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Coordination in multi-team programmes: An investigation of the group mode in large-scale agile software development

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Abstract

Coordination of work teams is critical when managing large programmes that involve multiple teams. Prior studies of knowledge work indicate that such work relies heavily on coordination through "personal" modes such as mutual adjustment between individuals or through scheduled or unscheduled meetings. We studied how coordination through scheduled and unscheduled meetings change over time in two large software development programmes. Findings include transitions from scheduled to unscheduled meetings and from unscheduled to scheduled meetings. The main implication is that programme management needs to be sensitive to the vital importance of coordination as well as the coordination needs as they change over time.

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1. Introduction

Coordination of work teams are of critical importance when managing large projects that involve multiple teams. Multi-team projects are used in many domains, often to "*achieve high quality innovations in a satisfactory time-to-market*"[1] and in such programmes "*hundreds of people may be required to develop components of a new product simultaneously*"[1]. Much of the resources used on innovations today are used on software development. Coordination was early identified as a particular challenge in software development projects. In the 90ies, software projects were often associated with overruns on time and cost, and many referred to a "software crisis". As Kraut and Streeter[2] state, "*While there is no single cause of the software crisis, a major contribution is the problem of coordinating activities while developing large software systems. We argue that coordination becomes much more difficult as project size and complexity increases.*"

Since then, new methods for software development have been suggested, what is referred to as agile software development[3, 4]. The practices in this field have also inspired the project management discipline[5]. These methods were however, intended for small, self-managing and co-located teams. Nevertheless, the popularity of these methods has spurred use also in large development programmes. This article examines a specific type of coordination practice in large-scale agile development programmes: The use of the "group mode". Prior studies of knowledge-work indicate that such work relies heavily on coordination through "personal" modes such as mutual adjustment between individuals or through scheduled or unscheduled meetings. We analyse how coordination through scheduled and unscheduled meetings ("group mode") change over time in two large software development programmes that make use of agile development methods, and thus emphasize informal coordination. We ask the research question: *How are group mode coordination practices used in large-scale agile development?*

2. Coordination modes

A common understanding of coordination is to manage dependencies between e.g. tasks, resources or technology[6]. Three main determinants for coordination mechanisms are identified in prior literature[7]: *Task uncertainty* - the "difficulty" and "variability" of work undertaken by an organizational unit. Higher degrees of complexity, thinking time to solve problems or time required before an outcome is known indicates higher task uncertainty. *Task interdependence* - the extent to which persons in an organizational unit depend on others to perform their work. A high degree of task-related collaboration means high interdependence. *Size of work unit* - the number of people in a work unit. Increases in participants in a project or program means an increase in work size unit.

There are a number of mechanisms that can be applied to achieve coordination, and coordination is usually exercised through several mechanisms[8]. Van de Ven et al.[7] proposes three coordinating modes, which is used by Dietrich[8] in their study of multi-team projects: by programming or codification (impersonal mode), and coordination by feedback (or "mutual adjustment"[9]) on the individual (personal mode) or on a group level (group mode). The impersonal coordination mechanisms are codified, and require minimal verbal communication between people once implemented. Examples include pre-established plans, process documentation, intranet pages and roadmaps. Coordination by mutual adjustment or feedback is based on informal communication. In the personal mode, individual role occupants serve as the mechanism for making mutual task adjustments through either vertical or horizontal channels of communication. The mechanisms for vertical communication are usually line managers and unit supervisors. In the group mode, the mechanism for mutual adjustment is vested in a group of role occupants through scheduled or unscheduled meetings.

Software projects often solve complex tasks with high uncertainty. Van de Ven et al.[7] found that increase in task uncertainty leads to a substitution of the impersonal coordination with horizontal coordination mechanisms and group meetings. High task uncertainty gives a need for extensive and dynamic knowledge exchange to solve problems and adjust for emerging changes[7]. Dietrich[8] also point to prior studies which found that technological novelty relate to a higher rate of group meetings instituted by management. The scheduled meetings are effective because physical proximity allows richer communication which enables swifter and more flexible coordination[10]. However, coordination in the group mode based on mutual adjustment requires everyone to communicate with everyone. With 5 people there are 10 links, and with 15 people 120 unique links. Therefore, to employ mutual adjustment as the prime coordinating mechanisms, groups need to be kept dense - and, since our communication abilities are limited, that