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Effects of control on the performance of information systems projects: The moderating role of complexity risk

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ABSTRACT

Control of projects is a core issue for organizations. Successful projects, such as information systems projects, enable organizations to develop a superior supply network and enhance the capability of operations management. A few studies have investigated the effects of control on project performance; however, complexity risk has not been integrated into the relationship between control and performance. Limited evidence has been provided concerning whether modes of control differ in their effectiveness in the presence of a single risk factor. Based on quantitative data obtained from 128 information systems projects, behavior, outcome, clan, and self-control are empirically determined to be positively associated with the system performance of projects. However, complexity risk generates a mixed moderating effect on the relationship between control and performance. In the presence of a high complexity risk, the effects of behavior and self-control on performance are low, whereas the effectiveness of outcome and clan control increases. This finding implies that complexity risk is a double-edged sword with regard to control. Each control mode exhibits different characteristics and effectiveness under high complexity risk. Therefore, appropriate control modes should be carefully selected, and highly effective control modes, such as outcome and clan control, should be prioritized in managing complex system projects.

1. Introduction

Improving project management remains a primary concern of researchers and managers. Successful projects, such as information systems (IS) projects, enable organizations to develop a superior supply network and enhance the capability of operations management (Bergeron et al., 1991; Cao and Schniederjans, 2004; Chien et al., 2007; Setia and Patel, 2013). Given the demand for the integration of logistics, human resources, finance, and information, an increasing number of complex system projects (e.g., inter-organizational and enterprise resource planning or ERP systems projects) have emerged (Lu et al., 2006; Tenhiälä and Helkiö, 2014). However, projects over the last decade have exhibited poor performance regardless of complexity. The Chaos Manifesto released by The Standish Group (2013) indicated that only 39% of the investigated projects succeeded, 18% failed, and 43% encountered schedule, budget, and functioning issues. Projects with high complexity also face unfavorable situations (Hartono et al., 2003). Approximately 60% of the survey respondents claimed that they failed to receive even half of the expected benefits from implementing one type of complex project: the ERP system (Krigsman, 2013). These results suggest that previous projects display low performance and that poor control and risk management are practiced.

At least two research streams have aimed to improve project performance. One stream builds on control-based theory and highlights the importance of formal control (i.e., a mechanism that relies on process and outcome evaluation) and informal control (i.e., a mechanism that relies on social and self-regulating strategies) (Kirsch, 1996, 1997; Tiwana, 2008; Choudhury and Sabherwal, 2003). The other stream includes risk-based views and emphasizes the significance of managing critical risks (Wallace et al., 2004b; Schmidt et al., 2001; Liu et al., 2010). Researchers have recently combined these two streams and argued that risks interact with control to influence performance (Keil et al., 2013). However, the integration of the two research streams failed to consider the complexity risk. This research insufficiency is rather surprising because complexity inherently exists in the development of projects, wherein technological issues and organizational factors beyond the control of project teams must be addressed (Xia and Lee, 2005). Three research gaps in previous studies on project control have been identified.

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First, many studies have focused on the choice of control during the development of projects (Kirsch et al., 2002, 2010; Rustagi et al., 2008). However, the relationship between control and performance should be further examined. Previous research has presented four modes of control, namely, behavior, outcome, clan, and self-control. Behavior control is a formal mechanism employed by controllers to evaluate controlee performance on the basis of the latter's adherence to the prescribed procedures and the steps initially defined for a task (Kirsch, 1997). Outcome control is a formal mechanism that controllers utilize to evaluate controlee performance based on the extent to which output targets are achieved (Choudhury and Sabherwal, 2003). Clan control is an informal mechanism that controllers utilize in enabling the project team to embrace common values, employ consensual problem-solving approaches, and pledge to achieve collective goals (Kirsch et al., 2010). Self-control is an informal mechanism employed by controllers to allow controlees to set their own goals, manage their achievements autonomously, and sanction or reward themselves (Kirsch and Cummings, 1996). Control researchers argue that performance can be enhanced by employing various types of control. This argument is supported by the prior evidence (e.g., Tiwana and Keil, 2010; Keil et al., 2013). Nevertheless, contradictory results on the effects of these control modes on project performance have been obtained by previous studies. For instance, several studies have found that behavior control positively affects performance (Henderson and Lee, 1992; Klein et al., 2006), whereas other studies have suggested that the effectiveness of behavior control is insignificant (Tiwana and Keil, 2010). Contradictory findings also exist with regard to the effectiveness of clan control (Tiwana and Keil, 2010; Liu, 2015). Therefore, further empirical evidence is necessary for a clear understanding of this issue.

Second, project risks often affect control effectiveness. Such risks include complexity risk (i.e., the inherent uncertainty in system complexity), which denotes the difficulty of project development (Wallace et al., 2004a). Although risk and control have been integrated to examine their joint effect on project performance (Keil et al., 2013; Liu, 2015), complexity risk has not been investigated. Complexity risk is regarded as one of the critical risks in various types of projects, such as IS and new product development (NPD) projects (McCarthy et al., 2006; Liu et al., 2010). Further understanding of the role of complexity risk can provide insights into how to manage such a risk effectively. Furthermore, several findings on the interactions between control and risk are contradictory. For example, Keil et al. (2013) present a conceptual model that reveals that risks have negative moderating effects on the correlation between control and performance. They also empirically demonstrate that user and requirement risks weaken control effectiveness in projects. Although this finding is intuitive and has received empirical support, other researchers have argued that risks enhance control effectiveness because several control modes (e.g., outcome control) are effective in uncertain environments (Harris et al., 2009; Rustagi, 2004). Therefore, whether key risks, particularly complexity risk, enhance or suppress control effectiveness should be examined.

Third, although various risks have either positive or negative moderating effects on control effectiveness, such effects on each form of control are consistent. Limited evidence has indicated that some control modes are less effective, while others are more effective in the presence of a single risk factor. However, such a situation is possible for complexity risk because this risk is unpredictable and may not necessarily generate a negative effect. Several researchers argue that a high complexity risk in product development can increase profits with effective complexity management (Jacobs and Swink, 2011). Complexity risk can also promote innovation despite increasing transaction costs and reducing product responsiveness (Choi and Krause, 2006). Furthermore, different control types have different features. Behavior control is mechanistic and emphasizes predictable performance, whereas self-control is highly flexible and allows for considerable emergence (Ouchi, 1980; Das and Teng, 1998). By contrast, outcome and clan control are organic and balance the degree of control and emergence (Chua et al., 2012; Harris et al., 2009). Given that the management of complex systems with both emergence and control outperforms that with either emergence or control alone (Choi et al., 2001), the effectiveness of each control mode differs under the condition of high complexity risk. Therefore, investigating how complexity risk alters the correlations among different control modes and project performance is critical. Managers can then select appropriate control modes to manage complex projects.

The aforementioned problems are associated with practical issues because ineffective control mechanisms applied by managers in a particular risky context may work effectively in other contexts. Understanding these discrepancies enables users, project managers, and other stakeholders in cross-function teams or organizations to minimize investing unnecessary resources and costs and avoid unrealistic optimism about project outcomes. IS projects are investigated in this study because complexity is a property of IS, which is intangible and constantly changes (Brooks, 1995). We attempt to fill the aforementioned research gaps under the guidance of the following questions.

(1) How do control modes affect the performance of IS projects?
(2) How does complexity risk differentially change the control–performance relationship in IS projects?

Investigation of these issues can provide new insights that would contribute to general project and supply chain management literature. Control can be exercised in outsourcing projects, which are prevalent in IS projects. Thus, understanding of the above mentioned issues can contribute to the outsourcing literature by demonstrating how the performance of outsourcing projects is influenced by various control modes in the presence of complexity risk. The control issues investigated in this study relate to both the controller and controlee. Such a control relationship also exists between buyers and suppliers or between clients and vendors (Li et al., 2010; Stouthuysen et al., 2012). Therefore, this study contributes to the supply chain management literature because the control relationship can be extended to the buyer–supplier relationship. By investigating the effectiveness of each control mode, the controllers (e.g., buyers) in a project or a supply chain can discover how to work effectively with controlees (e.g., suppliers) and manage their relationships to achieve high performance. In addition, investigation of the collective effect of complexity risk and control on performance allows managers to effectively adopt different forms of control to manage other complex systems, such as NPD projects and supply networks (Choi and Krause, 2006; McCarthy et al., 2006). Thus, this research contributes to the NPD and supply chain management literature by integrating complexity and control.

This paper is structured as follows. First, existing studies on control, risk, and complexity are reviewed, and the relevant theories associated with these concepts are introduced. Second, the research model is developed and the hypotheses are presented. Third, the measurement model is evaluated and the hypotheses are empirically tested through hierarchical regression analysis based on survey data obtained from 128 IS projects. Finally, the results of the hypothesis testing are presented, and the theoretical and managerial implications of the findings are discussed.