

An Integrated Model of Knowledge Sharing in Contemporary Communication Environments

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4 An Integrated Model of Knowledge Sharing in Contemporary Communication Environments

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Why do people share (or withhold) knowledge through online public knowledge management systems (KMS)? What benefits and costs might they experience from doing so? How does one's ability to cognitively integrate the knowledge shared through a KMS affect these costs and benefits? Sharing knowledge, both contributing and collecting, requires active communication and engagement with others; involves complex issues about knowledge, governance structures and public goods, and individual and collective costs and benefits, and is increasingly done through online public knowledge management systems. An interdisciplinary review of these issues leads to an integrated model of individual and collective influences on knowledge sharing behavior through, and use of, knowledge management systems. Primary contributions of the model include the role of cognitive integration in mediating between a knowledge management system's use and resulting costs and benefits, and the notion that such costs and benefits can occur at both the individual and collective level.

Knowledge management, and specifically knowledge sharing, constitutes an important topic of scholarly inquiry and organizational practice. The purpose of knowledge management is to enhance organizational performance by explicitly designing and implementing tools, processes, systems, structures, and cultures to improve the creation, storage, search, retrieval, sharing, re-use, and value of all three types of knowledge (human, social and structured) that are critical for decision making (Alavi & Leidner, 2001; De Long & Fahey, 2000). Knowledge management, in general, comprises both a process and a perspective, one that understands both the cognitive and the social nature of knowledge.

Knowledge management systems (KMS) are social systems, often supported by technology, used for knowledge sharing purposes. They do not have to involve information and communication technologies (ICTs) (consider the

office bulletin board or even the familiar water cooler). However, this review presumes that a KMS uses ICTs to support knowledge management processes—most simply, the creation, storage, transfer, and application of knowledge (Alavi & Leidner, 2001, p. 107). Specific types of ICT-enabled KMS include content management tools, knowledge sharing tools, and knowledge search and retrieval systems (see Benbya, Passiante, & Belbaly, 2004, who provided case studies of eight major corporate ICT-enabled KMS and how those support knowledge generation, storage, distribution, and use). An ICT-enabled KMS may emphasize documents, terms, and fields associated with those documents, an internally generated representation of the content or concepts, directories of projects and people, diagrams of relationships within and among experts and information, or social networking features to foster user-generated relationships and interpretations such as collaborative filtering and recommending. Further, with intranets, the Internet, and new multi-media systems, analysis and application of knowledge sharing now extends well beyond the traditional organization with generally clear boundaries and membership. Information communication technologies have been proposed, designed, and implemented to foster intra-, inter-, and extra-organizational knowledge sharing (Maier, 2007; Tapscott & Williams, 2006). So this review also presumes the KMS is online and public.

With the continuing developing of Internet-based information and communication technologies, analysis and application of knowledge sharing now extends well beyond present discussions of the traditional organization with generally clear boundaries and membership. Yet, while ICTs have been proposed to enable knowledge sharing, many studies have identified challenges and disadvantages to their successful use for this purpose (see “Knowledge Sharing through Information and Communication Technologies” below). The primary focus of this review, then, is to integrate prior theory and research to develop a model of the influences on and outcomes of knowledge sharing through knowledge management systems in contemporary communication environments, primarily organizational and professional members that participate in *networks of practice*. Thus, in this review, we ask: Why do people share (or withhold) knowledge through online public knowledge management systems? What benefits and costs might they experience from doing so? How does one’s ability to cognitively integrate the knowledge shared through a KMS affect these costs and benefits?

Research in this area would seem to provide relevant opportunities for and challenges to, as well as requiring participation from, a wide range of expertise from the communication discipline (see also “Proposed Theoretical Model and Future Research” below). The most obvious areas include organizational communication, and ICTs/new media. The traditional bureaucratic organizational structure, designed to control the flow of information and centralize knowledge, is inappropriate and ineffective in rapidly changing environments, where members must share perceptions and knowledge within and across organizational boundaries (Taylor & van Every, 1993). Rather than being embodied

in formal structures and buildings, organizations are constituted through this communication, knowledge sharing, and sense-making (Taylor & van Every, 2000; Weick, 1995). Information communication technologies both facilitate as well as embody collaboration and knowledge sharing across time, space, social groups, media and knowledge domains, giving rise to virtual teams, social media, ad hoc and mediated networks, and new organizational forms (Benkler, 2006; Gibbs, Nekrassova, Grushina, & Abdul Wahab, 2008; Rice & Gattiker, 2001; Shirky, 2008; Tapscott & Williams, 2006).

Knowledge and Knowledge Processes

Knowledge is a key driver to sustaining a competitive advantage in today's global economy (Earl & Scott, 1999; Reagans & McEvily, 2003). Knowledge is a primary component of both the inputs (labor) and outputs (goods and services) of production (Grant, 1996).

Aspects of Knowledge

Familiar concepts such as *knowledge-intensive firm* (Starbuck, 1992), *knowledge society* (Drucker, 1969), *knowledge-based economy* (Adler, 2001), and *knowledge worker* (Due, 1995) reflect the central role of knowledge in the United States and other societies (Jussawalla, Lambertson, & Karunaratne, 1988). Creating, accessing, and sharing knowledge are central to the growth of knowledge based economies and increased employment, health, and well-being of populations in developing countries (Dolfsma, 2006; Rodrigues, 2003; UNESCO, 2005; see also Harris, 2001, for the intellectual origins of the knowledge-based economy as well as the internationalization of knowledge). Theories of production and economies since Adam Smith (1776/1904) have noted the crucial role of knowledge as industrial and societal inputs, processes, and outputs, particularly in affecting market equilibrium in the form of prices, including through information asymmetries, the costs of obtaining information, and imperfect or incomplete information. Endogenous/new growth theory in economics, and, later, resource-based organizational theory, recognized society's ability to use knowledge to generate continuing technological improvements and ongoing returns of knowledge products at low marginal cost, and organizations' ability to develop first-mover advantages, non-substitutable internal competencies, innovativeness and competitive advantages through creating, sharing, and re-using knowledge (Martin, 2008).

Of course, knowledge sharing is much easier recommended than achieved. A survey of knowledge management (KM) projects in 431 U.S. and European organizations found that slightly over half (54%) reported that one of the most notable difficulties in running a successful KM initiative is motivating individuals to change their current behavior (Ruggles, 1998). According to Martin (2008, p. 391), "Extensive knowledge sharing within organizations still appears to be the exception rather than the rule." Even sharing information

about, and even more so the implementation of, best practices—what might be expected to seem highly valued by potential adopters—face considerable barriers. Such obstacles can encompass the organizational context (institutional and organizational environment, absorptive capacity, competency traps, identity, culture, and size), the diffusion process (stages of diffusion, attributes of the innovation, the recipient, and the knowledge to be transferred, and the state of relationship between the source of knowledge and the receiving unit), and management-related barriers (the level of managerial commitment and the appropriateness of training and reward systems) (Simard & Rice, 2007). A wide variety of disjunctures between contextual elements and a KMS may inhibit knowledge sharing, such as where incentives to share are limited, where collaboration challenges traditional power structures, where mediated interactions are insufficient to develop trust, or where content, technology, or access are problematic (Barrett, Cappleman, Shoib, & Waltham, 2004). Thus, understanding the range and level of potential influences on how information and communication technologies might be used to foster knowledge sharing, which may lead to both positive and negative outcomes at both the individual and collective level, is a crucial challenge to organizational researchers and practitioners alike.

One of the critical goals of managing knowledge in organizations as well as in other communities and groups involves enabling and motivating members to provide, gain access to, and share each other's knowledge. To be useful, this knowledge must be provided in a form and context useful to others. On the one hand, communicators could simply strive to make very explicit information available, perhaps accompanied by explanations and procedures. More significantly, other cases entail revealing one's personal understanding and knowledge to others in that explicit form; that is, sharing tacit knowledge as explicit knowledge.

Explicit knowledge (or "know what") is knowledge that can be codified (Nonaka, 1994; Nonaka & Takeuchi, 1995), easy to imitate (Alavi & Leidner, 2001; Argote & Ingram, 2000), and transferred at low or zero marginal cost (Roberts, 2000). It is embodied in symbols (documents, drawings, manuals, reports), artifacts (machines, tools), or routines (Rice, 2008; Roberts, 2000). *Tacit* knowledge (or "know how") encompasses knowledge that is deeply embedded in human activity and experience (Nonaka, 1994), and difficult to replicate and transfer (Alavi & Leidner, 2001). We can further conceptualize tacit knowledge as including *cognitive knowledge*, consisting of mental models and beliefs, and *technical knowledge*, or skills and crafts (Nonaka, 1994; Nonaka & Takeuchi, 1995).

A significant debate has emerged on the tacit-explicit distinction, centering on whether or not tacit knowledge can be transformed into explicit knowledge (Flanagin, 2002). Additionally, some question whether the two comprise truly dichotomous states of knowledge (Roberts, 2000). Rather, tacit and explicit knowledge may be mutually reinforcing and constitutive dimensions of knowl-

edge (Hislop, 2002; Polanyi, 1966; Schultze, 2000). Indeed, people need tacit knowledge in order to apply explicit knowledge in a meaningful way (Alavi & Leidner, 2001; Wenger, McDermott, & Snyder, 2002). Experience, reflection, and the interpretation of context interact with information to create knowledge (Davenport, De Long, & Beers, 1998). Both organizations and individuals are constrained by their *absorptive capacity*, or the ability to process new knowledge as a function of an existing knowledge base (W. M. Cohen & Levinthal, 1990). Conversely, data and information can add value to knowledge and open up new possibilities for innovation (Grover & Davenport, 2001). Starbuck (1992) observed that even experts in knowledge intensive firms enhance their tacit knowledge through the application of explicit knowledge. Experts in many fields learn not only by doing, but also through courses and books (Davenport & Prusak, 1998).

Many scholars suggest that knowledge resides at the individual level of cognition (Grover & Davenport, 2001; Simon, 1991). However, Nonaka and Takeuchi's (1995) socialization, externalization, combination, and internalization model of organizational knowledge creation proposes that knowledge initially resides in the minds of individuals while spiraling outward through social interactions to form the bases of knowledge at the organizational level. Social participation with others gives meaning to our experiences, and it functions as the foundation from which interactants create and share new knowledge (Alavi & Leidner, 2001; Brown & Duguid, 2000; Nonaka, 1994; Nonaka & Takeuchi, 1995; Roberts, 2000; Vera & Crossan, 2003; Wenger, 1998; Wenger et al., 2002). Others favor a conceptualization of knowledge as residing in organizations (Levitt & March, 1988), a community of practice (CoP), a network of practice (NoP), or, more generally, social networks (Brown & Duguid, 2000; Contractor & Monge, 2002; Iverson & McPhee, 2002; McDermott, 1999; Rice, 1982; Rice, Collins-Jarvis, & Zydney-Walker, 1999; Wenger, 1998; Wenger et al., 2002). Some have argued for a framework that takes both perspectives into account, while drawing attention to the social character of collective knowledge (Alavi & Leidner, 2001). Others have asserted that the location or sources of knowledge extend even to physical structures, technologies, processes, and routines (Argote & Ingram, 2000; Grover & Davenport, 2001; Rice & Gattiker, 2000).

Managing Knowledge through Knowledge Processes

The processes of creating, transferring, and applying knowledge underlie many discussions of organizational knowledge and subsequent value creation.

Knowledge *creation* or generation encapsulates the development of new organizational capabilities or innovations. Knowledge *transfer* entails the exchange of knowledge from one location/person/organization to another where it is needed and applied. It usually indicates providing knowledge to, or obtaining knowledge from, one or more others, often mediated by technology.

If scholars describe knowledge as an economic transaction that occurs through knowledge markets, they tend to use knowledge *exchange* as the dominant term (Davenport & Prusak, 1998; Nahapiet & Ghoshal, 1998). Knowledge *sharing* emphasizes the socially embedded nature of knowledge and the existence of reciprocity, trust, and an underlying relationship in the exchange (Van den Hooff, Elving, Meeuwssen, & Dumoulini, 2003). Indeed, when expertise is widely distributed in an organization, knowledge sharing becomes a necessary prerequisite for the creation of firm-wide intellectual capital (Huysman & de Wit, 2003; Nonaka, Noboru, & Toyama, 2001) and subsequent value creation (Kogut & Zander, 1992; Moran & Ghoshal, 1996; Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998). This perspective stems from the knowledge-based view of the firm, which treats knowledge as a strategic resource (Grant, 1996). Knowledge *reuse* underscores the possible multiple uses of the same knowledge when shared among multiple people across time (Markus, 2001). Finally, knowledge *application* focuses on the productive use of knowledge for decision-making and problem-solving purposes (Alavi & Leidner, 2001; Alavi & Tiwana, 2003; also utilization, Easterby-Smith & Lyles, 2003). Benbya et al. (2004) provided a nice summary of how various researchers label each phase of the overall knowledge process.

Sharing knowledge entails both *contributing* and *collecting*. Indeed, a willingness, eagerness, or ability to both collect and contribute knowledge underlies the act of knowledge sharing (Jarvenpaa & Staples, 2000; Kalman, Monge, Fulk, & Heino, 2002; Van den Hooff, De Ridder, & Aukema, 2004). Both contributing and collecting knowledge may be highly active processes (Van den Hooff & De Leeuw van Weenen, 2004). For example, many computer bulletin boards or discussion lists are commonly used to post a question or ask for help or advice—an active role oriented toward collecting (Ridings, Gefen, & Arinze, 2002). Thus, knowledge retrieval entails more than just a one-way interaction between contributor and retriever, and it opens up the possibility of a collector-contributor-collector interaction cycle. Knowledge contributing and collecting behaviors can occur as a person-to-person, generalized other-to-person, or person-to-generalized other interaction (see “Collective and Individual Level Influences, Knowledge Sharing Processes, and their Outcomes,” which returns to this theme).

Especially in online and public contexts, knowledge sharing comprises essentially a voluntary activity, even under conditions of cooperative mechanisms that might be instituted by an organization (Davenport, 1997; Wenger et al., 2002). Enforcing rules or formalized processes as part of a KM strategy can actually hinder knowledge sharing (Hinds & Pfeffer, 2003). Indeed, when comparing the behavior of voluntary and required online groups, Finholt and Sproull (1990) found that individuals in discretionary groups displayed a greater rate of participation than individuals whose membership in a particular online group was enforced by their employer. Paradoxically, introducing incentives or rewards to encourage cooperative behavior can have the adverse effect of producing a high volume of low quality knowledge contributions (Cabrera

& Cabrera, 2002; Fulk, Flanagan, Kalman, Monge, & Ryan, 1996). For example, while economic incentives did predict increased provision of answers by researchers on Google's Answer Web site, social incentives (comments and ratings) generated greater ongoing (persistent) provision and even higher average gains (Raban, 2008). So mixed incentives seem to generate greater social capital and more information exchanges, in at least this kind of KM site. However, metaknowledge about the importance of one's knowledge for other group members can enhance the quality of contributions to a discretionary database, particularly in combination with a reward system that encourages high quality contributions (Cress, Kimmerle, & Hesse, 2006).

Central to knowledge sharing is a dilemma inherent in theories of public goods (Dawes, 1980). Typically, individuals' incentive structures favor withholding private resources (in this case, knowledge) over contributing these resources for the creation of a public good, which may involve immediate costs but is unlikely to generate a direct, immediate reward to the individual provider. Individuals not only tend to withhold contributions, they also tend to *free ride* off the contributions of others by consuming a collective good to which they did not contribute. Yet, if everyone behaves in this same manner, then they never produce, and everyone is worse off than they would have been otherwise. Dawes referred to this problem as a *social dilemma*, or any situation in which the interests of the collective are pitted against the interests of the individual (see also Liebrand, Messick, & Wilke, 1992). More general concepts of over-consumption of a public good include *social loafing* in group contexts (Latane, Williams, & Harkins, 1979), and *the tragedy of the commons* (Hardin, 1982), such as traffic jams and global warming.

These issues arise from two unique characteristics of public goods: non-excludability and jointness of supply. Individuals cannot be excluded from consuming a public good, and an individual's consumption of the good does not diminish the amount available to others (in the above examples, this is true only up to a certain level) (Hardin, 1982; Marwell & Oliver, 1993). These characteristics are especially salient for information goods as the material costs of access and distribution approach zero and as social members may easily use (and redistribute) without contributing. In the case of knowledge sharing, a collective knowledge base is the public good (Nahapiet & Ghoshal, 1998; Van den Hooff & De Leeuw van Weenen, 2004; Van den Hooff et al., 2004; Wasko & Faraj, 2000). An undersupply of knowledge sharing among individuals is the public goods problem that must be resolved (Cabrera & Cabrera, 2002; Connolly & Thorn, 1990).

Collective action provides the means by which members produce a public good. Collective action theories assert that individual motivations to contribute or not depend to some extent on the extent to which the good has already been produced at any given point in time (Fulk et al., 1996; Hardin, 1982). Collective action becomes sustainable once a sufficient number of participants, or *critical mass*, contributes (Markus, 1990; Rogers, 2003). However, situations do arise in which a small number of resource-rich individuals can contribute a

sufficient number of resources to secure the good for others (Oliver, Marwell, & Teixeira, 1985). Indeed, according to Markus, the first adopters must have quite different resources and interests than later users, or they would have no reason or ability to be an early adopter, and the system would never be used. The *production function* of collective action can be either decelerating or accelerating. In situations of knowledge sharing, the production function is typically accelerating, such that later contributions produce progressively greater rewards for both individuals and the collective—than do initial contributions (Markus, 1990; Monge et al., 1998). It may also be a *reciprocal production function*, where contributions of both early and later users benefit each other.

These functions relate to *network externalities*. The core premise behind network externalities is that interactions among actors, or systems that promote such interactions, can positively or negatively affect others in the social or technical system (Shapiro & Varian, 1999). For example, in one organization, the use of a new desktop video system led to an increase in interrupted meetings—a negative externality—as well as the ability to generate greater awareness through the research group of others' interests and expertise—a positive externality (Kraut, Rice, Cool, & Fish, 1998).

Thus, both short-term and long-term benefits and costs may accrue at both the individual and collective level. Economic problems underlying valuing, generating, and sharing information, for both individual and public benefit, have been well described by information economists (e.g., Arrow, 1984; Lambertson, 1971; Marschak, 1964; Stigler, 1961). Other theoretical approaches to understanding motivations for and rewards of knowledge sharing include economic exchange theory, social exchange theory, and social cognitive theory (Bandura, 1986; Bock & Kim, 2002; Cook, 1987; Homans, 1958).

Organizations and Networks as Knowledge Governance Structures

Both the process of sharing knowledge and the technological components that accompany most KM initiatives are deeply embedded in their social contexts (groups, organizations, networks, culture, nation). These contexts involve social interactions that foster or constrain learning among their members (Granovetter, 1985). Kogut and Zander (1992) described formal organizations as superior to markets for knowledge transactions because they function as social communities that are upheld by cooperative organizing principles.

However, other forms, neither formal organizations nor markets, may better foster knowledge sharing, especially in contemporary communication environments. The efficiency of the vertically integrated firm, in terms of asset specialization of repeat transactions, no longer offers an optimal governance structure in the marketplace when viewing efficiency from a knowledge perspective (Adler, 2001; Hedlund, 1994; Shirky, 2008). A logic of network forms is a more appropriate conceptualization of transactions that depends highly on

idiosyncratic, complex, and dynamic exchanges in mediated environments that significantly reduce transaction costs (Powell, 1990).

Two conceptual subsets of the network perspective—*communities of practice* (CoPs) and *networks of practice* (NoPs)—have been proposed as ideal social contexts for learning and knowledge sharing, offering advantages above and beyond those afforded by an organizational perspective. Huysman and deWit (2003) asserted that networks in general are ideal for knowledge sharing in cases where members struggle to determine available and necessary knowledge. Networks facilitate or constrain access to collective action, trust, and tacit knowledge (Martin, 2008). Communities and networks of practice comprise social processes designed to increase this access for and by its members (though they do not always achieve this in practice).

CoPs and NoPs represent unique types of networks in which a shared practice or common set of concerns binds members together (Brown & Duguid, 2000). Wenger et al. conceptualized practice as “a set of frameworks, ideas, tools, information, styles, language, stories, and documents that community [or network] members share” (2002, p. 29). Practice rests upon a baseline of tacit knowledge shared by all members of a CoP/NoP, but it is embodied in, and arises from, a mutually reinforcing relationship between tacit and explicit forms of participation (Wenger, 1998). Yet, it is also defined by the relations, unspoken norms, implicit rules, underlying assumptions, and shared understandings that may never be formalized, but nonetheless defining characteristics of membership in a CoP/NoP. The combination of a community/network and a shared practice lends credence to the argument that CoPs/NoPs are more effective for knowledge transactions than networks alone, especially for more voluntary forms of knowledge sharing.

A number of attributes blur the boundaries between CoPs and NoPs, while other attributes differentiate them. Membership in both CoPs and NoPs is voluntary, producing emergent organizing structures, although certain measures can be taken to foster their development (Brown & Duguid, 2000; Nonaka et al., 2001; Wenger et al., 2002).

CoPs generally interact face-to-face, continually renegotiating meaning through shared experiences and perspectives, creating a network of strong ties (Brown & Duguid, 2000; Wenger, 1998). They tend to produce a localized sense of belonging through shared codes and narratives, with direct reciprocity and coordination. While knowledge flows easily within a CoP, the physical space between communities can constrain the flow of knowledge across them (Walsham, 2001). Indeed, Heaton and Taylor (2002) demonstrated how two CoPs in the same area of computer supported collaborative workgroups performed work practices quite differently due to the cultural norms and practices embedded in their national identities.

NoPs, however, typically link individuals with others whom they may never meet, constituting a network of weak ties. Thus, NoPs hold a clear advantage over CoPs in terms of their ability to innovate. In addition, NoPs commonly

comprise geographically dispersed strangers who communicate through indirect means, such as professional associations, publications, conferences newsletters, Web sites, bulletin boards, and listserves (Brown & Duguid, 2000; Gibbs et al., 2008; Wasko & Faraj, 2005). Since members do not personally know one another, direct reciprocity and coordination are difficult to achieve in NoPs. For this reason, *generalized reciprocity* replaces *direct reciprocity* in loosely coupled systems, such as NoPs (Cohen & Prusak, 2001; Rice, 1982; Wasko & Faraj, 2005). Data from an exploratory study on why individuals participate in an electronic NoP suggested that a primary motivating factor for contributing content stemmed from a desire to give back to the community in return for previously received advice from individuals in the community (Wasko & Faraj, 2000).

Related to these network forms, social capital theory offers a broad framework for identifying some of the collective level influences on knowledge sharing (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998; Wasko & Faraj, 2005). However, the rich literature on this concept extends beyond the page limitations of this chapter, if not the conceptual scope. Thus, we note only a few particularly salient points.

From a social capital perspective, the resources in which one invests are social relations, which can be “accessed or mobilized for purposive action” (Lin, 2001, p. 29), including collective action (Adler & Kwon, 2002). The three primary dimensions of social capital include *structural* (networks of social interaction that provide advantages to the members), *cognitive* (shared language and vocabulary), and *relational* (trust, norms, identification, and obligations and expectations) (Nahapiet & Ghoshal, 1998).

Social capital may be both a public (available to the community) and private good (available only to members of a network) (Putnam, 2000). By investing in social capital, an individual may reap personal rewards while simultaneously contributing to the production of social relations as a positive network externality (Adler & Kwon, 2002; Coleman, 1988). Social capital can produce additional network externalities aside from social relations, such as *connectivity* and *communality* (Coleman, 1988; Nahapiet & Ghoshal, 1998). Social capital facilitates the flow of knowledge and acts as an agent of social influence (Cohen & Prusak, 2001; Coleman, 1988; Lin, 2001). Inkpen and Tsang (2005) applied a social capital perspective to knowledge transfer by identifying facilitating conditions for each of the three dimensions of social capital.

Knowledge Sharing via Information/Communication Technologies

Knowledge management initiatives generally emphasize how ICTs can support knowledge sharing (Easterby-Smith & Lyles, 2003; Huysman & de Wit, 2003). However, some theorists, researchers, and practitioners critique this assumption. Nonetheless, concepts described in the prior section provide good foundations for analyzing how KMS might support knowledge sharing.

The Potential of Information and Communication Technologies to Foster Knowledge Sharing

Information and communication technologies transcend the barriers of time and space, thereby facilitating knowledge-sharing activities among geographically distributed individuals (Constant, Sproull, & Kiesler, 1996; Wasko & Faraj, 2000). Furthermore, ICTs can drastically reduce the perceived costs of contributing knowledge (Bimber, Flanagin, & Stohl, 2005; Cabrera & Cabrera, 2002; Hansen, Nohria, & Tierney, 1999). Human network *weak ties* are characterized by low levels of closeness and infrequent interaction between two parties (Granovetter, 1973). Members primarily use the Internet to support such weak ties, which are especially beneficial for accessing new and useful information and reducing information search costs (Constant et al., 1996; Granovetter, 1973; Hansen, 1999; Katz & Rice, 2002; Kraut et al., 1998; Levin & Cross, 2004; Lin, 2001). For example, collaborative participation in the creation of open-source software has proliferated through online weak ties (Kollock, 1999; Tapscott & Williams, 2006). Individuals are willing to offer helpful advice in online networks despite the lack of a strong personal connection with the requestor (Constant et al., 1996; Finholt & Sproull, 1990).

About three-quarters of companies in a 2007 McKinsey global survey were applying collaborative tools, and “about 20 percent of these companies are trying to use collaborative tools to go beyond classical knowledge management within their companies” (Bollier, 2007, p. 17, referring to Bugbin & Manyiska, 2007). Multinational organizations implement KMS to foster CoPs across divisions, companies, and nations (Pan & Leidner, 2003). KMS may be also be categorized as supporting content management systems, transfer/retrieval/collaboration systems, or collaborative/distributive systems (Martin, 2008, p. 395). Corporate portals may serve as KMS by synchronizing and supporting knowledge processes (Benbya et al., 2004). Intranets, electronic bulletin boards, expert databases, groupware, data warehouses, lessons learned databases, repositories, yellow page catalogs, decision support systems, and e-mail have all been proposed as tools to enable knowledge processes (Alavi & Leidner, 2001; Ruggles, 1998). ICTs that support the voluntary sharing of explicit/codified knowledge are commonly known as *discretionary databases* or “a shared pool of data to which several participants (individuals, departments) may, if they choose, separately contribute information” (Connolly & Thorn, 1990, p. 221). Certain types of ICTs seem highly capable of supporting tacit knowledge sharing and innovation including rich media (simulation tools, videoconferencing), person-to-person computer-mediated communication systems (e-mail), expert locating/mapping tools (electronic yellow page catalogs), and social network media (blogs, wikis, recommender systems) (Alavi & Leidner, 2001; Bolisani & Scarso, 1999; Flanagin, 2002; Rice, 1987; Shirky, 2008).

The term *Web 2.0* represents the new generation of social networking, collaboration, user-produced content, and mediated interaction through software

and services such as wikis, blogs, RSS (really simple syndication) feeds, tagging and social bookmarking, video and photography sharing, and filesharing and peer-to-peer tools such as Bittorrent and the descendents of Napster (Bruns, 2008). KM projects implement organizational blogs and reputation systems (Oravec, 2004). These new media represent the phenomena of collective intelligence, decentralized co-creation of value, and crowdsourcing (Bollier, 2007; Howe, 2008; Shirky, 2008; Tapscott & Williams, 2006), with Wikipedia as perhaps the most famous example. Social networking sites can be viewed as KMS for social knowledge sharing—creating, obtaining, and displaying relationships among members of various social networks, supported by a variety of individual, group and automated tools (boyd & Ellison, 2007). Given the shifting and permeable boundaries of organizations and constant interaction and knowledge sharing among organizations and stakeholders made possible by Web 2.0 technologies, the timelines of and formal organizational constraints on innovation are becoming shorter and looser, leading to the *permanently beta* organization (Neff & Stark, 2004, p. 173).

Knowledge management systems provide a means to generate collective benefits through the public good of shared knowledge. Notably, members can choose whether or not to contribute to or collect from the database, leading to both benefits and costs. The primary public good produced through the use of discretionary databases has been described as a special class of public goods known as *communality*, or a commonly available repository of knowledge (Monge et al., 1998). Once a *critical mass* of users and useful knowledge exists, the potential benefit of using the system exceeds the potential cost for the community of users, because of the wide and deep communality (Markus, 1990; Rafaeli & LaRose, 1993).

Another public good generated through successful KMS is *connectivity*, the ability to connect with other people (Fulk et al., 1996; Markus, 1990; Rice, 1982). Attaining universal access throughout the entire potential population of users, however, is not necessarily required. One or more subsets, or coalitions, of the intended collective may be sufficient to constitute a successful use of an interactive, networked medium (Fulk et al., 1996; Rice, 1990; Rice, Grant, Schmitz, & Torobin, 1990). However, a small group of adopting individuals may perceive a lack of sufficient connectivity since those whom they desire to contact have chosen not to adopt the system. Competing, alternative media can impede full connectivity, reducing communality and connectivity, and possibly causing one or more of the alternatives to fail (Fulk et al., 1996; Kraut, Rice, et al., 1998).

Critiques of the Use of ICTs for Knowledge Management and Sharing

Whether ICTs facilitate or hinder knowledge processes is the topic of many scholarly debates (Alavi & Leidner, 2001; Alavi & Tiwana, 2003; Davenport & Prusak, 1998; Roberts, 2000; Ruggles, 1998; Walsham, 2002). Some scholars contend that ICTs are better suited for the sharing of explicit knowledge

than for tacit knowledge (Hinds & Pfeffer, 2003; Roberts, 2000). As discussed above, scholars often assume that the transfer of tacit knowledge depends highly on direct interpersonal interaction, and thus physical proximity, in order to be effective (Nonaka, 1994; Nonaka & Takeuchi, 1995; Roberts, 2000). Hislop (2002), among others, argued that the fundamental nature of knowledge requires very specific conditions for ICTs to support knowledge sharing, because knowledge is grounded in practice, rather than an objective entity that can be easily exchanged. Johannessen, Olaisen, and Olsen (2001) are more critical, arguing that using ICTs to share knowledge will over-emphasize explicit knowledge, relegating important, strategic tacit knowledge to the background, ultimately resulting in knowledge mismanagement. Alternatively, according to Roberts, even if KMS are limited to the domain of explicit knowledge, the sharing of codified knowledge has the potential to produce new knowledge through its integration with existing tacit knowledge, as discussed above.

Collective and Individual Level Influences, Knowledge Sharing Processes, and Their Outcomes

This section reviews more detailed implications of the prior conceptual foundations, to develop an integrated model of collective and individual influences on knowledge sharing processes, the cognitive integration of that sharing, and related sets of outcomes, both positive and negative, both collective and individual.

Collective Level Influences on Knowledge Sharing through a KMS

The collective level influences noted here draw upon both the NoP and social capital literature. In particular, the three dimensions of social capital—cognitive (shared language), relational (trust, norms of openness and knowledge sharing, social identification/commitment to a NoP), and structural (frequency and networks of interaction)—influence the knowledge sharing behavior of NoP members.

Shared Language

Although innovation generally occurs through the combination of diverse knowledge and experience, sharing knowledge requires at least some degree of shared context and language (Nahapiet & Ghoshal, 1998; Rogers, 2003). Individuals who share a common social, cultural, and linguistic background, and understanding of the acronyms, slang and jargon that are unique to a shared practice (such as a professional domain) will be more likely to benefit from a KMS (De Long & Fahey, 2000; McDermott, 1999; Roberts, 2000). Shared language facilitates individual and group action, thereby producing collective benefits (Tsai & Ghoshal, 1998). It also fosters the use of collaborative technology for various types of work tasks (Majchrzak, Rice, Malhotra, King, &

Ba, 2000). Participation in a NoP commonly requires generally competent use and understanding of the shared codes and jargon of the NoP (Gherardi & Nicolini, 2002). Furthermore, competence in a discursive practice is critical to the process of social learning, which entails both actively contributing to, and passively absorbing, the shared repertoire of a community for the generation and negotiation of meaning (Jacobs & Coghlan, 2005; Wenger, 1998). Lave and Wenger's (1991) idea of *legitimate peripheral participation* proposes that some CoP members exist on the periphery of the community while others reside at the core. Thus, membership within a CoP or NoP entails varying degrees of participation, which may be constrained or facilitated by the extent to which one has mastered the language of the community or network.

Competence-Based Trust

Trust is a multidimensional concept that includes a belief in the competence, openness, good intentions, and reliability of others (McAllister, 1995; Mishra, 1996). It enables cooperation and knowledge creation within organizations, particularly in terms of knowledge sharing and contributing to a discretionary database (Adler, 2001; Dawes, 1980; Nahapiet & Ghoshal, 1998; Nonaka et al., 2001). Trust in the good intentions of others with whom one conducts knowledge transactions is positively associated with resource exchange in an organizational setting (Tsai & Ghoshal, 1998). Trusting relationships also influence the type of outcome from knowledge seeking efforts (Cross, Rice, & Parker, 2001).

Within the context of a NoP, interpersonal reciprocal trust is replaced by generalized trust such that individuals derive trust from the similarities resident in a collective identity (D. Cohen & Prusak, 2001; Kramer, Brewer, & Hanna, 1996). Under conditions of generalized or intransitive trust, resources are shared with, and expected to be shared with, others in the community, if not reciprocally to the initial provider, and community resources will be available to the initial provider, even if indirectly.

Competence-based trust is of particular importance for many KMS initiatives (Hollingshead, Fulk, & Monge, 2001; Tsai & Ghoshal, 1998; Van den Hooff, Elving, et al., 2003). Trust in the competence of others positively influences individuals' willingness to both contribute to and retrieve information from a virtual community (Ridings et al., 2002) and the extent to which one contributes to a communal public good (Monge et al., 1998).

Norms of Knowledge Sharing and Openness

Norms constitute an important influence on motivating members to share knowledge (Nahapiet & Ghoshal, 1998), particularly for NoPs of a professional orientation (DiMaggio & Powell, 1991). Moreover, norms influence individuals to contribute to a public good despite a payoff structure that favors free riding (Dawes, 1980). Thus, norms of cooperation (Nahapiet & Ghoshal, 1998),

collectivism (Van den Hooff et al., 2004), reciprocity (Hinds & Pfeffer, 2003; Wasko & Faraj, 2005), knowledge sharing (Constant, Kiesler, & Sproull, 1994; Yuan et al., 2005), and openness (Jarvenpaa & Staples, 2000; Nahapiet & Ghoshal, 1998; Van den Hooff, Vijvers, & De Ridder, 2003) have all been proposed as positive influences on knowledge sharing behavior. Norms of openness harbor a tolerance for mistakes or errors, an acceptance of failure, and a willingness to be criticized by others. An organizational or NoP culture with a norm of openness fosters knowledge sharing activities, both interpersonal and technologically mediated (Davenport, 1997; Jarvenpaa & Staples, 2000; Nahapiet & Ghoshal, 1998; Van den Hooff, Elving, et al., 2003; Van den Hooff, Vijvers, et al., 2003).

Sharing and openness in online systems can be represented by something as simple as receiving a reply to one's first contribution. In Joyce and Kraut's (2006) analysis of six public newsgroups, an initial reply to a contribution increased the likelihood of a subsequent contribution by 12%, regardless of the quality (accuracy or emotional tone) of the response. Joyce and Kraut argued that these initial responses constitute a sign of community commitment, which thus fosters repeat contributions.

Network of Practice Commitment

A strong sense of social identity and belonging to a social collective (Brown & Duguid, 2000; Hinds & Pfeffer, 2003; Kalman et al., 2002; Nahapiet & Ghoshal, 1998; Van den Hooff, Elving, et al., 2003; Wasko & Faraj, 2005), or to an organization in particular (Kalman et al., 2002; Nahapiet & Ghoshal, 1998; Nonaka et al., 2001; Van den Hooff & De Leeuw van Weenen, 2004; Van den Hooff, Vijvers, et al., 2003), is critical for inducing cooperative knowledge sharing behavior. Brewer and Kramer (1986) also concluded that salient group identity increases the likelihood of cooperation in social dilemmas.

Other scholars prefer to leverage the theoretical construct of *organizational commitment* to study the relationship between a strong sense of belonging to a collective and knowledge processes (Kramer et al., 1996; Van den Hooff & De Leeuw van Weenen, 2004; Van den Hooff, Vijvers, et al., 2003; Wasko & Faraj, 2005). Some scholars assert that attitudinal commitment is a conceptually and empirically sound replacement for identity when investigating information or knowledge sharing phenomena in organizations or other collectives (Kalman et al., 2002; Wasko & Faraj, 2005).

Empirical evidence suggests that the degree of organizational commitment to a collective significantly predicts knowledge sharing behavior, both in a technologically mediated environment and in a more traditional social context (Cabrera & Cabrera, 2002; Kalman et al., 2002; Van den Hooff & De Leeuw van Weenen, 2004). Contrary to these findings, Wasko and Faraj (2005) reported a lack of empirical support for the connection between commitment to an electronic NoP and the volume of contributions made to the NoP. Similarly, Van den Hooff and De Leeuw van Weenen determined that

organizational commitment only elicited knowledge collecting behavior while commitment to a smaller, more intimate group (a department), elicited both collecting and contributing behaviors.

Frequency and Networks of Interaction

Frequent interaction among members of a collective strengthens the ties, relational bonds, and trust among actors, creating a dense network structure that facilitates the flow of knowledge and influence (Markus & Benjamin, 1997; Nahapiet & Ghoshal, 1998; Rice & Aydin, 1991; Roberts, 2000; Tsai & Ghoshal, 1998). Most scholars adopt the theoretical framework of social capital in making such claims since such an approach grants favor to interpersonal social relations, and the use of network methods to study the relationship between various aspects of social structure and knowledge processes (Nahapiet & Ghoshal, 1998; Wasko & Faraj, 2005). The strength of social ties and actor centrality have been investigated as facilitators of knowledge sharing behavior, particularly in terms of contributing behavior, such as to an online message board (Hansen, 1999; Wasko & Faraj, 2005). For example, employees from one business unit were more likely to share information with employees of another business unit when they frequently engaged in social interaction with those employees (Tsai & Ghoshal, 1998). Weak or infrequent ties can increase the speed of sharing for highly codified, non-redundant, stand-alone knowledge but may impede the sharing of knowledge that is both non-codified and dependent (Hansen, 1999; Levin & Cross, 2004). In the case of NoPs with geographically dispersed members, face-to-face interaction is highly unlikely. Instead, interpersonal relationships between NoP members more likely develop through a diverse array of less direct communication channels such as professional associations, publications, conferences, newsletters, Web sites, virtual teams, bulletin boards, social networking sites, and listserves (Brown & Duguid, 2000; Gibbs et al., 2008; Wasko & Faraj, 2005).

Beyond mere frequency or strength of interaction, however, the patterns of interaction, for both individuals and organizations, also influence the extent and kinds of knowledge sharing. For example, greater social cohesion (relations among one's contacts) and range of contacts (across different knowledge areas) fostered greater knowledge transfer within a R&D firm, after controlling for the strength/frequency of dyadic communication relationships (Reagans & McEvily, 2003). Further, beyond even this network orientation, the patterns of relationships among members and with artifacts themselves may constitute the nature of knowledge associated with a given practice (Østerlund & Carlile, 2005). Thus, not just the *extent of interactions* among members within a practice, but also *patterns of the relations* will influence the extent and nature of knowledge sharing. Thus, a KMS integrated into one's existing social networks and peer groups is more likely to succeed (Brown & Duguid, 2000; Rice, 1990).

Propositions about Collective-Level Influences on Knowledge Sharing

People tend to use a KMS, in general, and specifically for both knowledge contributing and knowledge collecting activities, when they perceive that the members of a NoP: have mastered the language (jargon and codes) of a NoP; adhere to norms of knowledge contributing, knowledge collecting, and openness; exhibit a high level of competence-based trust; perceive a high degree of NoP commitment, and engage in frequent and patterned network interaction.

Individual Level Influences on Knowledge-Sharing through a KMS

An important characteristic of activities (such as work tasks, or collaborative projects) involves the degree of interdependence required to complete them.

Activity Interdependence

The underlying premise of task interdependence is that activities can only be completed as a team effort, whether sequentially, in parallel, or reciprocally, and thus requiring knowledge by more than one team member of at least relevant aspects of each other's task components. Consistent with this perspective, task interdependence is positively associated with knowledge sharing through a KMS (Jarvenpaa & Staples, 2003; Van den Hooff, Elving, et al., 2003). Yet, a KMS holds the potential to benefit more than just those who work in an organizational team-oriented environment. For example, computer programmers' involvement in the opensource software phenomenon highlights the collective nature of their work that would otherwise go unnoticed if we relied solely on a basic description of their daily work routine (Kollock, 1999; Markus, Manville, & Agres, 2000).

Tacitness of Knowledge Required for the Activity

From a KM perspective, the extent of tacit knowledge required to successfully complete an activity is an important attribute to consider. Highly equivocal tasks require the use of an interactive and rich communication medium (Daft & Lengel, 1984). Nonaka et al. (2001) argued that face-to-face contact serves as the primary mechanism for converting tacit knowledge into tacit knowledge. Hansen (2002) suggested that weak ties are beneficial for effectively transferring explicit knowledge, while strong ties are necessary for tacit knowledge exchange. In sum, individuals engaged in activities involving tacit knowledge should be less likely to collect knowledge from a KMS because they require a richer form of communication to complete their work.

Activity Load

Activity load is manifested by the time pressure experienced when performing a work task that often prevents an individual from doing other activities. Time pressure can create a barrier to participation in knowledge processes (Van den Hooff, Vijvers, et al. 2003). Sharing one's experiences with others, especially through a discretionary database, or learning how to use a KMS can be a burden when time is a valuable resource (Cabrera & Cabrera, 2002). In an industry study, managers reported that KM initiatives experience limited success, at least in part, because employees did not have enough time to participate in knowledge sharing through their KMS (KPMG, 2000). Siemsen, Roth, and Balasubramanian (2007) developed and tested a model involving different roles of the influences of motivation to share knowledge, ability to share knowledge (such as time), and opportunity to share knowledge (as well as control variables). In particular, they tested four different ways in which these central factors relate to affect knowledge sharing. Their *constraining factor* model fits the data best. Low levels of either motivation or ability, and somewhat more complexly for opportunity, stymied knowledge sharing. Especially when time was insufficient, motivation and ability levels had no effect; that is, the person was not able to engage in knowledge sharing regardless of their motivation or ability to share.

Knowledge Domain Expertise

One's expertise in the knowledge domain of a NoP can have important ramifications for the likelihood of *contributing* knowledge with other NoP members. For example, Wasko and Faraj (2000) found that some people opted not to contribute to an electronic CoP because they felt uncomfortable about their level of expertise. However, in a later study, they determined no significant link between self-rated expertise and volume of contribution (Wasko & Faraj, 2005). In studies of a non-mediated environment, and a collaborative media environment, people were more willing to share information with others when it was a product of their own knowledge or understanding rather than an information product owned by an employer (Constant et al., 1994; Jarvenpaa & Staples, 2000). However, related to the knowledge sharing social dilemma, assuming that people behave in a rationally self-interested way, they may be motivated to *protect* those resources that are most valuable to them in a competitive environment (Lin, 2001)—that is, undersupply expertise to the collective. In a highly competitive knowledge economy, contributing one's personal expertise to a collective is tantamount to foregoing one's strategic advantage in the labor market (Cabrera & Cabrera, 2002; Constant et al., 1994; Fulk et al., 1996; Fulk, Heino, Flanagan, Monge, & Bar, 2004; Hinds & Pfeffer, 2003). Thus, research is not consistent on whether having greater knowledge domain expertise will foster greater contributing behavior.

A positive relationship between expertise and knowledge collecting behavior is rooted in principles of rational economic behavior. Individuals who have *less* expertise in the knowledge domain of their profession (or other NoP) are more likely to attempt to increase their existing knowledge base through knowledge collecting as a means of securing a better position in the labor market (Lin, 2001).

ICT Competency

Technological competence may facilitate knowledge sharing through ICTs. One study found that the general use of computer-mediated communication tools, typically assumed to imply greater competency, positively related to knowledge collecting while not significantly corresponding to knowledge contributing (Van den Hooff & De Leeuw van Weenen, 2004). Having sufficient computer skills fostered the use of collaborative media for both contributing and collecting information in a study by Jarvenpaa and Staples (2000). Van den Hooff (2004) reported that prior experience with a collaborative technology positively influenced the use of that technology for knowledge sharing purposes. In a more general assessment of technological competence, Yuan et al. (2005) found that user skill level was positively associated with both contributing and collecting behavior in the use of a discretionary database. However, Majchrzak et al. (2000) discovered that the use of a collaborative technology did not increase over time as users gained more experience with it.

Other Influences, Context, and Controls

Other potential individual influences include the extent to which one feels their contributions are unique, identifiable, and beneficial for the collectivity (Ling et al., 2005, applying collective effort theory to explaining under-contribution to an online movie recommender system). More generally, each context will have relevant other factors that would need to be controlled or measured in order to avoid confounds and reflect meaningful influences. These issues may range from demographic and professional or organizational characteristics (such as the percentage of problems, information, or relationships involved in one's activities that pertain to the knowledge being shared). Close analysis of the individual's context is necessary to identify and develop valid measures for these controls.

Propositions about Individual-Level Influences on Knowledge Sharing

People more likely use a KMS in general, and specifically for both knowledge contributing and knowledge collecting activities, when they experience greater activity interdependence, more tacit knowledge in their activities, lower activity load, and greater Internet competence. People who perceive that they are more expert in the knowledge domain of a NoP tend to use a KMS, in general,

and possibly more for knowledge collecting than contributing (which in some cases may be negative). Various demographic, activity, and membership factors, operating as control variables in an integrated model, would also influence KMS use, contributing, and collecting.

Knowledge Contributing and Collecting, and KM System Use

KMS use constitutes a behavioral construct that comprises three mutually reinforcing behaviors: knowledge contributing, knowledge collecting, and general KMS use.

Knowledge Contributing

Scholars commonly assume that knowledge collecting precedes knowledge contributing behavior (Fulk et al., 2004; Yuan et al., 2005). Collecting knowledge from a KMS can shed light on the extent to which the content is useful and the likelihood that others will make this same assessment. Lending credence to this assumption, at least two studies found knowledge collecting to be a highly significant predictor of knowledge contributing behavior (Fulk et al., 2004; Van den Hoof & De Leeuw van Weenen, 2004). Alternatively, some individuals might initially contribute to a KMS without collecting much from it in return. Indeed, critical mass theory requires early adoption/contribution by users with greater resources and motivation (Markus, 1990). Applying the concepts of positive and reciprocal productive functions, knowing that one can collect in the future would serve to (1) justify the time and effort expended in making initial contributions and (2) satisfy a desire for generalized or transitive reciprocation.

Knowledge Collecting

What about those free-riders or lurkers who primarily collect, without contributing? As discussed above, in the extreme, this practice constitutes an information-based version of the tragedy of the commons, and the community may collapse. However, individuals may feel generally both motivated, as well as compelled, to reciprocate the contributions made by others, perhaps through representing the collective and its norms, after collecting from a KMS. A network-evolution analysis of over-time participation in a computer conferencing system found that users who received (collected), but did not continue to send (contribution), messages quickly became isolates in the computer-mediated communication network (Rice, 1982). Thus, users must navigate between over-contributing (exceeding the carrying capacity of the system and their own processing abilities) and under-contributing (and, thus, perceived as not supporting generalized reciprocity and the collective benefit). Intriguingly, asymmetry of participation may, in fact, have collective benefits. For example,

members of some online communities do perceive value from having *lurkers*, those who read but do not post (Nonnecke, Andrews, & Preece, 2006). In general, in spite of the potential for asymmetric free riding, successful KMS do occur, as people come to both collect and contribute.

General KMS Use

It would seem likely that a KMS supports other general uses and applications, both to the extent that a KMS is integrated with other ICTs and to the extent that it offers support applications. Further, as with all innovations in general, and ICTs in particular, the various uses of a KMS and their social consequences are particularly difficult to discern during the initial stages of system adoption because the features and uses may be changed by the adopters (Rogers, 2003). That is, an innovation may be adapted after initial adoption, through reinvention, adaptive structuration, technology structuring, or technology adaptation (DeSanctis & Poole, 1994; Johnson & Rice, 1987; Kraut, Rice, et al., 1998; Majchrzak et al., 2000; Orlikowski, 1992). Thus, any model of KMS use would be more realistic by including general system use as well as knowledge sharing.

Propositions for KMS Use (Contributing, Collecting, General)

Knowledge collecting relates positively to knowledge contributing through a KMS. Knowledge contributing and knowledge collecting through the system correspond positively to general use, although other uses of the system may exist than contributing and collecting.

Knowledge Sharing and Cognitive Integration

Individual reflection is important for the creation of both individual and organizational knowledge (Alavi & Tiwana, 2003; McDermott, 1999; Nonaka, 1994; Vera & Crossan, 2003). Knowledge, in and of itself, holds little value if it is not integrated with existing knowledge and applied in a meaningful way (Alavi & Leidner, 2001; Grant, 1996).

Cognitive Integration

Knowledge is rooted in prior experiences that we have thought about and made sense of (McDermott, 1999; Walsham, 2001). A core tenet of cognitive theories of learning is that people come to make sense of the world around them by incorporating external stimuli into their existing mental models, either reconfirming or changing them (Nonaka et al., 2001; Polanyi, 1966). Moreover, the cognitive dimension of tacit knowledge suggests that new knowledge arises not simply from prior experiences, but from prior experiences that people have

reflected on and made sense of, and through developing shared mental models within an organization (Kim, 1993; Martin, 2008; McDermott, 1999; Nonaka, 1994; Walsham, 2001).

Vandenbosch and Higgins (1996) proposed that new knowledge can be integrated into existing cognitive structures through one of two ways. *Mental model building* occurs when individuals alter existing mental models to accommodate the receipt of new knowledge and perceive them as the primary source of innovation and creativity. *Mental model maintenance* occurs when individuals adapt incoming stimuli to their existing mental models, thereby validating pre-conceptions. Conceptually, this cognitive integration can arise from both contributing and collecting behavior. Collected knowledge may be new or simply a reiteration of previously acquired knowledge, reinforcing and maintaining knowledge. New knowledge more likely leads to a change in, and development of, new mental models. The process of contributing knowledge may help to refine an individual's thinking on an issue, challenge preconceptions, and develop new insight (Wasko & Faraj, 2000), although it primarily codifies and represents current mental models. Cognitive integration, especially mental model building, may enable double-loop learning, or change in the process or criteria for change, rather than single-loop learning, or improvement applying the process or reach the criteria (Martin, 2008).

Propositions for KMS Use and Cognitive Integration

KMS use, contributing, and collecting relate positively to cognitive integration (mental model maintenance and mental model building). However, such use may foster more model maintenance and collecting than more model building.

Potential Individual and Collective Costs and Benefits of Knowledge Sharing and Cognitive Integration through a KMS

Outcomes from knowledge sharing—both contributing and collecting—include both costs and benefits, at the individual and collective level. Indeed, Constant et al. (1996) found that both intangible personal benefits, such as earning the respect of others, and collective benefits, such as improved organizational citizenship, motivated contributions to a KMS. Monge et al. (1998) determined that police officers' use of a cross-jurisdictional discretionary database depended largely on the extent to which the database satisfied individual (rewards for individual performance) and collective (officer safety) interests. When examining why people contribute to KM systems, many studies tend to treat costs explicitly in terms of the time and effort that it takes an individual to use a particular system (Yuan et al., 2005). The notion of negative individual and network externalities at the collective level (Shapiro & Varian, 1999) is largely absent from empirical investigations of information or knowledge sharing (Fulk et al., 2004).

Individual and Collective Costs

Costs of contributing to a discretionary database can take the form of initial start-up costs as well as recurring costs (Monge et al., 1998).

INDIVIDUAL COSTS: CONTRIBUTING

System usability comprises an important component of time and effort (Davis, Bagozzi, & Warshaw, 1992; Van den Hooff, 2004). Additional expenses implicit to making a useful contribution may include formatting, compiling, or acquiring knowledge prior to using the system (Cabrera & Cabrera, 2002; Fulk et al., 2004; Monge et al., 1998), or physical, cognitive, and social costs in accessing the system (Rice, McCreddie, & Chang, 2001; Rice & Shook, 1988). Further, an individual may face the cost of losing some of his and her competitive advantage by making privately held knowledge publicly available to others (Cabrera & Cabrera, 2002; Constant et al., 1994; Fulk et al., 1996; Fulk et al., 2004).

INDIVIDUAL COSTS: COLLECTING

A number of knowledge collecting costs also result from using a KMS to share knowledge. First, the time and effort expended to collect knowledge from a KMS can vary significantly from one system to the next (Monge et al., 1998). Indeed, a high volume of posts or messages that lack sufficient filtering, evaluation, or recommendation mechanisms will likely deter people from collecting knowledge from a system (Wasko & Faraj, 2000). Even individuals who opt to free ride will likely incur at least some costs through simply accessing and using a system to collect knowledge. Second, an inability to verify the credentials of contributors or a lack of visibility as to who contributed content to a discretionary database can serve to erode trust in the credibility of the content (Cabrera & Cabrera, 2002). Third, to the extent that a sufficient range of perspectives and interpretation is lacking in the content posted to a KMS, the knowledge collected will be deemed less useful, and the system will be perceived as more costly compared to other sources of knowledge (Fulk et al., 2004). Fourth, as Fulk et al. noted, an individual's perceived value of a knowledge good is based on the perceived level of production of that good at a given point in time. When a KMS is initially deployed, the perceived level of provision often represents a cost rather than a benefit (Cabrera & Cabrera, 2002). Such cost can be attributed to a lack of critical mass at the early stages of system adoption relative to later stages; that is, the production function has not yet reached positive or reciprocal levels (Markus, 1990).

COLLECTIVE COSTS

Even when some individuals accrue personal benefits from contributing to a public good, negative collective externalities can result (Adler & Kwon, 2002).

In many knowledge-intensive professions (such as consulting, law, financial services), reputation is a primary source of value. A collective good that holds the potential to threaten a NoP's reputation in some way represents a collective cost to both participating and non-participating members. Finally, people are limited in their ability to process information (March & Simon, 1958). A KMS in which individuals contribute a wide array of competing interpretations or perspectives can lead to confusion rather than clarification for the collective (Kraut et al., 1998).

Individual and Collective Benefits

Experiencing a positive benefit for the time and effort expended in making a contribution can lead to future contributions by the initial user, and thus prime subsequent contributions by others.

INDIVIDUAL BENEFITS: CONTRIBUTING

Tangible benefits, such as monetary rewards or a promotion, may not be applicable for knowledge sharing communities that develop outside of formal organizational boundaries, such as NoPs. Instead, participating in knowledge sharing activities in a self-organizing KMS likely arises from a desire for psychological or intangible rewards (Constant et al., 1996; Osterloh & Frey, 2000; Shirky, 2008; Wasko & Faraj, 2000, 2005). Jian and Jeffres's (2006) test of their multi-dimensional model showed that utilitarian, normative, and collaborative motivations all influenced employees' willingness to contribute to shared electronic databases.

One intangible benefit from knowledge sharing behavior includes an increase in status or reputation in a collective and gaining a positive feeling from helping others (Constant et al., 1996; Huysman & de Wit, 2003; Wasko & Faraj, 2000, 2005). Some mechanism in the KMS must exist for indicating participants' identities, such as listing contributor names or persistent online usernames, affiliations, profession or even NoP affiliation in order for an increase in reputation to extend from an online environment to a NoP environment (Cabrera & Cabrera, 2002). This recognition constitutes one of the primary rationales in social networking sites where users rate and link other users' contributions (boyd & Ellison, 2007). Benefits of economic and professional payoffs can accrue indirectly from this enhanced status in professional or other work-related online groups (Butler, Sproull, Kiesler, & Kraut, 2002).

For example, an individual might receive client referrals from others in a particular geographic area based on a positive reputation that has developed through valuable contributions to a KMS. Lampel and Bhalla (2007) found that status (including prestige and reputation) increased voluntary contributions to online rating communities evaluating information goods (such as books, travel trips, music, services, etc.). In this context, status may be obtained either by contributions that show focused expertise, or a wide range of areas outside of

the review topic. Another intangible benefit of contributing arises from the positive feeling that people get from helping others, as in traditional volunteer work, and the open source community (Butler et al., 2002; Kollock, 1999; Wasko & Faraj, 2000).

INDIVIDUAL BENEFITS: COLLECTING

An implicit assumption in theories of collective action is that individuals elect to free ride because they perceive some intrinsic value associated with consuming a public good, low costs to obtaining that good, and few or no sanctions for non-contributing. Online public KMS where users are anonymous provide such contexts. However, the extent to which individuals benefit from the consumption of a public good is rarely raised as an empirical question. If an individual does not receive at least some benefits from the knowledge collected through a KMS, then he or she has no future incentive to collect from, or likely contribute to, the system. Individuals often seek knowledge from a KMS because of an obstacle or challenge in their daily work routine that requires problem resolution through new knowledge in a short time frame without much awareness of specific sources (Brown & Duguid, 2000; Fulk et al., 2004; Vandenbosch & Higgins, 1996).

COLLECTIVE BENEFITS

As discussed earlier, the primary public goods arising from contributing to and collecting from a KMS includes communality and connectivity. Empirical studies of using an ICT for knowledge sharing support both propositions (Katz & Rice, 2002; Van den Hooff et al., 2004; Van den Hooff, Elving, et al., 2003).

KMS Evaluation

A newly introduced KMS may have to compete in users' evaluations with existing systems or communication channels, especially if those already have established widespread connectivity (Fulk et al., 1996; Kraut, 1998). This perspective reflects the centrality of *relative advantage* in the adoption decision (Johnson & Rice, 1987; Rogers, 2003). However, a KMS that provides communality and connectivity, possibly opportunities for reinvention and additional uses, and is easy to use and compatible with current practices should receive positive evaluations.

Cognitive Integration, Costs and Benefits, and KMS Evaluation

Cognitive integration likely plays a mediating role between KMS use (contributing, collecting, general use) and outcomes (individual and collective, costs and benefits). As explained earlier in this chapter, the potential for value from

sharing knowledge through a KMS depends, at least in part, on the extent to which individuals have cognitively integrated that knowledge. Building or maintaining one's mental models contributes to confidence, improved competency, learning, and a better understanding of how the knowledge relates to individual and collective outcomes. Conversely, without reinforcing current or developing new knowledge, the material and social costs and possible misapplications of the knowledge of a KMS likely increases, also fostering a negative evaluation of the system.

Propositions for KMS Use, Cognitive Integration, and Costs and Benefits

The use of a KMS, in general, and specifically for both knowledge contributing and knowledge collecting activities, relates positively to perceived individual and collective benefits of contributing knowledge and collecting knowledge through the system and to a positive evaluation of the system.

Cognitive integration (mental model maintenance and mental model building) relates negatively to perceived costs (collective and individual) of contributing through the system. Cognitive integration corresponds positively to perceived benefits (collective and individual) of contributing and collecting as well as to the overall evaluation of the system. Exactly which aspects of cognitive integration (model building or model maintenance) might be associated with which benefits and costs (collective, individual, contributing, collecting) is an important topic for future theory and research. Cognitive integration is likely to be a partial or total intervening process between KMS use and outcomes.

Proposed Theoretical Model and Future Research

The preceding review provides the basis for the integrative theoretical model in Figure 4.1, which reflects the summary propositions at the end of each portion of the previous section. The main components, each represented by multiple concepts, include (1) collective (network of practice) influences, (2) individual influences, (3) knowledge management system use, (4) cognitive integration, and (5) outcomes.

Other models of knowledge sharing through knowledge management systems exist, of course. Alavi and Leidner (2001) derived rationales for KMS through a conceptual analysis of the main phases of knowledge management. A somewhat similar model emphasizing KMS information output quality, tested using responses from eight public-sector organizations in Singapore, found that major influences on knowledge collection included the perceived output quality and resource availability, especially when activities were more explicit (Kankanhalli, Tan, & Wei, 2005). Wasko and Faraj's (2005) model highlighted the influence of individual and collective factors on knowledge contributing behavior. Benbya et al.'s (2004) model emphasized more of the technical and managerial aspects of knowledge sharing. Chai, Gregory, and Shi's (2003)

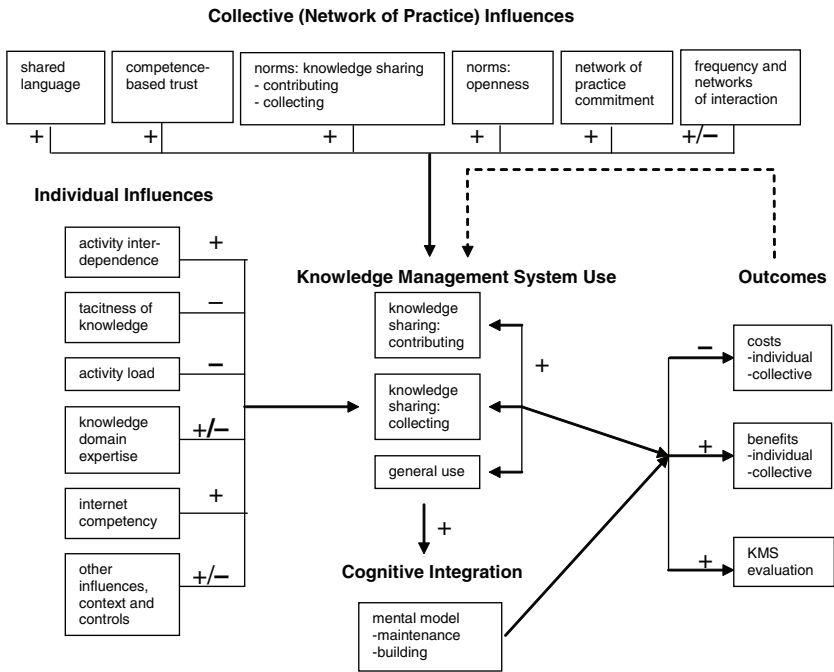


Figure 4.1 Model of collective and individual influences on knowledge sharing through a knowledge management system, cognitive integration of that knowledge, and costs and benefits at both the collective and individual level.

model, based on case studies in 11 multinational companies, included multiple sharing mechanisms. Kulkarni, Ravindran, and Freeze's (2006–2007) model was oriented toward organizational support factors (leadership commitment, supervisor and coworker support, and incentives) and information systems use research (information and system quality, user satisfaction).

Future Research

This topic and proposed model generate many possibilities and needs for future research.

Time

The sources and outcomes of influences on knowledge sharing processes are dynamic and complex. When sharing knowledge through a KMS, the costs, benefits, and overall evaluation of the system are highly relevant outcomes that, in turn, should influence future KMS use and knowledge sharing. The outcomes may also affect collective level influences (such as shared language, trust, openness and knowledge sharing norms, and frequency of interaction) as well as individual level influences (tacitness of knowledge required for an

activity, activity load, expertise, and Internet competency). Not only does a feedback loop exist between outcomes and behavior, it also exists among the intermediary components of knowledge contributing, knowledge collecting, general KMS use, and cognitive integration. Therefore, future research should study the over-time reciprocal relationships between outcomes (costs, benefits, and system evaluation), behavior (general KMS use, contributing knowledge, and collecting knowledge), and more indirect influences (collective and individual).

Culture

Only briefly mentioned, in the context of collective shared language and norms, are differences in cultural norms involving and influencing knowledge sharing either directly or as a moderator. A cultural perspective—whether organizational or social/national—likely emphasizes, among other things, the set of values, practices and relationships that constitute and reconstitute knowledge in use (see Hornikx & O’Keefe, this volume). Organizational culture may, among many other ways, be characterized as clan, ad-hocracy, hierarchical, market, control, collaboration, competence and cultivation (Martin, 2008). Each of these perspectives will have possibly very different assumptions and practices about sharing knowledge, leading to variations in the influences on, use and outcomes of, a KMS. De Long and Fahey (2000) proposed four ways in which culture (specifically, organizational) affects knowledge management processes, and, by implication, use of knowledge management systems. They asserted that (1) culture shapes assumptions about which knowledge is important and relevant, and different subcultures apply different criteria; (2) culture mediates the relationships between levels of knowledge (such as the boundaries between and valuation of individual and organizational knowledge, and the salience of trust and status); (3) culture creates a context for social interaction (both between hierarchical levels, and among peers within levels, such as through network patterns, collaborations, willingness to reuse knowledge, and handling mistakes), and (4) culture shapes the creation and adoption of new knowledge (such as seeking external knowledge, managing internal debates, levels of participation). For example, De Long and Fahey identified differences in the content, quality, and length of contributions to the same topic on four different language versions of Wikipedia. They attributed these differences to Hofstede’s cultural dimensions and other cultural markers (e.g., the greater the individualism index, the less likelihood of adding or clarifying information; see Pfeil, Zaphiris, & Ang, 2006). Future research should expand upon the role of culture in knowledge systems and processes.

Web 2.0

As noted earlier, the concept and forms of Web 2.0 have pushed the venues, participants, and ICTs involved in knowledge sharing well beyond the bound-

aries of organizations and even nations, and beyond experts and professionals. One of the most significant phenomena emerging from the Web is the *gift economy* and the *open source movement*, where millions of users voluntarily spend considerable time, energy, and financial resources developing and sharing knowledge (ranging from replies to questions on discussion boards and comprehensive entries on Wikipedia, to complex modifications of online multiplayer games, to highly sophisticated videos and software) (Kollock, 1999; Shirky, 2008; Söderberg (2007). While this review and proposed model presumes a specific knowledge management system (such as a public online database for professionals to share their expertise), the scope and pervasively interlinked components of the Web clearly represent both a massive-scale knowledge management system, as well as opportunities for studies of a wide variety of specific Web 2.0 forms and sites.

Related Areas of Communication Research

Research on knowledge sharing holds strong potential implications for a broad array of areas in the communication discipline. As just a few examples from topics in this volume of *Communication Yearbook*, KMS facilitates the sharing and disseminating of important research on genetics (see related review by Galvin & Grill, this volume) or statistical risk (see Noar, Harrington, & Aldrich, this volume). Indeed, participation in a KMS can even be considered a form of volunteerism (see related review by Ganesh & McAllum, this volume). Further, KMS are becoming crucial for sustaining large NoPs, such as media advocacy and activism groups, given that sustained collective action requires both communality and connectivity (see related review by Napoli, this volume). Table 4.1 underscores the potential relevance of knowledge sharing and ICTs across the field of communication by highlighting possible areas for collaborative research among International Communication Association divisions and interest groups.

Conclusion

Three questions motivated this review: Why do people share (or withhold) knowledge through online knowledge management systems? What benefits and costs might they experience from doing so? How does one's ability to cognitively integrate the knowledge shared through a KMS affect these costs and benefits? Fundamental concepts about knowledge processes, the social dilemma of knowledge sharing, networks of practice, social capital, and the potential of ICTs to support knowledge management and sharing generated a variety of collective and individual influences on KMS use. *Cognitive integration* is proposed as a primary component of the knowledge sharing process, acting as a mediator between behavior (knowledge contributing, knowledge collecting, and general knowledge management system use) and its outcomes.

Table 4.1 Summary Possibilities for Different Communication Research Areas with Studies of Knowledge Sharing and Knowledge Management Systems

- Communication and Technology: How users interact with a KMS in social and organizational contexts, and communication-related features of KMS
- Communication Law and Policy: Issues of intellectual property, economic value of networked knowledge, open source KMS
- Ethnicity and Race in Communication: Varying cultural values on what kinds of knowledge should or can be shared publicly, and the communication medium through which credible knowledge is best shared, and how to provide equitable access to knowledge across social and economic strata
- Feminist Scholarship: How gender influences the availability and value of kinds of knowledge and KMS
- Game Studies: How system design and social processes associated with online games fostering high involvement and large-scale collaboration could be applied to KMS
- Gay, Lesbian, Bisexual and Transgender Studies: How KMS may be used to foster support and knowledge sharing within and among specific communities
- Global Communication and Social Change: Globalization may be considered a massive knowledge-sharing system, involving regional, international, transcultural, transnational and global communication
- Health Communication: Certainly access to and sharing and discussing of health information and is being dramatically transformed through online media; especially relevant is how knowledge can be made more salient, accurate, and useful through personally-tailored web-based KMS
- Information Systems: Studies of information flows, human-computer interfaces, cognitive processing of information are central to KMS research and concepts
- Instructional/Developmental Communication: Learning depends on sharing knowledge, and online instructional media can be conceived as KMS
- Intercultural Communication: Meaningful and effective sharing across physical, social and culture contexts requires deep understanding of the differences and interactions among members of different cultures – including professions, and communities or networks of practice
- Intergroup Communication: What are the factors that would encourage or suppress sharing across boundaries of group social identity
- Interpersonal Communication: Developing shared meaning of information available through a KMS requires interpersonal communication processes that often are not well understood, especially across boundaries
- Journalism Studies: How can traditional journalistic practices, norms and media manage the challenge of new ways of sharing news and opinion, such as blogs, user-contributed stories, and newsgroups
- Language and Social Interaction: Core concepts in the study of human discourse and interaction raise a central critique of the concept of knowledge management, and especially KMS: the assumption that words mediated through a KMS could easily generate shared knowledge, much less transform tacit into explicit knowledge
- Mass Communication: The broad reach of online communication, even just among divisions of multinational corporations or members of NGOs in different countries; has blurred or erased the boundary between interpersonal and mass media; agenda-setting through community-based knowledge sources
- Philosophy of Communication: The very concept of knowledge, the nature of tacit and explicit knowledge, and even what it means to share or interpret knowledge are open to philosophical debate
- Political Communication: Analysis and implementation of KMS would seem to be relevant to the rise of the concept and implementation of e-government and concerns about online political communities

Table 4.1 Continued

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- Popular Communication: Popular communication and cultural studies research is increasingly focused on social media that can be thought of as non-professional KMS
 - Public Relations: Relationships between organizations, whether for-profit or non-profit, and their stakeholders, are increasingly being developed and maintained through knowledge-sharing media, with varying effectiveness
 - Visual Communication Studies: There has been little research on the visual (or audio!) representations of knowledge in KMS, such as how visual aspects of the interface or content influence use and effectiveness; whether credibility and trust change with different visual representations of participating individuals, groups, and communities on KMS sites
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Those outcomes are potentially both positive and negative, and occur at both individual and collective levels.

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