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Exploring the Ambivalent Effects of Control Modes on Project Performance Dimensions in Software Development Outsourcing

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ABSTRACT

Although software development outsourcing (SDO) market continuously grows and various types of SDO are available, the control performance of SDOs is still complicated. Not only positive effects but also no effects and even negative effects of control have been reported. This study focuses on these mixed results and classifies control by modes and SDO project performance by sub-dimensions. The paper presents a theory and research model on the duality between each control mode and SDO performance sub-dimensions. The study results suggest that it is not the amount of control exercised, but rather the amount of individual control mode appropriate to the specific SDO goals to enhance SDO performance. It also provides realistic suggestions and guidelines to companies and organizations that need to improve SDO performance in practice.

Keywords: Control Modes, Duality, Outsourcing, Project Performance, Software.
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1. Introduction

In the field of software development outsourcing (SDO), control has been recognized as an important tool for improving project performance. The term 'control' refers to an outsourcing client's control activities to ensure that the outsourcing vendor completes the project within budget and schedule and assures the quality of the software being developed. It is believed that the various forms of formal or informal control undertaken by the client promote the vendor's development efforts to achieve the project objectives, and thus the more the control, the higher the project performance (Choudhury and Sabherwal 2003; Gopal and Gosain 2009; Tiwana 2010). That is, the more the amount of control is applied to the vendor, the better the project performance will be.

However, this perception of the information systems field, which had little chance of being verified, may not be justified. In the real world of SDO, the more outsourcing customers control the vendors, the better the project performance? If we simply think of common sense, there seems to be not

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much room for an impression that increasing the amount of control will improve project performance. For example, is it good to have much control so that customers often have more than enough time to check the vendor's output to improve the project's performance? This study questions the perception of the relationship between control and performance in the SDO. The results of the recent research also show that the combination of types of control may have a negative impact on performance (Wiener et al. 2016), but there is no significant effect on performance (Chua and Story 2017).

Prior studies on control in SDOs present three different results that contradict the control outcomes. First, a set of studies (e.g., Rustagi et al. 2008), as well as internal development, assume that control increases performance and does not address the empirical evidence on the relationship between control and performance in the SDO. In these studies, without considering the differences between the internal development and the outsourcing development clearly, the control seems to improve the performance regardless of the situation. The second set of studies are mainly empirical ones and show that the control effect in SDO is complicated due to the inherent negative aspects as well as positive aspects (Gopal and Gosain 2009; Tiwana 2010; Srivastava and Teo 2012). These are the cases where the control is classified by sub-types or the project performance is classified by sub-types. Depending on the combination of the control mode and the project performance dimension, the control has a positive effect as well as a negative effect on performance. Thirdly, the control effects on SDO performance could not be confirmed (Tiwana and Keil 2009-10; Rai et al. 2012). These studies are mainly empirical ones, and they could not find any impact on the SDO situation, but the control has a positive effect on the performance in the internal development.

These mixed and confounding prior study results call for further investigation. Thus, this study investigates the effect of outsourcing customer's control behavior on the SDO project performance by classifying the control by its modes and the project performance by sub-dimensions and by exploring the relationships between control modes and SDO performance sub-dimensions more specifically. This study contributes to the body of knowledge by challenging the implicit belief that control in the SDO will improve performance in the information systems discipline, and highlighting the need to consider the inherent relationships between control modes and SDO performance dimensions. The remaining of this paper are as follows: theories and prior studies on control modes, prior studies on control outcomes in SDO, research proposition development and finally conclusions and discussions are presented.

2. Theories and prior studies on control modes

Control modes are a framework for classifying control mechanisms, largely divided into formal and informal controls (Kirsch 1996, Jaworski 1988). Formal control refers to an objective mechanism that is used to assess and compensate for performance in an effort to achieve a specific goal (Ouchi 1979, Jaworski 1988). Like formal controls, informal controls also assess performance and provide compensation for achieving goals. However, informal controls are less objective, generally implicit, and not centralized (Cardinal et al. 2004, Orlikowski 1991). Specific modes of formal and informal control are described below based on the typology described in previous studies (e.g., Ouchi 1979, Jaworski 1988, Orlikowski 1991, Cardinal 2001).

Formal controls are formally approved, usually codified and institutionalized mechanisms. Examples include written rules, performance-based compensation systems, and management guidance. Input control is used to manage resource availability and tends to focus on the human, material, or financial resources used in the project (Jaworski 1988, Cardinal et al. 2004). Sample mechanisms include staff recruitment and dismissal, formal recruitment and employment processes, and the development and use of vision statements. Output control or outcome control refers to the use of mechanisms to manage product and service outcomes through the establishment and measurement of specific objectives or indicators (Ouchi 1979, Cardinal et al. 2004).

Key performance indicators (KPIs) and goals related to project milestones, incentives, project plans, project schedules and budgets, quality, and satisfaction are examples of outcome control (Jaworski 1988, Kirsch 1996, 1997, Rustagi et al. 2008). Behavior control or process control refers to the use of mechanisms to manage work activities that convert the input to output. For example, it involves holding a specific meeting and ensuring that the employee spends a specified amount of time working on a given task (Jaworski 1988, Henderson and Lee 1992).

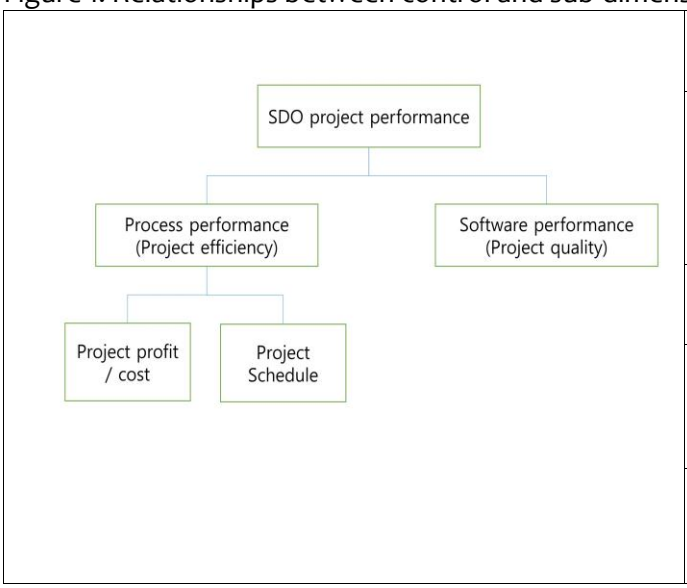
Other mechanisms of behavioral control include routine supervision, review meetings, development methodologies, vision statements to guide work behavior, and standard operating procedures (Kirsch 1997, 2004).

Informal controls include non-codified mechanisms such as shared values, norms, and beliefs that guide employee behavior and behavior (Jaworski 1988, Chua et al. 2017). Clan control refers to the use of social interaction to achieve a common goal while influencing the behavior of others in the group and the group consists of individuals whose work is interdependent and share common norms and values (Ouchi 1979, 1980). Clan control occurs where members of the clan take action to control their activities and achieve their goals. For example, a software development project team whose work is interdependent (e.g., the programmer's work may depend on the work produced by the designer) can develop its own values, norms, and expectations. After that, the team promotes the adherence of team members through socialization. The sampling mechanism of clan control involves the sharing of relevant "stories" that form peer pressure, socialization, norms, and behavior (Kohli and Kettinger 2004, Kirsch et al. 2010).

Self-control is related not only to intrinsic motivation (Manz et al. 1987) but also to the functioning of individual subject standards and goals (Jaworski 1988). Self-control not only monitors self-actions but also defines the specific goals and actions necessary to achieve these goals (Henderson and Lee 1992, Kirsch 1996). Like clan control, self-control is implemented by individual controls (Choudhury and Sabherwal 2003). However, it is important to encourage controllers to implement such controls by enabling them (e.g., reviewing the project workforce), by recommending (e.g., software testing procedures recommended) or by requesting (e.g., requiring more involvement from vendors' senior managers) can do.

These four types of control or the combined control mechanisms are known to influence the performance of information system development projects (Kirsch 1996, Choudhury and Sabherwal 2003). System development performance, which can be seen as a result of control, has been discussed in various aspects such as project schedule, budget, and system quality to be developed. [Figure 1] presents the sub-aspects of the system development outcomes discussed in the control outcome and examples.

Figure 1: Relationships between control and sub-dimensions of SDO project performance



Sub-dimensions of SDO Project Performance
SDO Project Performance (Hybrid): The degree to which you achieve multiple performance-related goals through control
Project profit/cost: Increase profit and reduce costs through control
Project schedule: The degree of completion of the project within the deadline
Software performance (project quality): Process or system quality through control

3. Prior studies on control outcomes in SDO

Research on control in SDOs has been in full swing since 2008, and research has only recently been published. The results of the empirical study are different from the control in the system development. Some studies did not empirically analyze the effects of control in SDOs on performance at all. Other studies did not aim to investigate the effects of control in SDOs on the performance itself, but some of the derived research has found that the effects of control on performance are not only positive but also rather negative and some have found that the impact of control on performance is not

significant. The results of this study are summarized in [Table 1].

Table 1: Previous studies on SDO control and their research results

Previous study	Research method	Time scale	Key findings
Cram et al. (2016)	Literature study	n.a.	Integrated prior IS control constructs and relationships into a IS control model, and applied this model to emergent IS processes to guide further research and practice
Gopal & Gosain (2009)	Questionnaire survey	Cross-sectional	Formal and informal control modes have an important effect on software project performance but need to be finely coordinated and directed toward appropriate goals.
Kirsch et al. (2002)	Questionnaire survey	Cross-sectional	Examined whether prior findings on IS control will generalize to the client-IS pair, and investigated the control exercise across this relationship.
Maruping et al. (2009)	Questionnaire survey	Cross-sectional	Integrated control theory into the increasing literature on agile methodology use and by exploring specific contingencies affecting the efficiency of different control modes.
Rustagi et al. (2008)	Questionnaire survey	Cross-sectional	Discovered that customers who have relationship management or technical knowledge, or have high trust levels in their providers, use formal control mechanisms to a lesser degree.
Srivastava & Teo (2012)	Questionnaire survey	Cross-sectional	Investigated the moderating effect of mechanistic governance on the relationships of relational governance and contract specificity with IS development quality and cost performance
Tiwana & Keil (2009-10)	Questionnaire survey	Cross-sectional	Controllers attempt greater exercise of control mechanisms in outsourcing projects relative to internal IS projects, but controls increase systems development performance in internal projects but not in outsourcing projects.
Tiwana (2010)	Questionnaire survey	Cross-sectional	Explored the interactions among control mechanisms in an information systems project's control portfolio to reconcile the conflicting theoretical perspectives on whether informal and formal controls are complements or substitutes
Tullio & Staples (2013)	Questionnaire survey	Cross-sectional	Discovered the combination of control modes found in open source software projects is different from those found in prior studies for internal or outsourced IS development projects.

So, what is the reason why the results of the effects of control in SDOs on performance are presented in three different directions with no coherence? As we have already seen in the background of the study, there are three main reasons for this. First, there are various types of controls that are exercised in SDOs, and these types have not only complementary attributes but also alternative attributes (Tiwana 2010). However, some studies have considered control as one big act without considering these types of control with different attributes, while some other studies have classified the control activities in detail, the researchers have been conflicting with each other.

Second, SDO outcomes not only have multidimensional attributes but also include the effect of offsetting these attributes. In other words, SDO is a complex task that must achieve both project efficiency (delivery date and budget) and the quality of software produced by the project at the same time. (Wallace et al., 2004). For example, customer-focused outcome control can help improve the quality of the final software, but it can also result in a delay in staffing or delivery (Gopal and Gosain 2009).

However, in some previous studies, there is a lack of consistency between previous research results by taking into account only some dimensions without considering the multidimensional nature of the SDO project.

Third, in SDOs, the effects of control on performance are uneven, which can be attributed to the fact that research has been done without considering the key variables that could affect the relationship between control and performance. In Gopal and Gosain (2009), there is still a lack of consideration of other variables that control the effect of control on performance, other than the interaction effect between the boundary spanner and control. These variables need to take into account the known attributes of the main control actor (the controller) and the volatility of the customer's requirements on the system to be developed (Rustagi et al. 2008; Maruping 2009).

Therefore, this study focuses on the division of control types and the distinction of SDO achievements that have not been sufficiently addressed in previous studies. This will contribute to the investigation of concrete measures for improvement of SDO performance, which must clarify causality between control and performance in SDO and achieve various goals.

4. Research proposition development

In this study, we try to establish a theory of individual causality between sub-types of control and sub-dimensions of project performance based on previous studies on control. The types of control exercised in SDOs are largely divided into formal control and informal control, as well as internal system development. Here again, formal control is divided into outcome control and behavior control, and informal control is divided into clan control and self-control.

Official control is generally called economic control and can be a control of the cybernetic point of view to perform instruction, observation, evaluation, feedback, and reinforcement of the painter based on rules and standards. Formal control is classified into behavior control and result control again according to the timing of intervention of the controller. Act control affects how the work is performed. (Ouchi 1979). Outcome control, unlike behavioral control, is the assessment of a worker's performance based on defined performance or standards (Jaworski 1988). Unlike official controls, informal controls (clan control and self-control) are based on social strategies that emphasize interpersonal and personal dynamics. Recent research shows that formal control such as behavior control and result control is the main factor in SDO, informal control such as clan control is an auxiliary means, and self-control is not exercised by the main control means at the time of internal development have been reported (Tiwana and Keil 2009-10). This study also considers the three types of control except for autonomous control according to the recent research results.

SDO project performance can be characterized largely in terms of effectiveness and efficiency (Wallace et al. 2004; Gopal and Gosain 2009). The effectiveness dimension assesses the degree to which the developed software meets the needs of the customer and is sometimes referred to as product performance. The concept of effectiveness relates to the detailed quality characteristics of the software developed. On the other hand, the efficiency dimension evaluates the degree to which the development process itself is well managed, that is, the process performance. The concept of efficiency is related to whether the software was developed within budget limits on time. Cost, over budget, and deadline compliance are characteristics of efficiency. In this study, we will consider the multidimensional nature of project performance and divide it into process performance and software performance.

SDO project performance has such a multidimensional nature, and sometimes there is a trade-off between them. Increasing software performance can result in lower process performance, and conversely, you may have to sacrifice software performance to meet process performance, such as delivery or budget compliance.

Because the types of controls used in the SDO vary and the SDO project performance variables are also diverse, there can be complex causal relationships between them. Result control can be linked to software performance improvement by evaluating the results that are generated during the development process. On the other hand, there are cases where process performance is degraded due to the clear identification and refinement of user requirements, addition, and delay of labor and time required to improve system quality. Such a discussion leads to the following proposition.

Proposition 1: Outcome control in the SDO will have an ambivalent effect on the project

performance dimensions.

Proposition 1-1. Outcome control will have a positive effect on the software performance being developed.

Proposition 1-2. Outcome control will have a negative effect on process performance.

Behavior control, which is another type of formal control, focuses on evaluating vendors' actions or activities rather than vendor outputs, which can lead to process performance such as delivery or budget compliance rather than improving the project's result, software performance have. However, emphasis or control over delivery or budget compliance may not lead to software performance, the end result of the project. Such a discussion leads to the following proposition.

Proposition 2: Behavior control in the SDO will have an ambivalent effect on the project performance dimensions.

Proposition 2-1. Behavior control will have a negative effect on the software performance being developed.

Proposition 2-2. Behavior control will have a positive effect on process performance.

In the case of clan control, the customer and the vendor are subject to social controls based on mutual understanding of goals and norms, which may negatively affect process performance but positively affect software performance. Clan control can have a positive impact on the software performance being developed because vendors gain a better understanding of their customers and better understand their goals, values , and requirements. However, the time and cost involved can degrade process performance. Such a discussion leads to the following proposition.

Proposition 3: Clan control in the SDO will have an ambivalent effect on the project performance dimensions.

Proposition 3-1. Clan control will have a positive effect on the software performance being developed.

Proposition 3-2. Clan control will have a negative effect on process performance.

5. Conclusions and discussions

This study focused on the differences and contradictions in previous SDO control study results and investigated to find the fundamental causes of the differences in the relationship between control and SDO performance. The study results provide and suggest the following academic and practical implications.

First, it is not the amount of control, but rather an amount of control mode that fits the SDO goal in order to improve SDO performance. To date, control in the SDO field is an important tool for improving performance, and it is assumed or recognized that as the amount of control exercised increases, the SDO performance is enhanced. This is basically extension of the study results on insourcing to the SDO area, which suggests that the control enhances the project performance, and the fact that control modes used for internal development and external development are different are not considered (Tiwana and Keil 2009-10) and that the combination of some control modes may lead to rather negative outcomes (Tiwana 2010). This study shows that there are different control modes and various project performance dimensions, and demonstrates that some control mode can have a negative impact on the individual project performance dimensions, and vice versa. More importantly, the claim that control in SDOs enhances performance, taken for granted in the field of information systems, is not the total amount of control exercised, but the amount of each control mode appropriate for the SDO project dimensions.

Second, the goals to achieve through SDO are very diverse and multidimensional, largely composed of process performance and software performance. Achieving all of these multidimensional performance goals is realistically difficult and, in practice, conflicts and priorities among the different performance goals can exist. In reality, some projects may have software performance as a more important goal than process performance. In this case, SDO performance can be enhanced if the project team act more actively in the type of control that can enhance software performance. Thus, this study provides a realistic solution to the problems faced by information system managers in IT outsourcing.

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