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How Communication Technologies Facilitate Knowledge Sharing:

An Overview and Critique

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Abstract

There is limited effort in applying an integrative perspective of collective action to ICT-enabled knowledge sharing. Based on a review of extant research, this article shows that knowledge sharing in organizations is enabled by social cognitive factors such as people's willingness and capacity to contribute in given social contexts, and inhibited by structural factors such as diversity and unfamiliarity in given group settings. ICT affect the knowledge sharing process by interacting with these factors in different ways: some technical features facilitate the social cognitive mechanisms of motivation, and other features are appropriated to support structures of social interaction in the coordination process. Organizational IT researchers need to make holistic theoretical progress for addressing how collective social influence mediates both the capacity and willingness of knowledge sharing, and how close interdependence and emergent, entrepreneurial structures are both needed for more effective coordination.

How Communication Technologies Facilitate Knowledge Sharing: An Overview and Critique

Knowledge sharing is an important activity for organizations. Successful knowledge sharing can lead to knowledge integration, reuse and application that enable organizations to accumulate intellectual capital and gain competitive advantage (Heinz and Rice 2009). Effective knowledge sharing entails contribution of domain expertise and retrieval from the knowledge base (Robert et al. 2008). Various information and communication technologies (ICT) such as intranet (Hollingshead et al. 2002), knowledge management systems (KMS) (Heinz and Rice 2009) and discretionary database (Fulk et al. 2004) have been implemented to facilitate knowledge sharing. It is hoped that ICT can facilitate the production of communal goods of knowledge that provide collective and individual benefits. Despite obvious utility and apparent easiness, however, ICT-enabled knowledge sharing is often plagued with various problems. For example, individuals might be unaware that they have something to share or unwilling to give up their unique knowledge for fear of losing competitive advantage (Cabrera and Cabrera 2002). Increasingly, new communication technologies like Twitter (or the enterprise version, Yammer) with features such as instantaneity, multimodality and interactivity are gradually being adopted by organizations in the hope that individuals will more *efficiently* share knowledge. To understand whether such new technologies are more *effective*, however, it is necessary to theorize ICT-enabled knowledge sharing in an appropriate framework.

In the organizational context, knowledge sharing is often framed as a problem of collective action (Fulk et al. 2004; Heinz and Rice 2009; Hollingshead et al. 2002). The logic is that it requires contribution at individual cost for the production of public goods that are non-exclude (everyone can use it) and non-rivalry (one's use will not make it less usable for others). The fundamental issues for collective action are motivation for contribution against the choice of free-riding, and coordination of participation among discrete interests (Hardin 1982; Olson

1965). For knowledge sharing, the problems of non-contribution or ineffective retrieval can be considered from a similar perspective. Collective action normally involves cost/benefit calculus for economists and political scientists. But for researchers of knowledge sharing, collective action is a cognitive and structural problem. It is the problem of identifying how people voluntarily justify and optimize the cognitive labor of contribution, and what makes the coordination of collective efforts more or less difficult in organizations.

Although ICT have been deployed in various organizational activities, until recently have scholars begun to examine the precise ways that technology facilitates social cognition and alleviates structural barriers in the knowledge sharing process (Maruping and Agarwal 2004; Olivera et al. 2008; Zammuto et al. 2007). While it is generally believed that ICT lower the cognitive cost for participation and the structural overhead for the organization of collective action (Bimber et al. 2005), there is limited effort in applying the similar integrative perspective to ICT-enabled knowledge sharing. For example, theories like Transactive Memory Systems (TMS) have considered how technical features optimize the distribution of expertise so that individual bears lower cognitive cost and have greater *capability* to share knowledge. But it is unclear how individuals can perceive greater benefits so that they are more *willing* to share knowledge. Theories like Adaptive Structuration Theory (AST) have addressed the appropriation of technology features to adapt to task structures in groups, yet it is unclear how individuals maintain a minimum degree of interdependence in order to commit to the organizational goal of knowledge integration. This limitation provides the motivation for this essay.

Based on a review of extant research, I argue that knowledge sharing in organizations is enabled by social cognitive factors such as people's willingness and capacity to contribute in given social contexts, and inhibited by structural factors such as diversity and unfamiliarity in given group settings. ICT affect the knowledge sharing process by interacting with these factors

in different ways: some technical features facilitate the social cognitive mechanisms of motivation, and other features are appropriated to support structures of social interaction in the coordination process. In specific, a technology is more effective for knowledge sharing if it a) increases self-efficacy about knowledge, b) facilitates social identification in the embedding group or organization, c) reinforces reciprocity, d) enables decentralized or diversified communication, e) facilitates open-ended and contextualized dialogues, f) mandates responsibilities for topics or problems, and g) allows emergent, informal coordination of contribution. The technology is less effective it lacks communication, storage and retrieval features for achieving these functions.

The essay is organized as follows. It first reviews the common drivers and barriers of knowledge sharing in the organizational context. It then considers the way that ICT influence the conditions of networked collective action. Using ICT-enabled collective action as a theoretical lens, it critiques the theories on how technology facilitates social cognition and how individuals or teams overcome structural barriers respectively. The theories under review are TMS and AST. It then revisits the central argument with an integrative framework and sample hypotheses. The essay concludes with a description of a hypothetical study that applies this framework.

Drivers of Knowledge Sharing

Common assumptions

It is assumed that organizations are in constant need of acquiring information from various sources because of limited resources and capacity (Daft and Lengel 1986). Information becomes knowledge after it is processed and internalized by individuals in their unique domains of work (Nonaka 1994). Individuals' cognitive capacity, working environment and various kinds of task or organizational constraints all influence the process and outcomes of knowledge

internalization. Therefore knowledge internalization is not purely a mechanical information-handling process (Heinz and Rice 2009). It is a social process in which individuals encode and embed knowledge within social relationships that configure reuse, interpretation and value creation (Markus 2001).

To obtain competitive advantage and improve operational efficiency, organizations often need to integrate disparate domains of knowledge. Knowledge integration requires the collective efforts of identifying knowledge domains, mobilizing knowledge exchange, and coordinating the contribution process and outcomes (Robert et al. 2008). Because knowledge is socially embedded, this integrative process is more complicated than simply aggregating information. In order to contribute to the knowledge base, knowledge owners need to bear the cognitive cost of organizing and presenting relevant and useful knowledge. It is particularly costly in terms of mental resources when tacit, embedded knowledge needs to be converted into explicit, codified knowledge (Nonaka 1994).

The cognitive cost may also include individuals' identification and alignment of goals in the embedding groups or organizations and voluntary alignment of behavior with their normative structure. These social cognitive costs need to be offset with motivations, or perceptions that justify the allocation of mental resources with sound evaluation of desired outcomes (Kanfer 1990). Therefore motivations for knowledge sharing can be both shaped by individual factors such as capacity and willingness, and collective influence such as norms, trust and social interaction (Heinz and Rice 2009). To understand why knowledge sharing is effective, it is therefore necessary to review these social cognitive mechanisms.

Individual cognition

At the individual level, knowledge sharing is first enabled by the *capacity* to process specialized knowledge, as well as the beliefs about its value and utility. Conversion of

internalized knowledge into an appropriate form for contribution requires the necessary competency and skills to identify problems, filter through various options, and deliver the ideal solutions, all under various cognitive constraints such as time pressure and workload (Olivera et al. 2008). When individuals have such skills and competency, it is also important for them to develop self-efficacy (Bandura 1997). Evidence has shown that individuals are more likely to contribute their knowledge when they have confidence about their expertise (Kankanhalli et al. 2005) and when they do have the appropriate expertise and skills (Bagozzi and Dholakia 2006; Wasko and Faraj 2000).

Furthermore, knowledge sharing is also driven by the *intention* to commit physical and mental resources for contribution and retrieval. The intention is often mediated by perceived activity interdependence, attitudes, and needs (Venkatesh et al. 2008). Individuals are more likely to share knowledge, when they perceive a certain degree of interdependence of actions and outcomes between knowledge producers and users (Markus 2001). For example, individuals' intention to share knowledge is strongly determined by their perception of the amount of contribution before them (Fulk et al. 2004). Contribution intentions can also be mediated by positive attitudes towards the use and outcomes of the knowledge management system (Bock et al. 2005). These positive attitudes can originate from actual participation in the knowledge sharing activities, but can also come from psychological involvement with the project based on its perceived relevance and importance (Hartwick and Barki 1994). Finally, individuals' willingness of sharing is also determined by the satisfaction of both extrinsic needs such as money and internalized needs such as status and reputation (Roberts et al. 2006; Wasko and Faraj 2005). The intention to share is higher when individuals are emotionally attached to the anticipated goal of knowledge sharing (Bagozzi and Dholakia 2006).

Collective social influence

At the collective level, social influence can shape individuals' capacity and intention for knowledge sharing. Social capital is the collective productive resources that inhere in social relationships and meaningful interactions (Coleman 1988; Lin 2001). Social capital can be manifested at the organizational level by mutual trust based on competence or benevolence, norms that encourage reciprocity, and shared mental model about tasks (Nahapiet and Ghoshal 1998). When individuals perceive a social environment that rewards openness and cultivates trust, they are more likely to contribute to knowledge sharing (Robert et al. 2008). Furthermore, the behavioral norms of the embedding social environment can also moderate the effect of individual willingness. This is because perceived risks are reduced and perceived extrinsic benefits are increased in a social environment of reciprocity and mutual obligation (Kankanhalli et al. 2005). Actually, knowledge sharing is even more successful when it is automatically initiated by voluntary actions based on trust and reciprocity rather than organizational mandates (Bock et al. 2005; Hartwick and Barki 1994). Finally, both expertise efficacy and sharing intentions can be increased, when individuals share a strong sense of and commitment to the collective identities and goals of the teamwork (Bagozzi and Dholakia 2006).

Moreover, knowledge sharing can also be motivated by frequent and meaningful social interaction at both group and organizational levels. Another aspect of social capital is the structural configuration in organizations that facilitate decentralized communication (Nahapiet and Ghoshal 1998). When people are actively involved in diverse communication across structural closures or group boundaries, they are more likely to share unique knowledge with and uncover unspecified information needs from otherwise disconnected clusters of knowledge domains (Burt 2007). A more decentralized communication network is simply more participatory, increasing individuals' intention to share knowledge and enhancing their perceived self-worth (Dennis and Garfield 2003). In addition, knowledge flow can happen more effectively

when multiple angles of interpretation are allowed and rich contexts are provided in the communication process (Faraj and Sproull 2000; Kudaravalli and Faraj 2008).

In summary, knowledge sharing in organizations is motivated by individuals' capacity and intention to commit mental resources for solving knowledge-related problem. Their capacity and intention are further socially shaped by the cognitive, relational and structural resources in the embedding group or organization. These resources determine the development of shared mental models, trust based on reciprocity and social obligation, and participatory communication. Most of the studies reviewed here concern the use of ICT one way or another. Yet I have intentionally avoided discussing the specific technologies with the goal of identifying general social cognitive mechanisms that can be considered in the theoretical framework of ICT-assisted collective actions. These social cognitive mechanisms provide the basis for the theoretical discussion of how ICT intervene the knowledge sharing process. It appears that:

1. People are more likely to share knowledge, when they have valid efficacy about their skills and competency.
2. The intention of sharing is mediated by perceived activity interdependence, attitudes and expected satisfaction of needs associated with sharing.
3. Because knowledge sharing entails active alignment of individual and collective goals, individuals' capacity and intentions for sharing are moderated by their commitment to the social identity of the organization.
4. Individuals' intentions for sharing are moderated by norms of reciprocity in the embedding social contexts.
5. Individuals' capacity and intentions for sharing are also moderated by the pattern of communication and social interaction in the embedding social contexts.

These are the social cognitive mechanisms that maximize perceived practical and social benefits and minimize cognitive cost, and therefore facilitate knowledge sharing.

Barriers to Knowledge Sharing

Knowledge sharing also entails effective coordination of resource allocation and reward distribution. Regardless of whether knowledge sharing is voluntary or mandatory, behavior rules and technical details about what to share and how to share need to be deployed to satisfy a wide range of interests (Markus and Mao 2004). An appropriate degree of task interdependence must be designed and implemented in order to increase mutual awareness and interest in each other's contribution. A balanced and reasonable plan for equal and flexible access to the knowledge base should be in palace to deliver collective benefits. As Faraj and Sproull (2000) demonstrate, expertise coordination can only be effective when distributed, heedful and emergent social interactions are present in the process of knowledge sharing. However, coordination of knowledge sharing can often be complicated by inherent structural factors in groups and organizations. Unfamiliarity and diversity can make social interactions heedless, centralized and stagnant.

Unfamiliarity as a structural barrier

First, unfamiliarity with both technical information and social heuristics of external knowledge can make coordination difficult. This may seem like a social cognitive problem because individuals can become more familiar over time (Harrison et al. 2002). But evidence suggests that individuals either intentionally choose collaboration partners based on previous relationships (Cummings and Kiesler 2008; Hinds et al. 2000) or are often arbitrarily put in ad hoc and one-off teams in emergent situations (Majchrzak et al. 2008). Lack of familiarity is thus

a structural problem that may not practically be solved with improved social cognition of expertise or benevolence.

Unfamiliarity with the technical aspect of external knowledge negatively influences expertise coordination because individuals lack a working understanding of the level of expertise distribution and interdependence for the present tasks. Without the awareness of the interdependence among different parties, individuals are less likely to correctly evaluate the value of knowledge that is held by themselves and others. As a result, they may fail to perceive the necessity and benefit of knowledge sharing. Research shows that lack of familiarity has a negative effect on coordination effectiveness even for tasks that are structurally not complex (Espinosa et al. 2007).

Unfamiliarity with social heuristics of the knowledge sources, on the other hand, can lead to a deficient understanding of the relevant attributes and situation of knowledge sharing partners. Lack of a shared frame of reference as the result of unfamiliarity with others' situations and preferences can make the coordination of knowledge input and output costly or even wasteful in terms of time and mental resources. This is because individuals need extra efforts to develop a common ground for communication and actions (Clark and Brennan 1991). Lack of knowledge about others' situations can often lead to attributional errors especially in a distributed environment (Cramton et al. 2007). Evidence further suggests that the negative effect of unfamiliarity with team members on coordination effectiveness is even stronger when teams get bigger and more dispersed (Espinosa et al. 2007).

Diversity as a structural barrier

Second, diversity is another structural barrier to effective coordination of knowledge sharing. Diversity refers to the degree of difference in attributes (van Knippenberg et al. 2004). Individuals in a given organizational configuration can differ in many attributes such as

demographics, geographic location, status and experience. Many perspectives such as information processing and social categorization have suggested that diversity can have mixed effects on team process (Earley and Mosakowski 2000; Hinsz et al. 1997). Thus the effect of diversity on the coordination of knowledge sharing can be complicated, depending on the degree of diversity and the type of diversity (van Knippenberg et al. 2004).

Although a moderate degree of diversity in expertise domains proves to be beneficial for expanding the range of perspectives in knowledge integration (Dahlin et al. 2005), the ideal degree of diversity is hard to calculate and is even harder to be observed in real life organizations. In most cases, a higher degree of diversity and a lower degree of diversity (homogeneity) can both exist to undermine the coordination process. For example, high diversity in demographics such as gender and location causes serious communication problems (O'Leary and Cummings 2007), and high diversity in expertise domains has a negative effect on in-depth analysis and integration of perspectives (Dahlin et al. 2005). However, a highly homogeneous group can also be susceptible to groupthink. They can be inclined to structural clustering, in which common beliefs are continuously reinforced with redundant communication (Burt 2007). Structural closure may exclude individuals from perceiving emergent opportunities and accessing alternative perspectives in a heedful way (Weick and Roberts 1993). As a result, lack of distributed communication across group boundaries leads to less effective coordination of knowledge sharing (Robert et al. 2008; Wasko and Faraj 2005). Taken together, it is reasonable to assume that both structural diversity and homogeneity can negatively influence coordination of knowledge sharing. Structural diversity makes it difficult for different individuals or groups to communicate and integrate perspectives, and structural homogeneity makes groups resistant to alternative ideas and emergent structures. Both structural configurations can become barriers to effective coordination that may require strategic adaptation or formal organizational intervention.

In sum, structural factors such as unfamiliarity and diversity/homogeneity can inhibit knowledge sharing by making expertise coordination less effective. Lack of shared cognition of interdependence and expertise distribution makes individuals less aware of and attentive to others' knowledge. And lack of understanding about the social heuristics of knowledge partners often leads to attributional errors that lower the expectation of the feasibility and value of external knowledge.

In comparison, structural diversity in location and demographics mainly results in less frequent or less effective communication, thus lowering the quality of social interaction. But more seriously, structural diversity in expertise domains, experience or affiliation can lead to misalignment of interests and conflicting perspectives on the collective value of a knowledge base. However, it should be noted that lack of diversity – or homogeneity – could also make expertise coordination structurally exclusive and resistant to innovation. In short, structural factors undermine knowledge coordination mainly by reducing interdependence and mutual appreciation among knowledge contributors, and increasing misalignment of perspectives and structural exclusion in the coordination process.

Knowledge Sharing as ICT-enabled collective action

As discussed earlier, knowledge sharing is inherently a collective-action problem. It involves voluntary collective efforts from multiple individuals, and the outcome of knowledge sharing is a public good that is non-excludable and non-rivalry. It is believed that new media such as the Internet has lowered individual cognitive cost for participation in collective action. Bimber et al (2005) argue that because the Internet has made participation and coordination so low-cost in terms of mental efforts, collective action is virtually "a set of communication processes involving the crossing of boundaries between private and public life". The basic idea is

that since contribution to online collective actions is so easy (leaving a comment on a blog, or saving the browser cookie for Google), participation no longer requires close coordination of intentional efforts of committing considerable resources. Instead, collective action is determined by the process of "interaction and negotiation of individuals' communicative and information environment". In other words, online collective action is essentially the process of how individuals communicate with one another and identify the degree of alignment of goals and interests with certain organizational entities.

At the same time, online collective action also involves the loosening of traditional boundaries in the formal organization of collective contribution of resources and allocation of benefits. Both formal organizations and informal, emergent networks of practice based on impersonal and frequent social interactions can effectively coordinate different forms of collective actions. Therefore, the effect of new technologies on collective action can be understood in two respects: how technologies influence interpersonal communication about expertise coordination within an organizational environment, and how technologies influence organizational structure. Indeed, this view is echoed in Flanagin et al's model, which proposes that the combination of interpersonal and personal interaction and the integration of institutional and entrepreneurial engagement of coordination characterize new forms of collective actions online (Flanagin et al. 2006).

To adapt this perspective for the study of knowledge sharing, it is necessary to first recognize that individuals' social interaction with the social environment has even a more important influence on individuals' motivation to contribute knowledge. Given that contribution can be made so easy and effortless, it is particularly important to understand what organizational norms and social dynamics sustain individuals' intention to share valuable knowledge. Why will not people share knowledge if it is already so easy? As shown in the literature review, the

collective social influence can have equally important effect on both the capacity and intentions of individuals to share knowledge. Zammuto et al (2007) have identified several technological affordances such as virtual media in organizations that facilitate broader and instant participation across corporate boundaries. However, research needs to identify the social cognition of norms and trust that truly motivate individuals' *intention* to collaborate and share.

Second, it is necessary to recognize that both a certain degree of task interdependence and emergent structures are needed in the coordination of knowledge sharing. Given that the boundaries between private resources and public benefits become fluid, it is equally important to perceive that interdependence among actors and alignment of share goals is still necessary for building a useful knowledge base. As revealed earlier, structural factors of unfamiliarity and diversity do influence knowledge sharing in different ways. To solve the problem of structural closure and misalignment of perspectives, advanced ICT functionalities can be employed. For example, visualization tools of work processes can help people organize their work in a more emergent and mutable way. And real-time communication tools allow social actions that enable people from diverse backgrounds to create common grounds (Zammuto et al. 2007). A more entrepreneurial, emergent and decentralized structure of coordination can thus be effectively established. However, research still needs to explain whether and how formal organization is needed to ensure that an appropriate amount of interdependence, tight coupling of interests, and mutual appreciation are needed for the coordination of knowledge sharing. In other words, emergent, decentralized and entrepreneurial sharing needs to be structurally balanced with interdependent, collectivized and institutional integration.

Critiques of theories

I have tried to show that for knowledge sharing to be effective, ICT need to be used to increase individuals' capacity and willingness of contribution and facilitate the construction of a

positive social environment that is rich in distributed communication, norms of reciprocity and trust. ICT also need to be employed to minimize the effects of unfamiliarity and structural difference on the development of task interdependence, goal alignment and emergent structures during the coordination process. Based on this premise, I suggest (and repeat here) that a technology is more effective for knowledge sharing if it a) increases self-efficacy about knowledge, b) facilitates social identification in the embedding group or organization, c) reinforces reciprocity, d) enables decentralized or diversified communication, e) facilitates open-ended and contextualized dialogues, f) mandates responsibilities for topics or problems, and g) allows emergent, informal coordination of contribution.

The proposition of these functionalities is based on the review of specific characteristics of the social cognitive mechanisms and structural barriers to ICT-enabled knowledge sharing from a perspective of online collective action. Theories of ICT should explain the underlying logic of phenomena, rather than predict simple effects of specific technical features (Sutton and Staw 1995). Therefore I have intentionally focused on general functionalities rather than on specific features in order to facilitate theoretical discussion of previous studies. To put this creative conceptualization to work, some of the proposed functionalities need to be implemented with the development and deployment of specific technical features. My conceptualization is also intentionally abstract to allow for flexibility of matching functionalities with one or multiple design features. For example, a mandatory feedback system would be employed to both increase self-efficacy about knowledge and encourage reciprocity. And decentralized communication can be implemented with both a multiple-to-multiple messaging system and an archive system that allows groups to access each other's brainstorming session records.

This creative conceptualization allows for a critical review of previous theories. Rather than simply trying to combine or integrate two or more disparate theories, this critical review

aims at revealing the strengths of these theories in explaining certain aspects of the social cognitive and structural dynamics and the weaknesses in the explanatory power for other aspects. The selection of theories under review is based on the sole need for clarifying and demonstrating the creative conceptualization in this essay. The discussion of these theories does not suggest that an ingenious combination of them will in any way provide a quick theoretical solution for explaining the effect of new ICT on knowledge sharing.

Transactive Memory Systems (TMS) Theory

Transactive Memory System (TMS) is a the collection of individual memory and expertise in combination with the communication about the encoding, decoding and retrieval of information between individuals (Wegner 1987). In organizations, transactive memory systems normally consist of a perceived cognitive interdependence among members of a given group, a distributed intelligence about the location (owner) of specific expertise for components of the task, and a shared mental model about the goals and practices for accessing and integrating distributed expertise (Brandon and Hollingshead 2004). TMS theory posits that expertise coordination based on transactive memory will be more effective, because the division of cognitive labor reduces the need and cost for individuals to possess and handle redundant information. TMS-based expertise coordination is also more effective because the information relationships required for expertise encoding, storage and retrieval can enhance task interdependence and increase alignment of perceptions and actions at the group level. When ICT such as the intranet are employed to facilitate TMS development, it is argued that the distribution of non-redundant knowledge and efficient communication coordination – two characteristics of TMS – will benefit the production of collective information goods at the organizational level (Hollingshead et al. 2002).

The TMS theory is particularly useful for revealing the social cognitive mechanisms that increase individuals' *capacity* to share knowledge. For any given tasks, individuals no longer need to possess all aspects of knowledge. The division of cognitive labor enables them to have greater autonomy in reallocating their cognitive resources for tasks and problems and identify the most ideal path to developing and possessing unique knowledge. As the cognitive cost is lowered, the perceived benefit for solving the task is increased when individuals gradually develop efficacy about their own knowledge, about knowledge and capability of other group members, and about the group as an organic unit of integrated expertise. The TMS theory is also helpful for understanding the social organization of structural diversity in knowledge coordination (Wegner 1987). Individuals are engaged in constant interaction in order to modify mutual awareness of knowledge distribution and develop shared mental models about knowledge integration. As a result, they have a greater sense of interdependence and follow a greater degree of concordance of actions. The effective construction of the task-expertise-person combination makes the coordination of knowledge sharing more accurate and productive, despite the obvious diversity in expertise domains (Brandon and Hollingshead 2004).

However, the TMS theory is inadequate in explaining the social cognitive mechanisms for increasing individuals' willingness or intention to share knowledge. Although Hollingshead et al (2002) identify the importance of an incentive system that rewards reciprocity and penalizes non-contribution, the classic TMS theory does not reveal how social transactions of knowledge are mediated by individuals' belief and motivation systems, and how the group as a shared memory system develops an optimal structure of social interaction and cultivates social identities, norms and trust among the experts. Furthermore, the TMS theory has been inadequate in accounting for emergent structure of expertise coordination, which is increasingly prevalent in current organizations. Despite the benefit of a shared cognition of interdependence and shared

mental model about knowledge-related activities, it is unclear how TMS should adapt to disruptive changes in task structure, knowledge domains and personnel change. This makes the TMS theory insufficient in explaining collective actions in the present media environment, where emergent and informal networks become legitimate forms of organizing. Majchrzak et al (2008) have recently argued that knowledge coordination particularly for emergent response teams needs to rely on flexible communication and emergent routines rather than on a shared metastructure of expertise interdependence. Similar perspectives should be extended into a broader context of knowledge sharing.

Adaptive Structuration Theory (AST)

Adaptive Structuration Theory (AST) is about the production and reproduction of social structures in individuals' active appropriation of the features and spirit of technologies in order to fit task requirements in specific organizational environments (DeSanctis and Poole 1994; Poole and DeSanctis 2004). The AST is a broad framework that has been widely used to explain groups' intentional adaptation of activities, social interaction and technology use in response to initial misalignments between technology and tasks. For example, researchers have shown that groups can modify information flow and restructure communication to compensate for the poor fit between technological systems and tasks over time (Fuller and Dennis 2009). The adaptation of technologies can also help groups to manage different types of conflicts at different stages of group development (Maruping and Agarwal 2004). The AST is relevant to knowledge sharing in organizations because it in particular reveals the structural dynamics in groups' employment of ICT for coordinating expertise integration.

The AST is helpful for understanding the utility and value of emergent structures in the coordination of collective efforts in knowledge sharing. Structural diversity may cause initial misalignment of perspectives and structural homogeneity can result in closure and stagnancy.

These structural barriers to effective expertise coordination can be resolved with teams' active reconfiguration of technological functionalities, organizational structure and group environment (Fuller and Dennis 2009; Majchrzak et al. 2000). Research shows that any pre-existing social structure is inherent malleable in groups' adaptive response to discrepant events that occur as a result of organizational conflicts or inadequate technologies (Majchrzak et al. 2008). Therefore, emergent structuring is not only a legitimate way for individuals to coordinate knowledge sharing within adverse social structures, but also a necessary way for them to innovatively use technologies and modify the larger organizational environment.

However, the AST may be inadequate in explaining how interdependence and mutual awareness of expertise distribution are maintained in groups' active realignment of structures. Recent updates to the AST suggest that appropriation is structurally nested across individual, group and institutional levels, so that individual action and interaction are part of a mutually reinforcing relationship with elements of the organizational structure (Perlow et al. 2004). In other words, the embedding organizational structure may have to intervene to ensure a minimum degree of interdependence and mutual obligation, especially when ad hoc teams lack the necessary understanding and appreciation of each other. However, it is unclear how this interdependence is sustained in the coordination process when such teams readjust communication or technology use to alleviate initial misalignment. Emergent structuring is certainly important, yet an uncritical application of the AST to knowledge sharing in the new media environment may result in the negligence of the enabling or constraining effect of organizational structure on entrepreneurial individuals or groups.

In summary, both TMS and AST theories are useful for studying ICT-enabled knowledge sharing. Both theories reveal certain mechanisms of knowledge sharing, but are inadequate in explaining other dynamics of the expertise coordination process. But such limitations are not

attributable to the inherent logic of respective theories, Rather, the creative conceptualization is intentionally broad to examine the overall relevance and value of all dominant theories in the IS field. Therefore, the solution is not to simply synthesize or combine the two theories, but to adjust them in specific ways to fit the emergent research questions.

Application of the collective-action perspective in ICT research

In aggregate, existing studies address the social cognitive mechanisms of both the capability and the intention for knowledge sharing in the context of online communities. For example, scholars identify that deep profiling and interactive communication are increasingly available, which enables individuals to more effectively identify the source of knowledge and increase interpersonal affinity (Ma and Agarwal 2007; Postmes 2006). Enhanced self-presentation and identity-based communication contribute to a more efficient attribution process where the negative effect of situational invisibility on information sharing is minimized (Cramton and Orvis 2003). As a result, members of online communities can perceive a higher salience of trust and social presence, thus effectively mitigating uncertainty in knowledge transactions (Pavlou et al. 2007). Furthermore, stronger mutual identification and easier communication enable individuals to develop more diversified relationships based on either shared interest or interpersonal attraction. A widened range of communication facilitates individuals' participation in more diverse types of collective actions (Flanagin et al. 2006). In other words, ICT provide new features that help individuals participate in more forms of knowledge sharing in a better way.

Researchers have also examined features of online communities that influence individuals' intention for sharing. For example, community-wide reputation and feedback systems make individuals personally identifiable and accountable for their previous activities.

Such systems not only help community members make more informed decisions about knowledge sources. They also make sure individuals' previous and future contribute be rewarded with positive feedbacks and higher reputation ranking (Resnick et al. 2000). Effective reputation systems therefore foster a norm about reciprocity and mutual obligation, which increase individuals' willingness for sharing (Fuller et al. 2007).

However, it appears that limited empirical evidence exists to reveal how structural difficulty in organizing knowledge sharing has been solved with a balanced configuration of interdependence and emergent structuring. It has been argued that a hybrid of informal structures and self-organizing networks can make structural barrier of collective actions more permeable (Bimber et al. 2005). For example, in the account of Wikipedia by Tapscott and Williams (2008), a dynamic organizational structure of both formal hierarchy and distributed participation, strong sanctioning mechanisms and inclusive communication tools all contribute to an effective and dynamic coordination of knowledge contribution. Emergent structures are often created in people's active adaptation of the structure of technology, the group, and the organizational in response to discrepancies (Majchrzak et al. 2000). And they are more beneficial for knowledge coordination than a shared metastructure of interdependence in special circumstances (Majchrzak et al. 2008). However, it is unclear how technologies can be used to maintain an optimal degree of interdependence and mutual awareness when emergent and entrepreneurial efforts often appear easier and more necessary in the coordination of knowledge sharing.

This situation suggests that organizational IT researchers need to make holistic theoretical progress in explaining the role of new ICT in knowledge sharing. There are anecdotal studies that describe the phenomenon of emergent structuring and there are good empirical studies that *in combination* reveal the technological mediation of capacities and intentions for sharing knowledge online. Yet good theories need to address how collective social influence

mediates both the capacity and willingness of knowledge sharing, and how close interdependence and emergent, entrepreneurial structures are both needed for more effective coordination. This sounds like an overly comprehensive task. But it might be a necessary step towards systematically studying ICT-enabled knowledge sharing as a collective action.

References

Bagozzi, R.P., U.M. Dholakia. 2006. Open source software user communities: A study of participation in Linux user groups. *Management Science* **52**(7) 1099-1155.

Bandura, A. 1997. *Self-efficacy: The excersie of control*. Freeman, New York, NY.

Bimber, B., A.J. Flanagin, C. Stohl. 2005. Reconceptualizing collective action in the contemporary media environment. *Communication Theory* **15**(4) 365-388.

Bock, G., R.W. Zmud, Y. Kim, J. Lee. 2005. Behavioral Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces and Organizational Climate. *MIS Quarterly* **29**(1) 87-111.

Brandon, D.P., A.B. Hollingshead. 2004. Transactive memory systems in organizations: Matching tasks, expertise and people. *Organization Science* **15** 633-644.

Burt, R.S. 2007. *Brokerage and Closure: An Introduction to Social Capital*. Oxford University Press, New York.

Cabrera, A., E.G. Cabrera. 2002. Knowledge-sharing dilemmas. *Organization Studies* **23** 687-710.

Clark, H.H., S.E. Brennan. 1991. Grounding in communication. L.B. Resnick, J. Levine, S.D. Teasley, eds. *Perspectives on socially shared cognition*. APA Press, Washington, DC, 127-149.

Coleman, J. 1988. Social Capital in the Creation of Human Capital. *American Journal of Sociology* **Supplement 94** S95-S120.

Cramton, C., K. Orvis. 2003. Overcoming barriers to information sharing in virtual teams. C. Gibson, S. Cohen, eds. *Virtual Teams That Work: Creating Conditions for Effective Virtual Teams*. Jossey Bass.

Cramton, C., K. Orvis, J. Wilson. 2007. Situation invisibility and attribution in distributed collaborations. *Journal of Management* **33** 525-546.

Cummings, J.N., S. Kiesler. 2008. Who collaborates successfully? Prior experience reduces collaboration barriers in distributed interdisciplinary research *the ACM conference on Computer-Supported Cooperative Work*, San Diego, CA.

Daft, R.L., R.H. Lengel. 1986. Organizational information requirements, media richness, and structural design. *Management Science* **32**(5) 554-571.

Dahlin, K.B., L.R. Weingart, P.J. Hinds. 2005. Team diversity and information use. *Academy of Management Journal* **48**(6) 1107-1128.

Dennis, A.R., M.J. Garfield. 2003. The adoption and use of GSS in project teams: Toward more participative processes and outcomes. *MIS Quarterly* **27**(2) 289-323.

DeSanctis, G., M.S. Poole. 1994. Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science* **5**(2) 121-147.

Earley, P.C., E. Mosakowski. 2000. Creating hybrid team cultures: an empirical test of transnational team functioning. *Academy of Management Journal* **43** 26-49.

Espinosa, J.A., S.A. Slaughter, R.E. Kraut, J.D. Herbsleb. 2007. Familiarity, Complexity, and Team Performance in Geographically Distributed Software Development *Organization Science* **18**(4) 613-630.
Faraj, S., L. Sproull. 2000. Coordinating Expertise in Software Development Teams. *Management Science* **46**(12) 1554-1568.
Flanagin, A., C. Stohl, B. Bimber. 2006. Modeling the structure of collective action. *Communication Monographs* **73** 29-54.
Fulk, J., R. Heino, A. Flanagin, P. Monge, F. Bar. 2004. A test of the individual action model for organizational information commons. *Organization Science* **15** 569-685.
Fuller, M.A., M.A. Serva, J.S. Benamati. 2007. Seeing is believing: The transitory influence of reputation information on e-commerce trust and decision making. *Decision Sciences* **38**(4) 675-699.
Fuller, R.M., A.R. Dennis. 2009. Does Fit Matter? The Impact of Task-Technology Fit and Appropriation on Team Performance in Repeated Tasks *Information Systems Research* **20**(1) 2-17.
Hardin, R. 1982. *Collective Action*. RFF Press.
Harrison, D.A., K.H. Price, J.H. Gavin, A.T. Florey. 2002. Time, teams, and task performance: changing effects of surface- and deep-level diversity on group functioning. *Academy of Management Journal* **45** 1029-1045.
Hartwick, J., H. Barki. 1994. Explaining the role of user participation in IS use. *Management Science* **40**(4) 440-465.
Heinz, M., R.E. Rice. 2009. An integrated model of knowledge sharing in contemporary communication environments. C. Beck, ed. *Communication Yearbook*. Routledge, New York, NY, 172-195.
Hinds, P., K. Carley, D. Krackhardt, D. Wholey. 2000. Balancing similarity, competence, and familiarity: A study of how people choose workgroup members. *Organizational Behavior and Human Decision Processes* **81** 226-251.
Hinsz, V.B., R.S. Tindale, D.A. Vollrath. 1997. The emerging conceptualization of groups as information processes. *Psychological Bulletin* **121**(1) 43-64.
Hollingshead, A.B., J. Fulk, P. Monge. 2002. Fostering intranet knowledge sharing: An integration of transactive memory and public goods approaches. P. Hinds, S. Kiesler, eds. *Distributed Work*. The MIT Press, Cambridge, MA, 335-356.
Kanfer, R. 1990. Motivation theory and industrial organizational psychology. M.D. Dunnette, L. Hough, eds. *Handbook of Industrial and Organizational Psychology: Theory in industrial and organizational psychology*. Consulting Psychologists Press, Palo Alto, CA, 75-170.
Kankanhalli, A., B.C.Y. Tan, K.-K. Wei. 2005. Contributing knowledge to electronic knowledge repositories: An empirical investigation. *MIS Quarterly* **29**(1) 113-143.
Kudaravalli, S., S. Faraj. 2008. The Structure of Collaboration in Electronic Networks. *Journal of the Association for Information Systems* **9**(10/11) 706+.
Lin, N. 2001. *Social capital*. Cambridge University Press, New York, NY.
Ma, M., R. Agarwal. 2007. Through a Glass Darkly: Information Technology Design, Identity Verification, and Knowledge Contribution in Online Communities. *Information Systems Research* **18**(1) 42-67.
Majchrzak, A., S.L. Jarvenpaa, A.B. Hollingshead. 2008. Coordinating Expertise Among Emergent Groups Responding to Disasters. *Organization Science* **18**(1) 147-161.
Majchrzak, A., R.E. Rice, A. Malhotra, N. King, B. S. 2000. Technology adaptation: The case of a computer-supported interorganizational virtual team. *MIS Quarterly* **24**(4) 569-600.

Markus, M.L. 2001. Toward a theory of knowledge reuse. *Journal of Management Information Systems* **18**(1) 57-93.
Markus, M.L., J.-Y. Mao. 2004. Participation in development and implementation - Updating an old, tired concept for today's IS. *Journal of the Association for Information Systems* **5**(11/12) 514-544.
Maruping, L.M., R. Agarwal. 2004. Managing team interpersonal processes through technology: A task technology fit perspective. *Journal of Applied Psychology* **89**(6) 975-990.
Nahapiet, J., S. Ghoshal. 1998. Social capital, intellectual capital and the organizational advantage. *Academy of Management Review* **23**(2) 242-266.
Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science* **5**(1) 14-37.
O'Leary, M., J.N. Cummings. 2007. The spatial, temporal, and configurational characteristics of geographic dispersion in work teams. *MIS Quarterly* **31**(3) 433-452.
Olivera, F., P.S. Goodman, S.S.-L. Tan. 2008. Contribution Behaviors in Distributed Environments. *MIS Quarterly* **32**(1) 23-42.
Olson, M. 1965. *The Logic of Collective Action: Public Goods and the Theory of Groups*. Harvard University Press, Boston, MA.
Pavlou, P.A., H. Liang, X. Yajing. 2007. Understanding and Mitigating Uncertainty in Online Exchange Relationships: A Principal-Agent Perspective. *MIS Quarterly* **31**(1) 105-136.
Perlow, L.A., J.H. Gittell, N. Katz. 2004. Contextuailzatin patterns of work group interaction: Toward a nested theory of structuration. *Organization Science* **15**(5) 520-536.
Poole, M.S., G. DeSanctis. 2004. Structuration theory in information systems research: Methods and controversies. M.E. Whitman, A.B. Woszczynski, eds. *Handbook of information systems research*. Idea Group, Hershey, PA, 206-249.
Postmes, T. 2006. The psychological dimensions of collective action, online. A. Joinson, K.Y.A. McKenna, T. Postmes, U. Reips, eds. *Oxford Handbook of Internet Psychology*. Oxford University Press, Oxford, UK, 165-184.
Resnick, P., R. Zeckhauser, E. Friedman, K. Kuwabara. 2000. Reputation systems. *Communications of the ACM* **43**(12) 45-48.
Robert, L.P., A.R. Dennis, M.K. Ahuja. 2008. Social Capital and Knowledge Integration in Digitally Enabled Teams. *Information Systems Research* **19**(3) 314-334.
Roberts, J., I.-H. Hann, S. Slaughter. 2006. Understanding the motivations, participation, and performance of open source software developers: A longitudinal study of the apache projects. *Management Science* **52**(7) 984-999.
Sutton, R.I., B.M. Staw. 1995. What Theory Is Not. *Administrative Science Quarterly* **40**(3) 371-384.
Tapscott, D., A.D. Williams. 2008. *Wikinomics: How Mass Collaboration Changes Everything*, Expanded ed. Portfolio, New York.
van Knippenberg, D., C.K.W. De Dreu, A.C. Homan. 2004. Work group diversity and group performance: an integrative model and research agenda. *Journal of Applied Psychology* **89** 1008-1022.
Venkatesh, V., S.A. Brown, L.M. Maruping, H. Bala. 2008. Predicting Different Conceptualizations of System Use: The Competing Roles of Behavioral Intention, Facilitating Conditions, and Behavioral Expectation. *MIS Quarterly* **32**(3) 483-502.
Wasko, M.M., S. Faraj. 2000. "It is what one does": Why people participate and help others in electronic communities of practice. *Journal of Strategic Information Systems* **9** 155-173.
Wasko, M.M., S. Faraj. 2005. Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly* **29**(1) 35-57.

Wegner, D.M. 1987. Transactive memory: A contemporary analysis of the group mind. B. Mullen, G.R. Goethals, eds. *Theories of group behavior*. Springer-Verlag, New York, 185-208.
Weick, K.E., K.H. Roberts. 1993. Collective mind in organizations: Heedful interrelating in flight decks. *Administrative Science Quarterly* **38**(3) 357-381.
Zammuto, R.F., T.L. Griffith, A. Majchrzak, D.J. Doughetry, S. Faraj. 2007. Information technology and the changing fabric of organization. *Organization Science* **18**(5).