Global Software Development and the Problem of Increased Uncertainties: Information Processing Requirements for Coordination

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ABSTRACT

In global software development (GSD) work configurations, distance, task, and interaction technologies are sources of uncertainties that combine to challenge traditional information processing requirements for coordination. However, in previous research, GSD coordination is explained in terms other than uncertainties. Thus, how the problem of increased uncertainties in coordination can be understood remains a puzzle. This paper studies how a team of developers in the USA and Ireland managed the diverse and emergent uncertainties it faced. The main information processing requirements for coordination whose relationships are modeled are (1) structuring task components according to location; (2) selecting people according to their task-resolving qualities; (3) exploiting their distance-bridging qualities; and (4) supporting them with diverse interaction technologies. By this modeling, the paper extends information processing requirements for GSD coordination beyond mere support for interactions and structuring of task components that are prevalent in the literature.

Keywords: Coordination, Global Software Development, Information Processing, Information Technology, Uncertainties

INTRODUCTION

Coordination of human activities has been both a longstanding and important issue in Organizational and Information Systems (IS) research streams. Defined as “managing interdependencies between activities” (Malone & Crowston, 1994), its importance has persisted even as the co-evolution of organizational behavior and information technology has resulted in different work configurations over the years. One of these configurations is globally distributed work or virtual teamwork which manifests in particular forms such as global software development (GSD) (Carmel, 1999; Kotlarsky & Oshri, 2005). The importance of GSD coordination research is due to issues such as the complex nature of software development itself (Brooks, 1987), the influential role of distance (Olson & Olson, 2000), the frequency of information exchanges among developers (Herbsleb &
Mockus, 2003), the potential mutual knowledge problem among them (Oshri et al., 2008b), and the influential role of their various identities and cultures (Huang & Trauth, 2007, 2008) and of politics (Nicholson & Sahay, 2001). These are all problems of uncertainties because they engender erratic interdependencies. Uncertainty generally refers to incomplete information about an organizational phenomenon that makes it difficult to predict its behavior accurately (Miliken, 1987). It is a problem that is reported in the organizational research literature to be directly related to coordination (Argote, 1982). In global software projects, uncertainties are identified with varied parameters such as task complexity, task environment, and inter- and intra-team interdependencies (Tushman & Nadler, 1978). Yet, in previous research, the concept of coordination is explained in terms other than uncertainties.

For example, Sabherwal (2003) explains coordination of outsourced software development in terms of differences in organizational goals and structures between clients and vendors; Herbsleb et al. (2000, 2001) and Herbsleb and Mockus (2003) approach coordination from the perspective of distance, speed and delay in communications to provide their explanations; Grinter et al. (1999) proffer methods such as functional areas of expertise, product structure, process steps and customization as the bases of coordination; Herbsleb and Grinter (1999) look at the coordination problem and its resolution in terms of software architecture plans and communications; Cataldo et al. (2007) focus mostly on mechanisms as opposed to processes in their explanations on GSD coordination; Huang and Trauth (2008) explain it in terms of the impact of diverse cultural perceptions of temporal separation; and Kotlarsky et al. (2008) take a knowledge-based perspective on coordination, arguing that it is more suitable than an information processing perspective in the context of a knowledge-intensive activity such as software development. However, their knowledge-based perspective focuses narrowly on analysis of the intellectual contributions of ‘coordination mechanisms’ at the expense of explanations of relationships between them. Besides, those mechanisms are not grounded in empirical data in their research. Rather, they are a priori concepts that are deduced from the literature. Because of this deduction, their perspective overlooks, for instance, the important issue of expertise sourcing even in their analysis of ‘social mechanisms.’

Therefore, each of these coordination perspectives is incomplete because it addresses aspects of the diverse sources of uncertainties that cause erratic interdependencies and undermine coordination. As it shall be seen in this paper, perspectives such as knowledge, communication, process steps, and architecture plans do not capture the unpredictable character of software requirements that emerge from diverse global sources. They are confined to support for developers’ interactions, while important aspects of their selection and exploitation are overlooked. The perspectives reflect the aspects, testifying that less than a holistic approach to the problem of uncertainties has been taken in previous research. This limitation exists mainly because the perspectives are developed with a priori coordination frameworks. Thus, they miss out on emergent phenomena such as changing software requirements which are very important exemplars of the problem of increased uncertainties. They fail to account for interactive and sometimes ambiguous events of GSD which, although they fall outside the scope of existing frameworks, are the very sources of uncertainties that affect coordination.

As a result of this limitation, existing perspectives do not facilitate a holistic and grounded study and analysis of, firstly, the diverse range of uncertainties that undermine GSD coordination; and, secondly, how the diverse range of human and technological resources in GSD can be mobilized and applied to address the problem so that coordination can be achieved. In short, despite the fact that most of the problems reported in GSD are fundamentally problems of increased and emergent uncertainties, previous research has not given it explicit attention. Thus, an under-researched yet important question in information systems development is: how can
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