. The path was positive and significant ($\beta = .33, p < .001$), suggesting that structural capital increases the likelihood of more helpful

contributions. Hypotheses 4a and 5a suggested a link between high levels of cognitive capital and the helpfulness of contribution. The results indicated that neither self-rated expertise nor tenure in the field were linked to providing helpful contributions. Finally, hypotheses 6a and 7a suggested a link between the dimensions of relational capital and the helpfulness of contribution. Contrary to H6a, the results show a negative and significant link between commitment to the electronic network of practice and helpfulness ($\beta = -.20, p < .05$), while no link was found between expectations of reciprocity and the helpfulness of contribution.

Links to Volume of Contribution

The R^2 for the volume of contribution model was .37. We proposed direct links between perceptions of enhanced reputation (H1b), enjoy helping (H2b), and volume of contribution. The path for reputation was significant ($\beta = .15, p < .05$), while the path for enjoy helping was not. Hypothesis 3b proposed a link between an individual's network centrality and the volume of his or her contributions. The path was positive and significant ($\beta = .46, p < .001$), supporting the contention that structural capital increases the likelihood of a high volume of contribution. Hypotheses 4b and 5b suggested a link between high levels of cognitive capital and volume of contribution. The results were split, with no significant link between self-rated expertise and volume of contribution, while tenure in the field was positively and significantly linked to volume of contribution ($\beta = .23, p < .01$). Contrary to the prediction of H7b, the results showed a negative and significant link between an expectation of reciprocity and volume of contribution ($\beta = -.24, p < .05$), and no link was found between commitment to the network and volume of contribution.

Discussion

The aim of this study was to test a model of social capital to investigate why people contribute knowledge to others, primarily strangers, in electronic networks of practice. Our results provide support

Table 3. Individual Motivations, Social Capital, and Knowledge Contribution Results

		Helpfulness of Contribution		Volume of Contribution	
		β	t-statistic	β	t-statistic
H1	Reputation	0.21**	2.75	0.15*	2.12
H2	Enjoy Helping	0.13 [†]	1.67	0.06	1.14
H3	Centrality	0.33***	4.29	0.46***	7.07
H4	Self-rated Expertise	0.02	0.24	0.00	0.00
H5	Tenure in Field - months	0.06	0.71	0.23**	2.84
H6	Commitment	-0.2*	2.01	0.10	1.06
H7	Reciprocity	0.01	0.07	-0.24*	2.01

[†]p < .10, *p < .05, **p < .01, ***p < .001

for the theoretical model and qualified support for most of our hypothesized relationships. The results indicate that a significant predictor of individual knowledge contribution is the perception that participation enhances one's professional reputation. These results are also consistent with prior research in online settings, providing additional evidence that building reputation is a strong motivator for active participation and knowledge contribution (Donath 1999), and that reputations in online settings extend to one's profession (Stewart 2003). The results from this study also provide weak evidence that individuals who enjoy helping others provide more helpful advice, as suggested by prior research examining electronic networks openly available on the Internet (Kollock and Smith 1996). One potential explanation for the weak influence of intrinsic motivations may be due to the non-anonymous nature of the network and the professional implications of participation in the network. The results may indicate that when electronic networks of practice are used to support professional activities, the ability to leverage extrinsic rewards may become more salient than intrinsic returns to motivate knowledge contribution. Thus, an interesting area of further research would compare networks that directly support professional activities with other types of electronic networks of practice, and the influence of anonymity, to see whether there are differences in

motivations for posting different types of content in the different contexts.

In addition to individual motivations, our results provide some evidence that social capital develops and plays an important role underlying knowledge exchange, despite the media richness limitations inherent in online communication. Most significant is the role of structural social capital. Consistent with theories of collective action, individuals who are central to the network and connected to a large number of others are more likely to sustain contributions to the collective (Burt 1992), indicating that the development of a critical mass of active participants is important for sustaining electronic networks of practice (Marwell and Oliver 1993).

The results also provide some indication that cognitive social capital plays a vital role underlying knowledge contribution. Consistent with research on communities of practice (Brown and Duguid 1991; Orr 1996), an individual's experience in the practice is an important predictor of knowledge contribution. However, although an individual's self-rated expertise had a significant correlation with the volume of knowledge contributed, self-rated expertise was not significant in the overall model. This result is at variance with prior studies, which found that individual expertise is an important predictor of knowledge contribution and

the helpfulness of replies in electronic networks of practice in an organizational context (Constant et al. 1996) and in open networks on the Internet (Wasko and Faraj 2000). One potential explanation for the different results may be due to how expertise was measured across the three studies. In the current study, expertise was measured by averaging an individual's general level of self-rated expertise across nine legal subspecialties. In the Constant et al. (1996) study, expertise was self-rated based on the content of a specific message, indicating how informed an individual was on the subject matter of the question. In the Wasko and Faraj (2000) study, expertise was elicited through open-ended comments about why people participate and help others in general. While we predicted that cognitive capital consisted of both self-rated expertise as well as experience in the practice, the results seem to indicate that mastering the application of expertise and understanding how expertise is relevant, which takes experience, may be just as important in electronic networks of practice focused on professional knowledge exchange. Thus, the importance of experience and expertise in the practice when considering the type of knowledge exchanged, and how these constructs are measured, are additional areas in need of further research.

Directly contrary to expectations, the results suggest that high levels of relational capital do not predict knowledge contribution. This finding seems to provide support to the argument that relational capital may not develop in electronic networks due to a lack of shared history, high interdependence, frequent interaction, and co-presence (Cohen and Prusak 2001; Nahapiet and Ghoshal 1998; Nohria and Eccles 1992). Individuals contribute more knowledge in terms of volume, even though they expect that their help *will not* be reciprocated, and regardless of their level of commitment to the network. These findings directly contradict prior research in face-to-face settings, where it is consistently found that reciprocity is critical for sustaining supportive relationships and collective action (Putnam 1995b; Shumaker and Brownell 1984). One possible explanation is that network-based interactions may be generalized rather than dyadic, and direct

reciprocity is not necessary for sustaining collective action. In contrast to personal exchanges between two individuals where there is an expectation of direct reciprocity, reciprocity in electronic networks of practice may be generalized (Wasko and Teigland 2002). Generalized reciprocity occurs when one's giving is not reciprocated by the recipient, but by a third party (Ekeh 1974). If expectations of direct reciprocity are not key to sustaining knowledge contribution in electronic networks of practice, one potentially exciting area of further research would be to apply social network analysis techniques to examine whether patterns of generalized exchange substitute for direct reciprocity and how.

Another surprising result is the negative relationship between commitment and the helpfulness of contributions, even though these two variables were not correlated. Examination of the variance inflation factors suggests that multicollinearity is not the cause of this significant relationship. We performed additional analyses, which indicated that commitment is acting as a suppressor variable. Suppressor variables explain residual variance in the dependent variable after controlling for the effects of other variables (Cohen 1988). A classical suppressor variable is a variable that has a zero-order correlation with the dependent variable, but is correlated with one or more predictor variables and leads to improved prediction when included in multiple regression analysis (Pedhazur 1982). We investigated the suppressor impact by removing variables from the model and checking if the suppressor effect of commitment still remained. We found that reputation and centrality must be present in the model to get the suppressor effect,⁴ indicating that the semi-partial correlation between commitment and helpfulness is greater than its zero-order correlation because the irrelevant variance shared with reputation and centrality is suppressed, in effect purifying the relation between the commitment and the depen-

⁴Removing reputation results in a reduction of commitment β from .20 to .13 ($p = n.s.$), removing centrality results in a reduction of commitment β from .20 to .07 ($p = n.s.$), and removing both reputation and centrality results in a reduction of commitment β to .02 ($p = n.s.$).

dent variable. Thus, while commitment has a weak, positive correlation with the helpfulness of knowledge contribution, once the impacts of reputation and centrality are taken into account, higher levels of commitment predict lower levels of helpfulness. One potential explanation for this finding may be that after taking reputation and centrality into account, it is the individuals that are receiving knowledge, rather than contributing, that are more committed to the network. This would be an interesting question to examine in future research.

The results of this study have interesting implications for practitioners interested in knowledge management and how to leverage electronic networks of practice for competitive advantage. Organizations benefit from accessing external knowledge through electronic networks of practice because valuable expertise flows into the organization at relatively little cost. By participating in an electronic network of practice, individuals gain reputation and become central to a larger network of resources. Disallowing such participation may cut off valuable knowledge flows and reduce employee efficacy (Anand et al. 2002).

Managers interested in developing and sustaining knowledge exchange through electronic networks of practice should focus attention on the creation and maintenance of a set of core, centralized individuals with experience in the practice by using extrinsic motivators such as enhanced reputation to actively promote contributions to the network. Centralized individuals create a "critical mass" that sustains the network and maintains the network's usefulness by contributing knowledge to others. To help generate a critical mass, managers should target individuals with longer tenure and more experience in the practice. Another method to promote individual participation in the critical mass is to develop techniques that help build an individual's reputation in the profession. For example, it could be helpful to assign status to individuals and make this status apparent both within the electronic network of practice and off-line as well. Individual reputations may become more salient when managers build bridges between physical and virtual networks, finding ways to spread

reputations developed online to the profession as a whole.

Leveraging centrality and promoting individual reputations may also help signal the potential quality of responses to novice participants and lurkers, making the knowledge more accessible to all participants in the network. As Smith (2002) suggests, techniques that identify an individual's centrality can effectively support knowledge sharing by helping knowledge seekers assess the quality of responses to their questions. Gaining status and recognition in this way would motivate individuals to participate more in electronic networks of practice (von Hippel and von Krogh 2003). Therefore, making centrality a part of an individual's identification may provide an additional incentive for participants to respond frequently and well to many different people.

We should note that there are several limitations to this study, requiring further examination and additional research. One limitation is that we examined only one aspect of collective action: knowledge contribution. While it can be argued that knowledge contribution is key to sustaining online networks, future research should also examine how participation in electronic networks of practice affects individual learning and knowledge creation. Another limitation of this study is its focus on active participants. We did not investigate individuals who read but do not post, or members who do not log onto the electronic network of practice at all. Why individuals choose to participate in an electronic network of practice or online group is another area for future research.

Furthermore, the generalizability of our results may be limited, as we examined only a single electronic network of practice supporting a specialized knowledge practice. Future studies should examine whether other electronic networks of practice exhibit similar dynamics and compare individual motivations and social capital across networks to see if there are variations in the level of participation and knowledge outcomes similar to what we found. A related open question is whether the social capital model applies to different practices that are not strictly professional in nature such as those focused on hobbies or diseases.

Finally, this study was cross-sectional (based on four months of exchanges), so we cannot investigate the process by which social capital develops or the ways in which network structure changes over time. Because one of the independent variables and one of the dependent variables examined in this study were both assessed from message posting activity, the cross-sectional design makes it difficult to examine the dynamic interaction between knowledge contribution and the resulting changes to network structure. Therefore, we relied on theory to position network centrality as an independent variable in the model and used message postings from the two months prior to data collection for the dependent variable to test this relationship. However, network centrality could also be considered a dependent variable, or outcome of knowledge contribution. For example, while we argue that network centrality is an important indicator of why individuals choose to contribute knowledge, centrality measures may also potentially be used to show that individuals have in fact contributed, how often they have contributed, and to whom. Thus, future studies should take this dynamic nature of network structuring into account, using longitudinal data and additional measures of network centrality. Alternatively, future research might also benefit from examining different dependent variables that are not based on message activity, such as perceptions of knowledge contribution and knowledge acquisition at the individual level. Researchers could also incorporate event-driven methods that examine perceptions at the message level, similar to the method used by Constant et al. (1996).

Conclusion

Despite the promise of knowledge management technologies, organizations are struggling to turn electronic networks into active discussion forums (Orlikowski 1996). Knowledge contribution in electronic networks of practice is a socially complex process that involves a variety of actors with different needs and goals. In electronic networks, individuals contribute knowledge and help others

despite the lack of a personal, face-to-face relationship and the easy alternative of free-riding on the efforts of others. So, why do individuals share their valuable knowledge in electronic networks of practice? Individuals contribute knowledge to electronic networks of practice when they perceive that it enhances their professional reputations, and to some extent because it is enjoyable to help others. They contribute when they are structurally embedded in the network, and when they have experience to share with others. Surprisingly, we find that individuals who contribute knowledge do not seem to be more committed to the electronic network of practice than noncontributors, nor do they seem to expect help in return.

Acknowledgements

We would like to thank the editors of the special issue, V. Sambamurthy and M. Subramani, as well as our anonymous AE and reviewers for their efforts in helping us develop this paper and for an exemplary review process as a whole. Special thanks to Herbert R. McLure for his comments on earlier drafts of this work. We would also like to acknowledge the participation and feedback from our colleagues at the MISRC Conference on Knowledge Management, 2003.

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