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Editorial

Research issues in knowledge management and virtual collaboration in new product development: an introductory essay

In Fall 2001, we announced a call for papers that focused on research issues in knowledge management and virtual collaboration in new product development (NPD). We initiated the special issue because we wanted to have the opportunity to learn from, and share, the latest research on a topic of intense interest to industry today: the effectiveness of virtual collaboration to facilitate NPD. According to a September 2001 issue of *Computerworld*, 88% of companies surveyed stated they expected to increase their use of virtual collaboration tools in the future. For example, Cisco, has created the Cisco Collaboration Center of Excellence to achieve its FY2003 vision: internalize collaboration capabilities into Cisco's culture and the day-to-day work practices of its 10,000 employees.

Despite this industry attention, there is much not yet understood about how to effectively collaborate virtually to facilitate NPD. Do people learn differently, interact differently, manage knowledge differently, and share perspectives differently in a virtual, as compared to collocated, NPD effort? Do the features of today's collaborative tools (CTs) sufficiently address the needs of virtual collaborators? What are the most pressing research questions that we, as researchers, should be addressing in this area?

Our call for papers for this special issue included a statement of challenges and questions that was intentionally broad to encourage submissions from researchers with very different perspectives. After all, the topic of knowledge management and collaborative technology is relatively new, and we thought it premature to define too carefully the boundaries of the research issues to be addressed. These boundaries are likely to expand, contract, or be redefined as research issues are explored. The broad scope of our call for papers clearly produced the variety that we intended, and left us with the challenge of finding themes among the set of six papers that we finally accepted.

The special issue is divided into two groups of articles: those focused on how knowledge is developed and shared in NPD teams, and those more focused on the use of CTs for virtual collaboration. In the former group are articles by Mohrman et al., Cummings and Teng, and Leenders et al.

In Mohrman et al.'s paper, they conducted an impressively large ($n = 2400$) survey of scientists and engineers in 10 firms, focusing on knowledge work behaviors. Mohrman et al. show that the use of cross-functional teams and IT quality are important determinants of

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organizational performance, but not sufficient. A critical intervening variable is the knowledge work behaviors of the scientists and engineers: a willingness to try new approaches, using systematic processes to make decisions, knowledge-sharing, and tracking impact of their work on business performance. What we learn from Mohrman et al. for future research on NPD, then is that predictors of NPD performance need to include how the knowledge work process is managed and practiced.

Cummings and Teng focus on knowledge transfer between organizations, although their findings are relevant to knowledge transfer within the same organization, e.g., functions represented on NPD teams. Cummings and Teng define transfer success as commitment, satisfaction and ownership by recipients of the transferred knowledge. Consistent with other studies, they found that knowledge that is embedded in a source organization's routines and practices transfers less successfully than non-embedded knowledge. However, contrary to other studies, they found that more articulated (coded) knowledge transfers less successfully than less articulated knowledge. The explanation is that a source's knowledge articulation (i.e., codification) reflects norms and values that may be inconsistent with those of recipients. We suggest that this finding is likely to be unique to NPD because creative development of solutions requires synthesis among multiple knowledge sources—a synthesis that relies as much on tacit as on explicit knowledge (Grant, 1996).

What we learn from Cummings and Teng for practitioners is that a company should recognize that the development of knowledge repositories, portals connecting with external databases, and alerts about recent developments in the field will be of only limited value for knowledge transference. Instead, supplementing these activities with mechanisms for connecting people to people through web conferences, communities of practice, discussion boards, chat rooms, instant messaging, and expertise identifiers are needed for knowledge to be effectively transferred. For future research, the Cummings and Teng finding points us in the same direction as that of Mohrman et al.: which knowledge transfer processes are more (versus less) likely to lead to efficient and higher quality innovation? Future research is needed on the multiple characteristics of a process that leads to innovation (see Majchrzak et al., 2003, for an example).

The third paper on knowledge transfer development and sharing in NPD teams is by Leenders et al. In their paper, they examine the effect of frequency of communication and communication centralization on NPD creativity. They find that creativity is fostered with moderate levels of communication (neither too much or too little) and low centralization. This suggests, for the practitioner, that knowledge-sharing in NPD need not and should not be continuous; nor should the team leader be the heavyweight centralized repository for knowledge if creativity is the objective. Instead, team leaders need to shift from a heavyweight role to one of process facilitation, monitoring knowledge-sharing enough to know when the optimal frequency and degree of decentralization are achieved. Future research can clearly be helpful in identifying indicators of these optimal levels, as well as the effect that different factors such as degree of virtuality or task type will have on the optimal level. For example, could a virtual NPD team have a different requirement for frequent and decentralized communication than a collocated team?

These three papers together then suggest that knowledge-sharing for NPD must have a clear process for sharing and absorbing not just any knowledge, but new knowledge; not just codified knowledge, but poorly articulated knowledge; and not just frequently

communicated knowledge filtered through the team leader, but knowledge communicated in moderation and independently of the team leader. Can CTs help us with these knowledge-sharing requirements? The next three papers—by O'Sullivan, Cooper, and Susman et al.—address this question.

O'Sullivan studied a large aerospace company, AeroCo, that spent several weeks interacting face-to-face with its suppliers during the initial NPD phases prior to virtual collaboration. O'Sullivan concluded from his observation that virtual collaboration was facilitated because AeroCo, during the initial collocation period, worked closely with its suppliers to develop a common set of work standards and interfaces shared with other suppliers that allowed each supplier to complete some work independently. AeroCo also set up a process in which demonstrated adherence to these standards was a prerequisite to being able to collaborate virtually with the suppliers after they returned to their own companies.

We speculate that the process O'Sullivan observed exhibits the characteristics supporting the type of knowledge-sharing that the first three papers identify. By specifying interface and work standards, the new approaches that Mohrman et al. call for can be quickly identified as that knowledge that falls outside the standards. By articulating the standards when participants are collocated and forcing adherence to standards prior to virtual collaboration, both codified and less articulated knowledge is exchanged as suggested by Cummings and Teng. Finally, by having suppliers collaborate to define the standards, frequent and decentralized communication suggested by Leenders et al. is fostered. For practitioners, then, O'Sullivan provides a process whereby knowledge-sharing requirements are met. For future research, however, the question remains to be addressed: could this norm-setting and knowledge-sharing be effectively done virtually or must the suppliers be face-to-face initially? A case study by Majchrzak et al. (2000) demonstrated that virtual norm-setting and knowledge-sharing is not only possible but contributes to greater innovation than had previously been achieved with collocated NPD teams. Thus, collocation may not be the critical success factor for new NPD, it may be the way that CTs are used.

Cooper's article addresses this question of how to design CTs so that they contribute to knowledge-sharing for innovation. As a practitioner, she describes a number of problems that NPD teams have experienced in using CTs for innovation. From these experiences, she identifies a number of requirements that CTs should meet if CTs are to support knowledge-sharing for innovation, including providing context, timing, connectivity, and multiple levels of abstraction. She evaluates current CT and knowledge management tools and generally judges them to provide inadequate support, often having negative impacts on the NPD user. Her analysis provides a rallying cry for research specifically addressing the design and use of CTs for NPD.

Finally, Susman et al.'s article address the question that, even if CTs are designed to support knowledge-sharing for innovation, any CT is likely to initially be misaligned with the organization in which it is implemented. Based on in-depth interviews with two companies attempting to introduce CT, Susman et al. propose that misalignments are not objectively observable phenomena. There is no absolute metric or scale for determining that a CT is misaligned with an organization, task or team structure. Instead, misalignment is a psychologically derived construct such that different participants may experience misalignments differently. Susman et al. then propose that teams may have different abilities to reconcile members' differing interpretations of the misalignment. Given that individuals interpret,

and teams reconcile, misalignments differently, Susman et al. suggest that the actual misalignment between a CT and the organization may be less important for successful virtual collaboration than the team's ability to reconcile their differences in interpretations about misalignments.

For practitioners, this has profound implications. The current emphasis in CT support for virtual collaboration is to develop roadmaps of the types of CTs that would be helpful under different conditions (e.g. "when synchronous interaction is required, consider instant messaging") as well as self-assessment instruments for companies to determine if they have structures in place to support virtual collaboration. Susman et al.'s research suggest that these efforts are misplaced; instead, the success of virtual collaboration rests on the ability of the team to reconcile their differing interpretations of misalignments as they proceed through the NPD process. Thus, assessing the team's ability to identify these differences and form a common and richer understanding because of these differences will contribute to the team's success.

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