THE TRANSMISSION OF CONTROL IN INFORMATION SYSTEMS PROJECTS

Research-in-Progress

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Abstract

Control transmission represents a central problem in any type of organization. However, while prior research has extensively studied the factors influencing the choice of control modes as well as the effects and dynamics of control, the transmission of control from controller to controllee has been largely neglected in the project control literature. Our study addresses this gap by examining in-depth the transmission of control in a large IS project involving multiple control dyads. Our preliminary results suggest that outcome control transmits well through the entire project hierarchy (i.e., between senior managers and project managers as well as between project managers and project team members), while behavior control only transmits well between project managers and project team members.

Keywords: Control transmission, control theory, case study

Introduction

Control theory is the primary theoretical lens through which the process of guiding individuals to project completion has been understood (Henderson and Lee 1992; Kirsch 1997). Prior research on control in information systems (IS) projects has extensively studied the factors influencing the choice of control modes (e.g., Choudhury and Sabherwal 2003; Kirsch 1997; Kirsch 2004; Rustagi et al. 2008), as well as the effects of control on project performance (e.g., Gopal and Gosain 2010; Tiwana 2010; Tiwana and Keil 2009). Despite these significant contributions, two gaps in the literature are particularly noteworthy: First, prior literature has focused almost exclusively on specific controller-controllee dyads, including the relationship between the IS manager and the project manager (Kirsch 1996; Kirsch 1997), the client liaison and the project manager (Kirsch et al. 2002), or the project manager and the project team (Henderson and Lee 1992; Kirsch et al. 2010). However, these studies regularly build on prior work without clarifying whether they focus on the same or a different control dyad than the studies to which they compare their results. Other studies do not specify on what control dyad they focus. By doing so, an implicit assumption is made that control actions and portfolios do not systematically differ between different control dyads. Second, the great majority of previous studies on IS project control rely on data reported by only one side of the control dyad, i.e., either the controller (e.g., Nidumolu and Subramani 2003; Tiwana and Keil 2007) or the controllee (e.g., Kirsch 1996; Kirsch et al. 2002), thereby leading to the implicit assumption that control mechanisms used by the controller are perceived the same way by the controllee.

The two research gaps highlighted above point to an important but largely neglected issue in the project control literature–the transmission of control from controller to controllee. The concept of control transmission can be divided into two sub-concepts. One aspect of control transmission refers to the consistency with which control mechanisms *received* by a controller are *given* to the controllee, and thus reflects how closely subordinates emulate their superiors in their own control attempts (Ouchi 1978). This aspect of control transmission is here referred to as *intra-node* control transmission. Another aspect of control transmission pertains to the accuracy with which control mechanisms *given* by the controller are *received* by the controllee, and thus describes whether controller and controllee have the same or different perceptions of the applied control mechanisms. This second aspect of control transmission is here referred to as *inter-level* control transmission. Thus, control transmission illustrates how control mechanisms "move" through the project hierarchy.

Control transmission represents a central problem in any type of organization (Ouchi 1978), including temporary organizations such as IS projects. For example, it is likely that control mechanisms will only influence controllee behavior and thus contribute to achieving project goals when they are accurately received by the controllee. Similarly, intra-node control transmission is critical in projects involving multiple control dyads. In such projects, higher-level controllers are responsible for determining whether or not the objectives have been met and, if not, to take appropriate control over the level below them and so on to successively lower levels (Ouchi 1978). Therefore, higher-level controllers may require some consistency in the process of control at various levels in order to be able make effective decisions.

Despite its criticality, the transmission of control has not been addressed in the project control literature. We aim at closing this gap by examining the transmission of control in a large IS project at a multinational engineering organization.

The next sections provide an overview of the project control literature and introduce the concept of control transmission. Later sections outline our research methodology, preliminary findings, and conclusions.

Control Theory

Control Modes and Mechanisms

IS project control primarily draws on agency theory (Eisenhardt 1989a). The principal-agency perspective of control suggests that there is a controller (principal) who uses a set of control mechanisms to ensure that the controllee (agent) performs its assigned tasks appropriately (Eisenhardt 1989a). These

mechanisms constitute a portfolio of controls (Choudhury and Sabherwal 2003; Kirsch 1997), and are typically categorized into formal and informal controls. Mechanisms used to exercise formal control are documented by management, whereas mechanisms of informal control represent unwritten determinants of behavior (Jaworski 1988).

There are two modes of formal control—behavior and outcome control. Behavior control operates when management holds the individual responsible for following prescribed processes but does not hold the individual responsible for the outcome (Jaworski 1988; Kirsch 1996, 1997). Behavior control can be effectively used when work procedures leading to desired outcomes are known and observable (Eisenhardt 1985; Kirsch 1996). Rewards and sanctions are based on the controllee's adherence to the specified behaviors (Kirsch 1996). Examples of behavior control mechanisms include development methodologies, walkthroughs, work assignments, system documentation, progress reports, and direct observation of personnel (Choudhury and Sabherwal 2003; Kirsch 1997). In contrast, outcome control focuses on the outputs (both interim and final) regardless of the process (Jaworski 1988; Kirsch 1997). To effectively implement outcome control, the controller needs to be in the position to define targeted project outcomes and compare them to actual outcomes (Kirsch 1997). Rewards and sanctions are based on the quality and timing of the delivered outputs. Examples of outcome control mechanisms include interim project milestones, budgets, standards, functional specifications, and expected levels of performance (Choudhury and Sabherwal 2003; Henderson and Lee 1992; Kirsch 1996, 1997).

The two informal control modes are self and clan control. Self-control is reliant on an individual's ability to monitor and control her/his own actions (Henderson and Lee 1992). The controllee sets his own goals for the assigned task, self-monitors, and self-rewards (Kirsch 1997). Thus, control mechanisms supporting self-control are primarily implemented by the individual controllee (Choudhury and Sabherwal 2003). However, the controller can also take actions to facilitate the use of self-control by the controllee, for example, by hiring self-controlled project personnel or recommending specific software testing procedures (Kirsch 1996; Kirsch et al. 2002). Here, a certain degree of trust in the intentions of the controllee is usually viewed as the primary prerequisite for effectively using self-control (Tiwana and Keil 2009). Kirsch (1997) defines a clan "as a group of individuals who are dependent on one another and who share a set of common goals" (p. 217). Thus, clan control aims at minimizing the differences between the controller's and controllee's preferences (Eisenhardt 1985). It is implemented by control mechanisms that promote common values and beliefs (Kirsch 1997), or identify and enforce acceptable behaviors through shared experiences and rituals (e.g., regular joint meetings) (Kirsch 1996; Ouchi 1980). Rewards and sanctions are based on whether individual members act in accordance with group values, norms, and objectives (Kirsch et al. 2002). Controllers, who are often outside of this peer group, can both contribute to the building of a clan and the leveraging of an existing clan for the purpose of goal fulfillment (Chua et al. 2012).

Control Transmission

In order to fully understand the concept of control transmission, it is helpful to start with a definition of "control given" and "control received". In line with Ouchi (1978), we define control *given* as the degree to which the controller exercises control as perceived by her- or himself, and control *received* as the degree of control as perceived by the controllee. Here, it is important to note that in large projects with multiple control dyads some individuals act as controller and controllee at the same time (Choudhury and Sabherwal 2003). For example, a senior manager may control the project manager who, in turn, may control the project team. In this example, it would be the responsibility of the project manager to "translate" the controls received from the senior manager into controls appropriate for controlling the project team (i.e., control given). Accordingly, intra-node control transmission refers to the relationship between control received and control given within one supervisory rank (Ouchi 1978). It thus shows how closely subordinates copy their superiors in their own control attempts. On the other hand, inter-level control transmission refers to the relationship between control given by a higher level (controller) and control received by a lower level (controllee). Here, it is important to note that both controller and controllee perceptions relate to the same set of control actions, namely those exercised by the controller. This enables us to determine whether controller and controllee have the same or different perceptions of the applied control mechanisms.

So far, there has only been one study by Ouchi (1978) which has examined the transmission of control. In

this study, Ouchi focuses on retail department stores, and thus traditional, non-temporary organizations characterized by clear lines of authority and direct and immediate control (Powell 1990). His results indicate that outcome control transmits more readily through the organizational hierarchy than behavior control. However, we do not know whether his results translate to temporary organizations such as IS projects. Such projects are typically non-routine and involve individuals with diverse skills and expertise (e.g., Kirsch 1997; Rustagi et al. 2008), and thus exhibit characteristics distinct from "ordinary" organizations. Furthermore, Ouchi's study has not examined the transmission of informal clan and self-controls.

We aim at extending Ouchi's study by empirically examining the transmission of formal and informal control in a multitier project control system. We thereby address calls from prior literature to examine the interactions across multiple control dyads within large multi-stakeholder projects (Chua et al. 2012; Kirsch 1996).

Hypotheses

The control system of an internal IS project typically consists of three hierarchical levels: (1) Senior managers having formal authority over (2) project managers who, in turn, have direct authority over (3) project team members. In the following, we argue that inter-level control transmission patterns partly differ across the two interfaces between these hierarchical levels, i.e. across the interface between the senior and project management levels and the interface between the project management and project team levels. This distinction is in line with Mähring (2002) who differentiates between control *over* the project (exercised by senior managers) and control *within* the project (carried out by project managers). Figure 1 illustrates the typical hierarchy of an IS project, including key participants as well as their formal control relationships. In the following, we develop our hypothesis regarding the transmission of control through the hierarchy of an IS project.

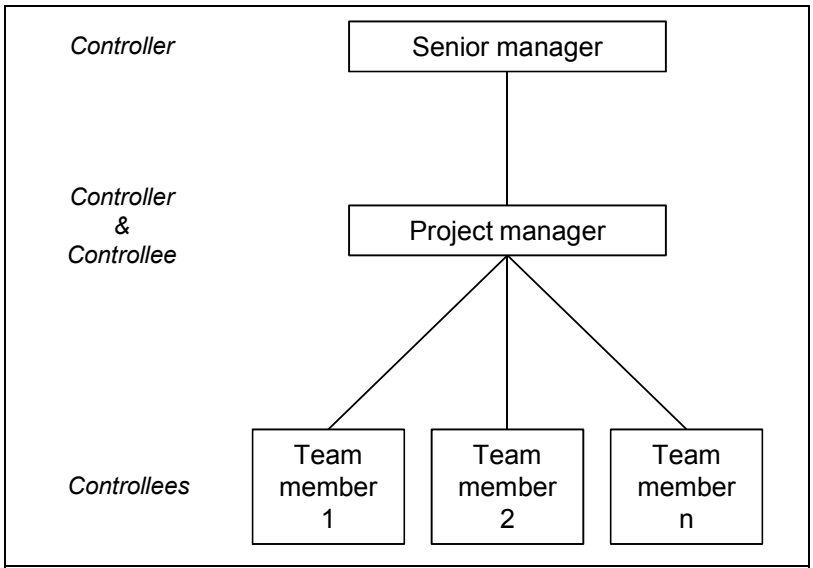

Figure 1. Project Hierarchy

Behavior control is typically considered to be highly flexible. Thus, it is able to capture a large range of desired activities and satisfy local needs (Ouchi 1978). However, "we cannot expect [senior managers] to be aware of the subtleties of behavior which are valued" (Ouchi 1978, p. 175) on the project level because of the hierarchical distance. Furthermore, senior managers often do not have the task knowledge that is required to pre-specify work processes and procedures. For example, as Thompson (1961) argues: "Whereas the boss retains his full *rights* to make all decisions, he has less and less *ability* to do so because of the advance of science and technology" (p. 47, emphasis in original). In contrast, we can certainly

expect project managers to be aware of such subtleties. This is because project managers usually work closely together with the project team and also possess the knowledge required to tailor behavior control mechanisms to the needs of the project team (Kirsch et al. 2002). On the other hand, outcome control is considered less flexible and subtle than behavior control (Ouchi 1978). However, it is usually quantifiable and thus at least apparently comparable across levels (Ouchi 1978). The high quantifiability of targeted outcomes facilitates controllers' ability to measure outcomes and communicate respective control mechanisms. Consequently, we predict:

H1a: Only outcome control, but not behavior control, transmits accurately between the senior management and the project management levels.

H1b: Both outcome control and behavior control transmit accurately between the project management and the project team levels.

Prior studies find that controllers combine formal and informal mechanisms into a portfolio of controls (Choudhury and Sabherwal 2003; Kirsch 1997). These studies also suggest that controllers prefer formal control over informal control until a sufficient amount or "comfort zone" of formal control is reached (Kirsch 1997). Thus, controllers will add informal control mechanisms when they feel that enough formal controls are in place. This emphasis of formal control within the control portfolio is also likely to affect the controllee's reception of informal controls given by the controller. This means that, independent of the actual level of informal control used by the controller, controllees receiving high levels of formal control will tend to perceive rather low levels of informal control. On the other hand, controllees receiving relatively low amounts of formal control will tend to more accurately perceive informal controls given by the controller. Thus, we assume that the amount of formal control will moderate the accurate inter-level transmission of informal controls. We therefore suggest:

H2: Informal control transmits well (a) between the senior management and the project management levels as well as (b) between the project management and the project team levels as the amount of formal control transmitted decreases.

Taken together, the above hypothesized relationships suggest an emulation effect on the project manager level with regard to outcome control, but not with regard to behavior control. In other words, while we hypothesize that outcome control will transmit well through the entire project hierarchy, we also theorize that behavior control will only transmit well on the project level, i.e., between project manager and project team (see H1a and H1b).

Research Methodology

We chose to examine a single case to study in-depth the phenomenon of interest (Miles and Huberman 1994), i.e., how control is transmitted in a large IS project involving multiple control dyads. This methodology is considered appropriate for how, why and what questions (Dubé and Paré 2003; Paré 2004) and especially suitable given the paucity of research on the transmission of control in IS projects.

We selected a large IS project which met several criteria important for this study (Yin 2003). First, the selected project comprises multiple control dyads, and more importantly, we have been granted access to controllers and controllees from all control dyads of the project hierarchy. This allows us to comprehensively examine the problem of control transmission. Second, the project involves highly complex and novel tasks. Thus, it is likely that both informal and formal controls are used, thereby enabling us to investigate the transmission of all four types of control.

Site Description

The case site is a large IS project at a major engineering firm. In 2008, the firm embarked on a strategic IS project to accelerate the product lifecycle, facilitate global collaboration, and improve product quality. Previously, each of the six business units involved in the project operated its own individual product lifecycle management system. The new system was to replace the aging product lifecycle management systems in the business units, as well as integrate their production processes. The new system is rolled out in an iterative manner. In total, there are seven system releases. The first four system releases were rolled out without major disruptions and were considered successes. The final implementation of the new

system is planned for 2015. Figure 2 shows the project timeline.

Several key stakeholders are involved in the project. There are two IS managers who are responsible for controlling the project managers. Senior management is supported by staff from the project management office that facilitates meetings, creates project management documents, and performs other support functions. The project managers, in turn, are responsible for controlling their respective team members. In total, there are eleven project managers responsible for different project tasks, such as data migration, testing, and implementation. In total, more than 200 persons are involved in the project.

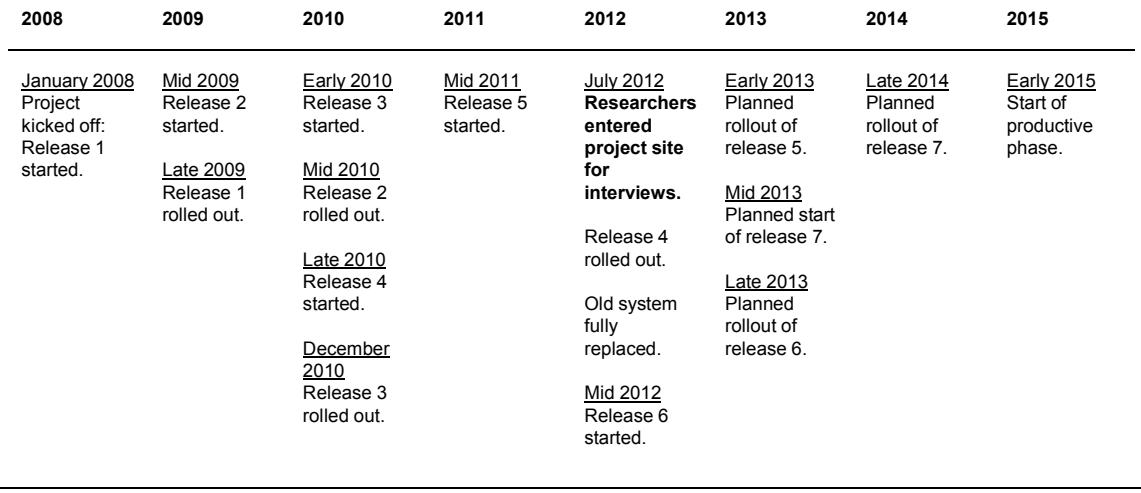

Figure 2. Project Timeline

Data Collection

Consistent with case study best practices, we obtained data from multiple sources (Eisenhardt 1989b; Paré 2004; Yin 2003). We examined archival data, including project progress reports, project management plans, and presentation slides. These materials were especially useful for us to trace the sequence of actions and events that occurred between 2008 and 2011. We also conducted a two-hour interview with the senior managers to inform us about the history and context of the project as well as key events and issues. This allowed us to gain a deep understanding of the project.

We entered the site for interviews in mid 2012. Before each interview, we reviewed prior interviews and the most recent project documentation, and discussed issues we needed to raise with interviewees. In addition, we created an interview protocol and adapted it to reflect changes in issues as the project progressed. We started the interview by asking interviewees about their role in the project, the tasks in which they were involved, and the deliverables for which they were responsible. We then asked interviewees about their perceptions of the controls used by their immediate superior (control received), as wells as their own control attempts (control given). In addition, we asked interviewees to describe problems and issues they encountered during the project, steps taken to resolve problems, their personal relationships with colleagues and how they interacted with them. We closed interviews by asking for interviewees' perceptions of project performance.

We conducted 15 semi-structured interviews: five interviews with distinct project managers, and ten interviews with team members from five distinct teams. At this point, it is important to note that the data collection is still ongoing. In total, we have scheduled 35 interviews (one interview with each of the two senior managers, one interview with each of the eleven project managers, and interviews with at least two team members of each team).

The interviews lasted between 45 minutes and 1.5 hours. Interviews were conducted face-to-face on site.

One interviewer asked the majority of questions and focused on maintaining eye contact with the interviewee. The other interviewer primarily focused on taking notes. Assigning researchers different roles is a typical and recommended interview strategy (Dubé and Paré 2003; Eisenhardt 1989b). All interviews were tape-recorded. We conducted no more than three interviews per day to ensure that interview quality was not compromised by fatigue. We also took field notes to record observations of, for example, the physical office arrangement (Paré 2004).

In addition to the interviews, we will conduct a quantitative online-survey to increase our ability to make valid and well-substantiated conclusions (Paré 2004). Invitations to participate in the survey will be sent by one senior manager to all project participants by the end of September 2012.

Preliminary Results and Conclusions

In this study, we are interested in answering the question of how control is transmitted in an IS project. Our preliminary results are reported in the following.

First, while project managers seemed to receive some outcome control, they seemed to receive very little behavior control. While there was a project plan that included important milestones and specifications, it was rather treated as a rough guideline and was meant to be tailored by the project managers. On the other hand, project managers reported to be well aware of the delivery dates and the expected performance levels. Thus, while outcomes were clearly communicated, there were no step-by-step rules to be followed. In contrast, project managers largely guided themselves in their work, and took responsibility for work outcomes. Thus, our results provide initial support for Hypothesis 1a.

> *"I sometimes met with [the senior managers] to inform them about the results. […] In general, I worked highly autonomous. In fact, they never really intervened."* (Project manager A)

The project managers, in turn, relied on behavior control to a much greater extent, both with regard to variety and intensity of the applied mechanisms. All project managers set up regular meetings in order to stay informed about the work progress and assign tasks to the team members. Furthermore, they continuously monitored the work process. Monitoring team member behavior was also facilitated by the physical office design: there are no separate offices for team members and project managers; project managers and team members are seated next to each other in a big "open office". Besides behavior control, project managers also used outcome control. For example, they used to break down the high-level milestones depicted in the project plan into manageable interim milestones and communicated them to the team members.

> *"We have regular meetings where we discuss the current status and assign new topics. I also like to stop by and check things face-to-face. […] From my personal experience, it is important to accompany the work process. You need to know what's going on."* (Project manager B)

Finally, both behavior and outcome control seemed to transmit well between project managers and team members. These results are discussed in the following. First, behavior controls are considered flexible mechanisms that can capture a wide range of desired activities (Ouchi 1978). Such flexibility seems to facilitate accurate inter-level transmission. Furthermore, the project managers indicated to be highly experienced in their professional field. Thus, they possessed the knowledge necessary to tailor behavior controls to the specific needs of the project team members. This might explain why behavior controls were received accurately by the team members. Second, the high quantifiability of targeted outcomes seems to facilitate the project managers' ability to communicate outcome control mechanisms, thereby leading to accurate outcome control transmission. Thus, our preliminary results indicate a high accuracy in the transmission of both behavior and outcome control between the project management and the project team levels, providing initial support for Hypothesis 1b.

> *"[The project manager] pre-specifies the deliverables very clearly. He does not say 'do as you like' but rather 'do it like this and that', and in the end we go through the results together."* (Team member B)

Taken together, our results suggest that outcome control transmits well through the entire project hierarchy, while behavior control only transmits well on the project level, i.e., between project managers and project team members.

In this study, we aim at enriching project control theory by exploring the understudied question of how control is transmitted in IS projects. In order to increase our ability to make well-substantiated conclusions we have already scheduled another 20 interviews. In addition, an online-survey targeted at all project participants will be conducted by the end of September 2012. We plan to finish our data collection by the beginning of 2013.

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