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The emergence of boundary clusters in inter-organizational innovation



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ABSTRACT

Firms that want to innovate often do so by conducting cooperative innovation activities with business partners. In such inter-organizational cooperations, business partners depend on each other's knowledge and bring in different types of expertise. In our research we focus on the knowledge exchanges across knowledge boundaries in inter-organizational activities for innovation. Information systems (IS) play an important role as enablers in this context. The concept of boundary objects has been used to describe interactions between actors with varying information and knowledge needs. While the vital role of boundary objects has been recognized in IS literature, the process of emergence of boundary-spanning has received less attention. Recent literature has hinted that, contrary to initial conceptualizations, boundary objects may not manifest as only single information technology artifacts. In this study, we offer the view of boundary objects as a cluster of several artifacts. By means of a qualitative case study, we describe the process of emergence of such boundary clusters and provide evidence for how they advance inter-organizational innovation activities. We describe how such clusters emerge from differences and dependencies in the knowledge of cooperating actors and explore the clusters' significance to knowledge exchanges in inter-organizational innovation contexts. In doing so, we offer an explanation of cluster emergence which links the interplay of artifacts, uses, practices, and knowledge to the coordination of cooperative inter-organizational innovation activities.

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1. Introduction

Today many firms strive to network with business partners in order to improve their capabilities for innovation through cooperative activities (Davenport, Leibold, & Voelpel, 2006). In this context, acquiring and integrating knowledge from outside the firm is vital (Chesbrough, 2003). One way to gain access to external knowledge is through establishing cooperative partnerships for New Product Development (NPD) (Davenport & Prusak, 2000). A characteristic of inter-organizational NPD teams is the need to integrate knowledge about the cooperating firms' objectives, contributions of involved actors, and information systems (IS) (Malhotra, Majchrzak, Carman, & Lott, 2001).

The role of IS in inter-organizational cooperation in general, and in cooperative innovation activities in particular, is significant (Carlsson, 2003). IS enable and constrain the sharing of knowledge within teams that come together across organizational and functional boundaries for a particular innovation project (Boland & Tenkasi, 1995; Brown & Duguid, 1991; Wenger, 2000). Rarely are the IS used isolated pieces of software; they are more often parts of a larger portfolio of systems and information technology (IT) artifacts employed to accomplish cooperative activities (Alavi & Leidner, 2001). It is vital to understand, manage, design, and use these IS resources by establishing appropriate management processes (Krishnan & Ulrich, 2001; Nambisan, 2003; Saraf, Langdon, & Gosain, 2007).

It is a widely accepted understanding that IT artifacts support knowledge exchanges between actors (Doherty, Karamanis, & Luz, 2012; Jonsson, Holmström, & Lyytinen, 2009; Schmidt & Simone, 1996). In this paper, we study interactions in a dispersed, inter-organizational NPD project team, and take a close look at the knowledge exchange between actors. We observe how they choose and make use of IT and other artifacts during their cooperation. In the early phases of innovation, the tasks an NPD team needs to accomplish are often unknown or unclear. They only become apparent step by step through an ongoing dialog (Hardy, Phillips, & Lawrence, 2003). Intermediate results as well as external events influence this dialog and divide it into what we call "cooperative episodes". This dialog endures through the later phases of the innovation process when tasks are matched with the help of systematic planning. The dialogical negotiation, reassessment and agreement on tasks, as well as the particular distribution of work, are accomplished through coordination. Our level of analysis is not an IT artifact, a single user, team, or firm; rather it is the emergence of artifact clusters during knowledge exchanges that establish cooperative episodes.

The concept of boundary objects is well established in literature on knowledge sharing and re-use (Carlile, 2002; Star & Griesemer, 1989). Boundary objects are used to understand interactions between actors with varying information and knowledge needs. While the vital role of boundary objects has been recognized in IS literature, we don't yet fully understand the processes of how boundary objects develop and how they function to overcome knowledge boundaries (Star, 2010). Lee (2007:335) hints at the opportunity to gain new insights into cooperative practices, when "avoiding the temptation to treat the boundary object as a black box". While boundary objects were often studied in their manifestations as single IT artifacts such as a database or spreadsheet (e.g. Gal, Lyytinen, & Yoo, 2008), recent literature has hinted that they are rarely solitary artifacts. Evidence of the use of multiple boundary objects to accomplish group tasks has been seen in various contexts such as in an aerospace laboratory setting (Bergman, Lyytinen, & Mark, 2007), marketing and sales (Levina & Vaast, 2005), systems development projects (Boujut, 2003; Kimble, Grenier, & Goglio-Primard, 2010; Levina, 2005), healthcare administration (Bossen & Markussen, 2010), and urban planning (Schmidt & Wagner, 2004; Wagner, 2012). In each context, boundary spanning was achieved through employing multiple artifacts and practices for knowledge exchange. While evidence of the combined usage of artifacts exists, prior literature does not explicitly consider the combination of artifacts as a specific concept. Following this line of research, we explicitly extend the idea of boundary objects, by using their conceptual foundations to describe clusters of artifacts that facilitate knowledge exchange.

We use an in-depth case study of an innovation project which we followed closely through a three year period. We focus on the significance of artifacts for knowledge exchanges during cooperative episodes. Previous studies state that the combination of boundary objects, agents and organizations could account for coordination and performance (e.g., Barrett & Oborn, 2010; Bergman et al., 2007; Koskinen, 2005; Lee, 2007). We advance the existing literature by analyzing how the interplay of a constellation of artifacts influences knowledge exchange and coordination. Interestingly, we see evidence that such "boundary clusters" can explain the occurrence of coordinated interaction, leading to progress in the

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