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Delivering complex engineering projects: Reexamining organizational control theory

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Abstract

The delivery performance of complex engineering projects, such as infrastructure projects, is poor and shows no sign of significant improvement. Most of these projects have been delivered by a contractor organization for a client—usually a public or statutory agency. To ensure expected outcomes, the client typically employs “control instruments”, such as specifying outputs, directing behaviors, selecting contractors and building relationships, to influence, or control, delivery by the contractors. The dominant literature informing the choice of control instruments is derived from organizational control theory, which primarily focuses on the exercise of control within a single organization and assumes that different types of control function independently. The persistent poor delivery performance of infrastructure projects suggests a need to revisit the recommendations of organizational control theory. While a number of papers have identified the potential of combining control instruments and the need to take into account the influence of operating in a client–contractor context the mechanics and influence of specific interactions remain little understood.

A case study of the delivery of the Open Pool Australian Lightwater reactor (OPAL) Nuclear Research Reactor Project in Australia, documents how the various controls employed interacted and jointly impacted on the delivery outcome. The findings start the process of further developing control theory and offer a number of practical suggestions for combining control types for practitioners.

There are two main contributions to theory by this study. First, it adds support to the view that the factors influencing the principal’s choice of control modes are more complex than depicted by the control theory framework. Second, it enriches the emerging balance of control literature (Cardinal et al. 2004), suggesting that it is not only the number of control modes that determines performance but also the interactions between them. Thus not only is the appropriate choice of control modes based on more than task programmability and outcome measurability, it appears that interactions between control modes also play an important role. In the case studied a combination of input, output and clan control was seen as forming an effective combination. It was also assessed to be important to avoid behavior control due to the interaction effect between behavior control and output control when employing such a grouping.

Keywords: Organizational control; Output control; Input control; Behavior control; Clan control; Control mode interaction; Project performance

1. Introduction

The delivery performance of complex engineering projects, such as infrastructure projects, is poor and shows no sign of significant improvement (Bruzelius et al., 2002; Evans and Peck, 2011; Flyvbjerg et al., 2002; Peakman, 2011). Most of these projects were delivered by a contractor organization for a client—usually a public or statutory agency. To ensure expected outcomes, the client typically employs “control instruments”, such as specifying outputs, directing behaviors, selecting contractors and building relationships to influence or control the delivery by the contractors. The literature that underpins the choice of control instruments is organizational control theory. The persistent poor delivery performance of infrastructure projects suggests problems with “control”

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and thus a need to examine control mechanisms selected and implemented in practice vis-à-vis control theory and its suggestions regarding the appropriateness of different control types.

The conventional organizational control theory (Eisenhardt, 1985; Ouchi, 1977, 1979; Rustagi et al., 2008) models the choices of control modes including output, behavior, clan and input controls as independent of each other. The framework's focus is on the choice of individual control modes rather than the effects of control modes on performance, and it ignores the potential interactions among the control modes (Liu et al., 2010; Tiwana, 2010; Tiwana and Keil, 2007). There is evidence however that performance is enhanced where different control modes are employed simultaneously, with significant correlations reported among control modes (Cardinal, 2001; Cardinal et al., 2004; Henderson and Lee, 1992; Kirsch, 1996; Long et al., 2002). Indeed, a number of researchers, over an extended period, have explicitly recognized the importance of the simultaneous deployment of multiple control modes including Anthony (1952), Snell (1992), Turner and Makhija (2006), Cardinal (2001), Cardinal et al. (2004) and Long et al. (2002). For example, Snell (1992) concludes: "…the advantages and disadvantages of each type of control might suggest their combined use in human resource management." And, Turner and Makhija (2006) comment: "It is important to keep in mind, however, that organizations typically use more than one type of control, and they employ a variety or combination of control mechanisms to achieve multifaceted goals."

More recently, Cardinal et al. (2004) proposed the concept of balance of control modes. Their central argument, which builds upon Long et al. (2002) and Jaworski et al. (1993), is that the use of output control, input control and behavior control simultaneously outperform the use of a single control mode. However the balance is vaguely defined as "harmonious use of multiple forms of control". This stream of research, including Snell (1992), Turner and Makhija (2006), implicitly assumes interaction among control modes but does not examine how control modes interact. There is indeed the possibility that one control mode could negatively affect the functioning of another (Liu et al., 2010; Tiwana, 2010; Tiwana and Keil, 2007). Thus we are left with the paradox that relying on a single control mode could lead to compromised performance outcomes (Cardinal et al., 2004) while utilizing multiple control modes could also lead to unsatisfactory results (Liu et al., 2010; Tiwana, 2010; Tiwana and Keil, 2007). Understanding how the various control modes interact is critical to understanding how combinations could improve performance.

A further limitation of control theory is that it historically assumed the perspective of managers "controlling" subordinates (Krisch et al., 2002). Only relatively recently, has control theory been applied to a client–contractor setting. Such a context has a number of features different from the hierarchical control setting, such as a lack of authority by the clients over the contractors; difficulty with monitoring contractor behavior and a lack of means of collecting information (Choudhury and Sabherwal, 2003). Furthermore, the focus is not on how the actual work contained within a project is structured and monitored (that is the contractor's responsibility) but how the contractor itself is managed by the client (Krisch et al., 2002). These differences suggest that different control modes – and by extension combinations – may be appropriate. For example, it was found that the clients of outsourced information systems projects primarily rely upon output controls, with behavior controls only added in later project stages; generally when the project is experiencing trouble (Choudhury and Sabherwal, 2003).

This study sought to investigate through a case study of a complex engineering project in a client–contractor setting, how control should be structured. Complex projects are those having large number of subsystems, and/or many stakeholders (referred to as structural complexity), and/or frequent changes in the components/systems (dynamic complexity) (Whitty and Maylor, 2009). Such a definition includes programs and mega projects.

The structure of the remainder of the paper is as follows. In the next section, the relevant literature is reviewed. The research design, a case study of Australia's recent nuclear research reactor, is then described. The results demonstrate how interactions among control modes influence the choice of control modes and explain how a portfolio of control modes, rather than a single control mode, was necessary for achieving successful project outcomes. Finally, implications are discussed and conclusions drawn.

2. Organizational control theory

Organizational control theory (Cardinal et al., 2004; Eisenhardt, 1985; Ouchi, 1977, 1979; Rustagi et al., 2008) is concerned with how an organization can exert influence in order to achieve its objectives. Ouchi's (1979) model is the dominant framework used in empirical studies on organizational control (Cardinal, 2001; Cardinal et al., 2004; Eisenhardt, 1985; Kirsch, 1996; Krisch, 1997; Rustagi et al., 2008). It proposes a contingent framework for the choice of control modes for managers which models the choice as a function of the context: task programmability (ability to specify the steps that need to be followed) and outcome measurability (ability to measure outputs).

As presented in Fig. 1, if a task is well understood (cells 3 and 4), it is possible to specify the behaviors necessary to achieve the planned result – "the information necessary for task completion is contained in rules" (Ouchi, 1979) – so behavior control (e.g. processes, design guidelines, role specification, close supervision) essentially specifying the steps that need to be followed is appropriate. There are contrasting views and an extensive literature on the shaping of behavior. McGregor (1960) for example presents two alternative theories (X and Y) regarding employee motivations and actions. Weick et al. (2005) focus on the context within which actions take place and suggest a process of sensemaking that shapes behavior where uncertainty and ambiguity are prevalent. If it is easy to measure outputs, (cells 2 and 4), then outputs can be monitored and output control (e.g. the system specifying, tracking, validating and incentivizing project targets) can be used to deliver the planned result — "rather than observing the steps through which they work and forming an assessment" (Ouchi, 1979) output is assessed against some predetermined criteria. Where either output or behavior control is possible, Ouchi (1979)