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Controlling Information Systems Development Projects: The View from the Client

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Increasingly, business clients are actively leading information systems (IS) projects, often in collaboration with IS professionals, and they are exercising a greater degree of project control. Control is defined as all attempts to motivate individuals to achieve desired objectives, and it can be exercised via formal and informal modes. Much of the previous research investigating the choice of control mode has focused on direct reporting relationships between IS project leaders and their superiors in a hierarchical setting. However, the client-IS relationships may take on a variety of forms, including both hierarchical and lateral settings. Moreover, prior research has found that the knowledge of the systems development process is a key antecedent of control, yet clients are unlikely to be as knowledgeable as IS professionals about this process. It is therefore unclear whether prior findings will generalize to the client-IS pair, and the goal of this research is to examine the exercise of control across this relationship. Data were gathered from a questionnaire survey of 69 pairs of clients and IS project leaders. The results are largely consistent with prior research on the antecedents of *formal* control modes, but they shed new insight on the choice of *informal* control modes. (*Control; IS Project Management; IS-Client Relationships*)

Introduction

The successful management of information systems (IS) projects continues to challenge IS professionals (McFarlan 1981, Guinan et al. 1998). Traditionally, the participation and involvement of business users in IS projects has been seen as an important contributor to project success (Ives and Olson 1984, Hartwick and Barki 1994). As participants in IS projects, users are typically responsible for articulating business needs and requirements and may also be involved in other activities such as testing (Ives and Olson 1984).

With the growing strategic importance of systems in organizations, firms are encouraging even more active participation by business managers on IS projects (Hartwick and Barki 1994, Sambamurthy and Zmud 1996). In fact, in most contemporary firms, senior business executives actively sponsor and champion IS projects (Beath 1991, Guinan et al. 1998). In addition, firms have begun to utilize a *client liaison* role as a means of fostering business unit ownership and leadership of IS projects (Brown and Sambamurthy 1999). In contrast to sponsors or champions, who tend to be most influential during the

initiation stage, client liaisons assume a significant role over the entire course of the IS project. In particular, they provide oversight to ensure that IS projects make progress in conformance with the business value propositions and proposed schedules and budgets. Client liaisons may provide this oversight by articulating requirements, but they also make decisions about a system's functionality, approve deliverables, foster common goals and visions, and act as communication conduits between the technical staff and the business unit (Guinan et al. 1998, Brown and Sambamurthy 1999). Thus, the role of the client liaison is distinct from the traditional user participant and the executive champion or sponsor.

Client liaisons can ensure that IS projects meet their goals by exercising *control* of IS project leaders. Control is defined as the set of mechanisms designed to motivate individuals to work in such a way that desired objectives are achieved (Kirsch 1996, Jaworski 1988). It is through this exercise of control that client liaisons motivate IS project leaders to deliver applications that meet specific needs and requirements and that are of value to their firms. Client liaisons complement the role of the IS project leader. While IS project leaders utilize a variety of control strategies to motivate team members to complete work tasks, client liaisons use their own control strategies to motivate IS project leaders to assure alignment of the project with the business units' interests (Clark et al. 1997).

Client liaisons can choose to exercise formal or informal modes of control, and a number of studies have examined the antecedents of control. However, the context of much of this research has been the direct reporting relationship between the targets of control and controllers (see, for example, Henderson and Lee 1992, Snell 1992). Control in such relationships is exercised within the boundaries of the power and influence dynamics associated with superior-subordinate exchanges. In contrast, the exercise of control by client liaisons does not always occur within the vertical channel. Very often, client liaisons may not have formal positions of authority over the IS project leaders within which to exercise their control. Regardless of the type of relationship between them, the client liaisons may provide considerable guidance to and oversight of the IS project leader

(Kirsch 1997). Moreover, the two parties may develop a close working relationship, enabling the client to influence the actions taken by the IS project leader. Thus, the exercise of control by client liaisons can occur when IS project leaders do not report directly to them, as well as when there is a direct reporting relationship. Few research efforts have examined the choice of control mode across formal and informal client-IS relationships, and it is unclear whether prior findings will generalize to such situations.

Beside the type of relationship, another potentially significant difference between a client and an IS manager acting as a controller is their level of knowledge about information systems development (ISD) practices. Usually, IS managers have considerable knowledge about ISD activities, structures, and processes because of their tenure in IS organizations and their experience with IS development. In contrast, client liaisons have varied backgrounds; firms tap either IS or business executives to play the role of client liaisons (Brown and Sambamurthy 1999). Because the knowledge of the ISD process has been found to influence the choice of control modes (cf. Kirsch 1996), this raises the question of how clients select control modes when they do not possess the level of understanding of IS practices comparable to that of IS professionals.

The goal of this research is to extend existing insights by examining the antecedents of control across client-IS relationships. The next section reviews prior literature. Subsequently, the conceptual model and hypotheses are presented, followed by an explanation of the research methodology and an overview of the empirical results. The paper ends with a discussion of the results and concluding remarks.

Background Literature

Control theories suggest that controllers utilize two modes of formal control: behavior and outcome (Arrow 1985, Ouchi 1979, Eisenhardt 1985). With behavior control, controllers define appropriate steps and procedures for task performance and evaluate controllees' performance according to their adherence to the prescribed procedures. Outcome control involves the definition of specific desired task outputs. Controllers define appropriate targets and allow

controllees to decide how to meet those output targets. Performance evaluation then focuses upon the extent to which targets were met, and not on the processes used to achieve the targets. Despite differences in how they operate, behavior and outcome control share a common underlying assumption that the controllers and controllees have incongruent goals, and they both align goals by providing appropriate incentives to the employees.

Control can also be exercised via informal modes. These control modes are social or people-based, focusing on the role that individual or group norms and values play in the exercise of control (Covaleski et al. 1998, Ouchi 1980). Self-control (Manz et al. 1987), one mode of informal control, occurs when an individual sets his own goals, self-monitors goal achievement, and rewards or sanctions himself accordingly. Prior literature suggests that controllers, who do not directly exercise self-control over others, nevertheless can encourage others to exercise self-control by appropriately structuring the work environment. For example, controllers can train controllees in appropriate techniques (Brief and Aldag 1981) or ensure that tasks are clearly defined with discernible boundaries (Kirsch and Cummings 1996). Controllers can also institute performance evaluation schemes that reward autonomy and self-management. A second mode of informal control is clan control, where a clan is a group of individuals who are dependent on each other and who have common goals (Ouchi 1980). Unlike behavior and outcome control situations, there is no need for explicit incentives to align the goals

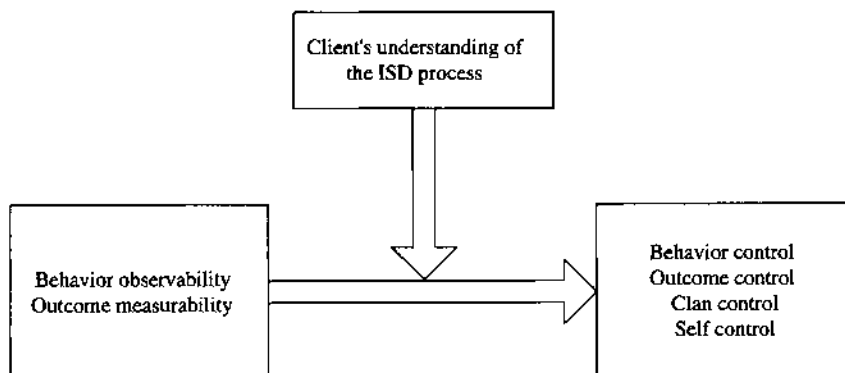
of controllers and controllees because of the existence of shared goals. Clan control operates when all members of the work group embrace the same values, adopt similar problem-solving approaches, and commit to achieving group goals (Ouchi 1979, Jaworski 1988). Individual efforts become difficult to identify and evaluate as the members collaborate on the task at hand. Consequently, rewards and sanctions are based on whether individual members act in accordance with group values, norms, and objectives.

Though researchers have investigated the antecedents of various control modes, there are two gaps in the literature. First, much of the prior evidence relates to direct reporting relationships between controllers and controllees. Moreover, studies specific to IS development projects focus primarily on relationships among IS personnel. Second, the evidence related to antecedents of formal control modes is more robust and consistent than evidence related to antecedents of informal controls. It is therefore unclear whether existing findings will generalize to client-IS relationships, and a research model was developed to explain the choice of control mode made by client liaisons in their dealings with IS project leaders.

Research Model and Hypotheses

As shown in Figure 1, the research model suggests that the client liaison's choice of control mode is dependent on behavior observability and outcome measurability. This relationship between antecedent conditions and control modes is moderated by the client liaison's understanding of the information

Figure 1 Predicting the Choice of Control Mode



systems development process. These relationships are explained and justified below, as specific hypotheses are developed.

Outcome measurability, which refers to the ability to measure achieved results, has generally been found to have a positive relationship with outcome control (Eisenhardt 1985, Snell 1992, Kirsch 1996). That is, if desired outcomes can be clearly articulated and accurately measured, controllers will be able to exercise outcome control. ISD project outcomes vary in terms of their measurability, and client liaisons may not be able to uniformly assess whether an IS project leader met specific targets. For example, determining if a project met its target implementation date is readily measured, but assessing whether a development effort adhered to all departmental or organizational standards is more problematic. Thus, the relationship between outcome control and outcome measurability would also seem to hold in the context of this research. Client liaisons can utilize outcome control if they are able to measure the outcomes of the ISD process:

HYPOTHESIS 1. High levels of outcome measurability will be associated with the exercise of outcome control.

Behavior-based control modes can be implemented when the controller (in this case, the client liaison) has access to information systems that reveal the behaviors of the controllee (here, the IS project leader). Eisenhardt (1985) found that as behavior observability (the availability of information that reveals controllees' behaviors) increases, the use of behavior control increases. Prior theory and evidence suggest that the use of behavior control is also a function of the extent to which the process that transforms inputs to outputs is understood (Ouchi 1979, Snell 1992). Subsequently, Kirsch (1996) argued that behavior observability and knowledge of the transformation process have a positive interactive effect on the use of behavior control, particularly for complex tasks. In an empirical study of IS projects, she found that as behavior observability increases, the use of behavior control increases, but only for those controllers who understand the ISD process. Such an interaction is likely to hold in this study because not all client liaisons are expected to have significant knowledge of ISD activities and processes:

HYPOTHESIS 2. High levels of behavior observability and client's understanding of the IS development process will be associated with the exercise of behavior control.

What happens when client liaisons are able to observe IS project leaders' behaviors, but are not knowledgeable about the IS process? Under such circumstances, the client liaisons may not intend to monitor and direct project team behaviors. Instead, their motives might be to ensure that they and the IS project leaders develop similar project-related approaches, values, and perspectives (Kirsch 1997). In doing so, clients are exercising clan control (Beath 1987, Kirsch 1996). Indeed, control theory argues that clan control will be implemented when it is not possible to implement formal modes of control (Ouchi 1980). The project team can be thought of as a clan and the IS project leader a window of access for the client liaison into this clan. Through the exercise of clan control, the client develops a social relationship with the IS project leader to understand the project team's goals and problem-solving approaches, and to instill and embrace shared project goals and values. Though the client lacks an in-depth understanding of the ISD process, the interactions between the client liaison and the project leader foster a sense of trust and commitment between the two (Beath 1987). It is therefore hypothesized that the combination of high behavior observability and low client understanding of the IS development process will be associated with the use of clan control:

HYPOTHESIS 3. High levels of behavior observability and low levels of client understanding of the IS development process will be associated with the exercise of clan control.

IS project leaders might exercise self-control under two different scenarios. There is evidence that as it becomes more difficult for controllers to measure whether specific targets are achieved by the controllees, they might encourage the use of self-control by the controllees (Kirsch 1996). This negative relationship between reliance on self-control and outcome measurability is expected to hold in this research setting as well. If clients cannot measure outcomes, then the exercise of outcome control is problematic. In

this environment, they might rely on the IS project leader to self-set goals, and self-manage the process for achieving those goals; in effect, the project leader is exercising self-control (Henderson and Lee 1992):

HYPOTHESIS 4A. Low levels of outcome measurability will be associated with the exercise of self-control.

If clients are unable to observe the activities and behaviors of IS personnel (i.e., behavior observability is low), then behavior control is ruled out. In this scenario, clients are not paying much attention to the day-to-day activities of the project leaders. This again presents an opportunity for the project leaders to exercise self-control, as they have been granted more autonomy and discretion in how they do their work (Henderson and Lee 1992, Kirsch 1996, 1997). Prior research suggests that increased managerial oversight in the form of team meetings and work rules seems to decrease the level of self-control exercised (Manz and Angle 1986, Alavi et al. 1986). Thus, it is expected that as client liaisons' ability to observe the IS project leaders' behaviors decreases, IS project leaders will be able to exercise more self-control:

HYPOTHESIS 4B. Low levels of behavior observability will be associated with the exercise of self-control.

Research Methodology¹

A large-scale questionnaire survey of client liaisons and IS project leaders of systems development projects was conducted to test the hypotheses. Two separate questionnaires were developed to reduce threats from common methods bias. IS project leaders were asked to provide data about the use of the four control modes (behavior, outcome, clan, and self) since the project leaders should be knowledgeable about their exchanges with the client liaisons and the steps they took to exercise self-control. Client liaisons were asked to indicate their ability to observe behaviors and measure outcomes (the antecedents) as well as their level of understanding of the IS development process (the moderator).

¹ Many methodological details were eliminated from the paper to conserve space. Additional information can be obtained from the first author.

Organizations and Projects

The researchers contacted senior IS executives in a variety of industries in the South, East, and Midwest. These executives were asked to identify appropriate projects and survey respondents. Project selection was based on two criteria. First, the development projects should have been completed during the last 12 months or should have been underway for at least 12 months and have completed one major client deliverable. Recency was considered important so that the respondents could reliably respond with their perceptions about different constructs. Further, the completion of at least one deliverable was required so that significant activities would have occurred on the project. This would ensure that the responses were not fleeting observations of the project, but reflected the true character of the project. Second, access to both IS and client personnel on systems development projects was mandatory for data gathering. The IS project leader was defined as the person from IS responsible for day-to-day management of the project from an IS perspective. The client liaison was defined as the person whose business unit is or would be significantly impacted by the system and who was responsible for oversight of the project from a client perspective.

Between July 1997 and January 1999, the researchers gained access to a total of 77 projects from 32 firms. Sixty-nine usable pairs (90% response rate) were returned. Though most of the participating firms are large for-profit firms, the sample does include three large public universities and four government agencies. IS respondents had 1.5 to 35 years experience in IS (mean = 14.10 years, s.d. = 8.48). The number of years in their current positions (at their current organizations) ranged from 0.50 to 20, averaging 3.79 (s.d. = 4.14). For the client liaisons, the number of years in their current positions (at their current organizations) ranged between 0.50 and 26 (mean = 4.89; s.d. = 5.04). Client liaisons' experience with IS varied from no experience to 33 years of experience (mean = 6.07; s.d. = 7.92).

As seen in Table 1, the size of the 69 projects varied in terms of project cost, duration, and effort. In 23 of the projects, the primary programming language used was COBOL; other languages included C++, Java,

Table 1 Project Characteristics

	Range	Median	Average	Std. Deviation	N*
Project Cost	\$4,032-\$500,000,000	\$250,000	\$18,412,125	\$76,927,965	49
Project Duration (months)**	1-47	9.00	12.13	10.23	60
Project Effort (person-hours)	96-150,000	1950	14,894	29,504	58

*N is the number of respondents providing this information. The highest possible N is 69.

**Nine projects were ongoing at the time of data collection; no duration is reported for these projects.

and Visual Basic. Of the systems, 26 were designed to run on client/server platforms, 11 on mainframes, 18 on a combination of platforms, 13 on some other platform (e.g., minicomputer), and, for one project, the platform was unknown.

The nature of the relationship between the client liaison and the IS project leader varied. In 29 of the 68 projects (one data point was missing), there was a direct reporting relationship from the project leader to the client. In the remaining 39 projects, there was no reporting relationship.

Questionnaire Development and Validation

Scale items are shown in the Appendix. Most items were derived from earlier work. Measures of behavior observability, outcome measurability, and client's understanding of the ISD process are based on scales described in Kirsch (1996). Measures of behavior and outcome control were adapted from Snell (1992) and Kirsch (1996), and the self-control items are based on scales used by Henderson and Lee (1992) and Kirsch and Cummings (1996).

The measurement of clan control proved especially challenging because few researchers have successfully operationalized this construct. In accordance with the literature, the perspective taken here was that the project team represented a clan, and that the client would attempt to become part of this clan by developing an understanding of and supporting project team goals, norms, and values. Scale items (see the Appendix) were developed to tap into these ideas.

Standard psychometric techniques were followed in validating the measures. Table 2 shows the Cronbach's alpha for the constructs. Other than project leader experience, which is measured in years, each item was measured on a scale of one to five. Though two reliability scores fall slightly below Nunnally's (1978) recommended cut-off of 0.70—behavior control (0.65) and outcome control (0.69)—these violations were not considered serious enough to warrant action.

Factor analyses were performed to examine convergent and discriminant validity. Multiple factor analyses were done in this study, given the relatively

Table 2 Correlation Matrix, Descriptive Statistics, and Reliability

	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9
1. Project Leader Experience (yrs)	14.10	8.48	n/a***	0.143	-0.118	0.006	-0.061	0.156	0.047	0.095	-0.146
2. Project Size	3.58	1.11		0.75	0.275*	0.104	0.377**	0.179	0.029	0.286*	-0.233*
3. Behavior Observability	3.23	0.83			0.71	0.512**	0.428**	0.388**	0.253*	0.375**	-0.311**
4. Outcome Measurability	3.81	0.73				0.79	0.335**	0.195	0.426**	0.179	0.022
5. Understanding of ISD Process	3.32	0.99					0.87	0.356**	0.057	0.380**	-0.114
6. Behavior Control	2.63	1.04						0.65	0.268*	0.541**	-0.373**
7. Outcome Control	3.66	0.89							0.69	0.368**	-0.274*
8. Clan Control	3.36	1.13								0.94	-0.449**
9. Self Control	2.81	1.21									0.90

*significant at 0.05 level (2-tailed).

**significant at 0.01 level (2-tailed).

***Cronbach's alphas reported on the diagonal.

small sample size. A principle component method of extraction with a varimax rotation was used. Scales measuring the independent and moderator variables were factor analyzed together, while scales measuring the dependent variables were factor analyzed together. The analyses resulted in the deletion of three items: one for outcome measurability and two for outcome control (see the Appendix for the deleted items). Based on the final factor loadings, the amount of variance explained, and the eigenvalues, the resultant measures were judged to exhibit convergent and discriminant validity.

The revised scales were then subjected to a multitrait-multimethod matrix analysis (Campbell and Fiske 1959) for further evidence of convergent and discriminant validity. Correlations of an item with other items measuring the same construct (within-construct correlations) and correlations of that item with items measuring other constructs (cross-construct correlations) are examined. Convergent validity is said to exist if the within-construct correlations are statistically significant, while evidence of discriminant validity comes from a small number of cross-construct correlations that exceed within-construct correlations (Campbell and Fiske 1959, Straub 1989). The results of this analysis are shown in Table 3. Other than behavior observability, the measures exhibit strong convergent and discriminant validity.

The results of the psychometric analyses suggest that six of the seven scales demonstrate acceptable reliability, convergent validity, and discriminant

validity. It must be noted, however, that the psychometric properties of behavior observability are not as strong. However, because the evidence is not overwhelmingly negative and because the scale was based on an existing measure, the decision was made to retain this scale and proceed with the analysis.

Analysis

The means and standard deviations of the measures of the constructs are shown in Table 2. Regression analysis was used for hypothesis testing. In addition to the hypothesized antecedent and moderating variables, two control variables were entered into the regressions: project size and the number of years of experience of the IS project leader. Rather than incorporating a variable such as project cost or duration as an indication of project size, a *relative* measure of size was added. The intent was to capture whether the respondents had experience with other projects of similar size (cf. McFarlan 1981). Therefore, project size was measured by asking both the client and the IS project leader to respond to: "Relative to other systems development projects for my area, this project is considered very large." As shown in Table 2, $\alpha = 0.75$. For number of years of experience, IS project leaders were asked: "How many years of experience do you have as an IS professional?" The average is about 14 years (s.d. = 8.48; see Table 2).

To test Hypotheses 1 and 4, multiple regression was used with the following model:

Control Mode

$$\begin{aligned}
 &= \beta_0 + \beta_1(\text{Project Size}) \\
 &+ \beta_2(\text{Project Leader Experience}) \\
 &+ \beta_3(\text{Behavior Observability}) \\
 &+ \beta_4(\text{Outcome Measurability}) \\
 &+ \beta_5(\text{Client Understanding of the} \\
 &\quad \text{Development Process}) + \varepsilon \quad (1)
 \end{aligned}$$

Hierarchical regression was employed to test the moderating effect of client's understanding of the ISD process on the use of behavior and clan controls (Hypotheses 2 and 3). With hierarchical regression, the independent variables are entered in the first step of the regression; in the second step, appropriate

Table 3 Results of the Multitrait-Multimethod Analysis

Construct	Range of Within-Construct Correlations	# of Cross-Construct Correlations > Within-Construct Correlations
Behavior Observability	0.259–0.490*	36 of 76 comparisons
Outcome Measurability	0.390–0.698**	7 of 90 comparisons
Understanding of Development Process	0.554–0.871**	0 of 60 comparisons
Behavior Control	0.488**	2 of 42 comparisons
Outcome Control	0.310–0.639**	14 of 60 comparisons
Clan Control	0.778–0.851**	0 of 76 comparisons
Self Control	0.819**	0 of 42 comparisons

*significant at 0.05 level (2-tailed).

**significant at 0.01 level (2-tailed).

cross-product terms are entered to test for interaction effects (Venkatraman 1989). In this case, the following term was added to Equation (1):

$$\beta_6(\text{Behavior Observability} * \text{Client Understanding of the Development Process}).$$

Several tests were conducted to check the assumptions behind regression modeling and no significant violations were detected.

Results

The results provide strong support for Hypothesis 1 (see Table 4). The independent variables entered yielded an adjusted R^2 of 0.149 (F -statistic = 3.383,

$p < 0.01$). As predicted, outcome measurability is significant ($b = 0.456, t = 3.909, p < 0.01$): In the presence of high levels of outcome measurability, outcome control is utilized.

Though the interaction effects on behavior control (Hypothesis 2) were not found, the main effects for behavior observability and client's understanding of the IS development process were found to be significant. As seen in Table 5, the independent variables entered in Step 1 yielded an adjusted R^2 of 0.183 (F -statistic 3.992, $p < 0.01$). Behavior observability is significant ($b = 0.406, t = 2.422, p < 0.05$), as is the client's understanding of the development process ($b = 0.244, t = 1.840, p < 0.10$). These results suggest that behavior control is used in the presence of either high levels of behavior observability or high levels of client understanding. One of the control variables is also significant, suggesting that when IS project leaders possess experience, client liaisons will exercise behavior control ($b = 0.026, t = 1.894, p < 0.10$).

As seen in Table 6, the clan control hypothesis (Hypothesis 3) is supported. The variables entered in Step 1 yielded an adjusted R^2 of 0.161 (F -statistic = 3.603, $p < 0.01$). Behavior observability and client's understanding of the ISD process are both significant, supporting the notion that these variables are associated with the use of clan control ($b = 0.390, t = 2.133, p < 0.05$; $b = 0.292, t = 2.016, p = 0.05$,

Table 4 Results of Regression Analysis for Outcome Control

Variable	<i>b</i>	Std. Error
Constant Term	1.976**	0.584
Project Size	-0.081	0.099
Project Leader Experience	0.011	0.011
Behavior Observability	0.126	0.141
Outcome Measurability	0.456***	0.152
Understanding of Development Process	-0.073	0.112
Adjusted R^2	0.149	
F -Statistic	3.383***	
Degrees of Freedom	5, 63	

$N = 69$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 Results of Hierarchical Regression Analysis for Behavior Control

Variables	Step 1: Enter Independent Variables		Step 2: Enter Interaction Term	
	<i>b</i>	Std. Error	<i>b</i>	Std. Error
Constant Term	0.458	0.699	-0.958	1.333
Project Size	0.013	0.118	-0.004	0.118
Project Leader Experience	0.026*	0.014	0.028*	0.014
Behavior Observability	0.406**	0.167	0.853**	0.396
Outcome Measurability	-0.080	0.182	-0.061	0.182
Understanding of the Development Process	0.244*	0.133	0.756*	0.431
Behavior Observability \times Understanding of the Development Process			-0.160	0.129
Adjusted R^2	0.183			
F -Statistic	3.992***			
Degrees of Freedom	5, 62		6, 61	
Change in R^2			0.019	
F Change			1.553	

$N = 68$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 Results of Hierarchical Regression Analysis for Clan Control

Variables	Step 1: Enter Independent Variables		Step 2: Enter Interaction Term	
	<i>b</i>	Std. Error	<i>b</i>	Std. Error
Constant Term	1.210	0.757	-1.535	1.418
Project Size	0.049	0.128	0.016	0.125
Project Leader Experience	0.016	0.015	0.021	0.015
Behavior Observability	0.390**	0.183	1.252***	0.420
Outcome Measurability	-0.105	0.196	-0.065	0.192
Understanding of the Development Process	0.292**	0.145	1.280***	0.459
Behavior Observability × Understanding of the Development Process			-0.309**	0.137
Adjusted R^2	0.161			
F-Statistic	3.603***			
Degrees of Freedom	5, 63		6, 62	
Change in R^2			0.059	
F Change			5.121**	

$N = 69$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

respectively). Moreover, entering the interaction term in Step 2 resulted in a change in R^2 of 0.059 (F -statistic = 5.121, $p < 0.05$), and the interaction term is significant ($b = -0.309$, $t = -2.263$, $p < 0.05$). This suggests that the interaction of behavior observability and controller's understanding of the development process is negatively associated with the use of clan control, as predicted. Figure 2 shows the nature of the interaction effect in terms of the relationship between

behavior observability and clan control for high levels (above the median) of client understanding of the transformation process and low levels (at or below the median). The upward sloping curve for low levels of client understanding shows that the positive relationship between behavior observability and clan control exists only for clients who lack in-depth understanding of the development process.

The results for self-control are shown in Table 7. There is partial support for the hypotheses. The adjusted R^2 is 0.116 (F -statistic = 2.783, $p < 0.05$), and as hypothesized, both outcome measurability and behavior observability are significantly associated with self-control ($b = 0.407$, $t = 1.880$, $p < 0.10$; $b = -0.620$, $t = -3.083$, $p < 0.01$). Though the relationship

Figure 2 The Behavior Observability + Client Understanding of the IS Development Process Interaction Effect on Clan Control

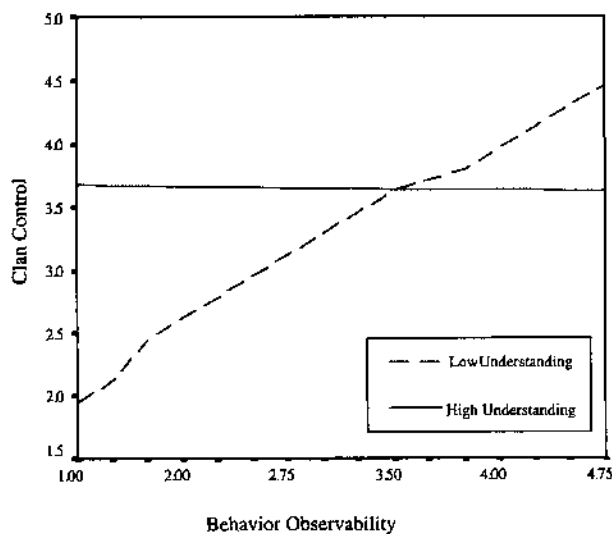


Table 7 Results of Regression Analysis for Self-Control

Variables	<i>b</i>	Std. Error
Constant Term	3.845***	0.832
Project Size	-0.094	0.141
Project Leader Experience	-0.023	0.016
Behavior Observability	-0.620***	0.201
Outcome Measurability	0.407*	0.217
Understanding of Development Process	0.014	0.159
Adjusted R^2	0.116	
F-Statistic	2.783**	
Degrees of Freedom	5, 63	

$N = 69$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

between behavior observability and self-control is in the predicted direction (Hypothesis 4b), the relationship between outcome measurability and self-control is in the direction opposite to that predicted (Hypothesis 4a). The results suggest that self-control will be exercised when behavior observability is low, or when outcome measurability is high.

Two sets of sensitivity analyses were conducted to check the robustness of the results. First, an additional control variable was added for type of relationship, indicating whether there was a direct reporting relationship from the project leader to the client liaison. This was added to assess whether formal controls were only exercised across direct reporting relationships, and informal controls across other types of relationships. The control variable was not significant in any regression, indicating that type of relationship is not a surrogate for type of control. Further evidence that type of control exercised is not a function of type of relationship is provided by a series of *t*-tests examining the differences in means of the control modes for those projects where a direct reporting relationship existed and those projects lacking such a relationship. The difference was not significant for any mode of control.

The second sensitivity analysis concerned the effects of project size. Thirty-six additional regressions were run in which combinations of the largest and smallest projects (by cost, effort, and duration) were removed from the sample. In 32 cases, the results are consistent with those reported here. In the remaining four, one of the hypothesized relationships was not significant, although the sign and direction of the regression coefficients are consistent with the reported results. Taken together, these additional analyses testify to the robustness of the results.

Discussion

This study was motivated by the need to better understand how client liaisons exercise control during systems development projects. Compared to IS professionals, who have been the focus of much prior research, client liaisons are less likely to exercise control within the vertical channel of superior-subordinate relationships and are more likely to vary

in their knowledge of IS projects and practices. Therefore, there is a need to examine the ways in which client liaisons structure their use of control on IS projects. Further, the exercise of control by client liaisons is in addition to the control exercised by the IS project leader over the work process activities of the project team. Specifically, the client liaison also exercises control to facilitate continued alignment of the project with the business units' goals and the promised value propositions (Clark et al. 1997). The results of this study provide support for most of the hypothesized antecedents of the exercise of control by client liaisons.

Before examining the results of the study and their implications, some of its key limitations must be evaluated. The first limitation is the moderate sample size. Though considerable effort was expended to increase the number of participants, only 69 completed pairs of projects were returned. This sample size could potentially limit the power of the statistical techniques; however, the results did yield a number of statistically significant findings. Moreover, a sample size of 69 compares quite favorably with other studies that have relied on matched pairs. A second limitation concerns the measures. Though the validation of the measures suggests the psychometric properties are reasonable, it is undoubtedly possible to improve them. Measuring these constructs, especially the various modes of control and behavior observability, is challenging, and developing improved measures would be a worthwhile endeavor.

Consistent with prior empirical evidence, the findings reveal that client liaisons exercise outcome control when outcome measurability is high, i.e., where it is possible to measure project outcomes. Further, instead of the anticipated interaction effects between behavior observability and client's understanding of the development process, the results reveal significant main effects. Other researchers have also found that the exercise of behavior control occurs with high levels of behavior observability and understanding of the development process (Eisenhardt 1985, Snell 1992). The results suggest that client liaisons can exercise behavior control if they are able to observe the relevant behaviors of the IS project leaders, or if they understand the IS development process well enough

to interpret and guide project leader behaviors and actions. Collectively, these findings suggest that prior literature generalizes well to the conditions under which client liaisons choose to exercise outcome or behavior controls.

However, the distinctive findings of this study are about the conditions under which client liaisons choose clan and self controls. In contrast with prior studies that have generally failed to demonstrate significant influences on the use of clan control, the results suggest that client liaisons can use clan control when behavior observability is high and there is a low understanding of the systems development process. In other words, under these conditions, client liaisons will find that clan control is a viable means for them to enhance their knowledge and their ability to judge the implications of the project leaders' behaviors for understanding project progress.² By participating in the project team meetings, understanding the project teams' goals, norms, and values, and overall attempting to "be a regular member of the project team," client liaisons could find clan control to be useful in overcoming their low understanding of the systems development process and maintaining control over the IS project leader. Such participation enables clients to develop the cognitive frames of understanding through which they can recognize the links between observable behaviors and project progress.

The findings suggest that high behavior observability is associated with the use of either behavior or clan control. Some researchers suggest that clan control may be a form of behavior control (e.g., Govindarajan and Fisher 1990). However, this research suggests that they are distinct. Though both modes of control have the same antecedent conditions (i.e., behavior observability and client's understanding of the development process), their interplay is quite different. In conjunction with earlier research (Kirsch 1996), the findings suggest that, given high levels of behavior observability, clients' understanding plays a key role in determining the type of control exercised. Client liaisons

who are knowledgeable about ISD are able to exercise behavior control. In contrast, less knowledgeable client liaisons are likely to rely on clan control.

Of course, when behaviors are not easily observable, it is difficult for the clients to rely on behavior or clan controls. Under such conditions, client liaisons are more likely to rely on the IS project leaders to exercise self-control by providing them with the requisite discretion. Though a significant relationship was found between outcome measurability and self-control, it was counter to the predicted direction. In particular, in the presence of high outcome measurability, the project leader exercised self-control. In addition to having a positive relationship with self-control, outcome measurability is also an antecedent of outcome control. Yet, the negative correlation between outcome and self-controls ($-0.274, p < 0.05$, Table 2) suggests that these two control modes do not operate at the same time. Despite being influenced similarly by outcome measurability, client liaisons do not seem to exercise outcome control when project leaders exercise self-control. The choice between the use of outcome or self-control might be mediated by factors not included in this study. One such factor might be the extent to which client liaisons influence the rewards and sanctions process for project leaders. When their influence is high, client liaisons may choose outcome control. Without strong influence, they may rely on the project leaders to self-control because they lack the ability to formally reward IS project leaders. Another mediating factor might be the prevailing organizational culture about the use of formal controls. Cultures that value formality are more likely to influence the selection of outcome over self-controls. The positive relationship between outcome measurability and self-control may also be indicative of a client liaison that has abdicated control.³ Despite the ability to measure outcomes, the client may choose not to exercise this type of control, perhaps because of lack of time or commitment to the ISD project. In such a situation, the project leader may exercise self-control to ensure that the project meets expected targets. Interestingly, such a scenario

² We thank a reviewer for pointing out this line of argument as a potential explanation for the use of clan control.

³ We thank the reviewers for suggesting that culture may influence the choice of control, and that clients may abdicate control responsibilities.

is counter to the prevailing wisdom in the ISD literature about the need for greater hands-on involvement of clients in systems development projects (Hartwick and Barki 1994). It is obvious that the exercise of self-control is a more complex phenomenon than uncovered by this research.

Implications for Research

This study makes significant contributions to the literature on the exercise of control in the context of IS projects, particularly given that many existing insights have been derived from observations of the exercise of control by IS professionals in superior-subordinate relationships. Consistent with earlier research, the results of this study point out that clients use outcome control when outcomes are measurable, and that behavior control is a function of behavior observability and client understanding of the transformation process. The finding between understanding of the transformation process and behavior control is especially important as it lends empirical support to Ouchi's (1978) argument that effective use of behavior control is dependent on recognizing and understanding "proper" behaviors. This finding also supports the argument that the presence of information alone is not sufficient for exercising behavior control; rather, clients must understand the information in order to act on it (Kirsch 1996).

In contrast with prior research, this study empirically demonstrates the relationship between the choice of clan control and the negative interaction between behavior observability and client understanding of the transformation process. This finding highlights the key role that knowledge plays in choice of control mode, and, in particular, the relationship between lack of knowledge and clan control. While prior research suggests that knowledge is needed for the exercise of formal, behavior control (Snell 1992, Kirsch 1996), it may be that controllers who lack appropriate knowledge can substitute informal, clan control for behavior control.

With respect to self-control, this study suggests that adding it to the typology of behavior, outcome, and clan controls (Ouchi 1979) may be worthwhile. Over-reliance on IS project leader self-control, however,

could present some significant dilemmas to the management of systems development projects because it implies that client liaisons are disengaging from those projects. Because client involvement is considered to be crucial to overall project success, interesting questions are raised by these findings. For example, how can clients provide overall involvement on systems development projects even though they might expect the IS project leaders to fashion self-control? Prior research has suggested that managers structure portfolios of control (Kirsch 1997), so it may be that client liaisons use other mechanisms to signal and implement their involvement with systems development projects. Future research is needed to understand the conditions under which self-control is used, and the way in which it is exercised.

The results reported here also suggest that both formal and informal control can be exercised across various types of organizational relationships between the controllers and controllees. This suggests that researchers should devote attention to how various control modes complement or substitute for each other across both vertical and nonvertical relationships.

Implications for Practice

Recent research suggests that formal mechanisms of control facilitate task management, whereas a major purpose of informal mechanisms is relationship management (Kirsch 1997). With formal mechanisms of control, managers can monitor, assess, and reward individual efforts toward completing tasks. Informal mechanisms, on the other hand, facilitate managers' efforts to foster relationships with individuals, build trust and confidence, and encourage learning and innovation (Das and Teng 1998). The findings reported here and elsewhere suggest that a client's understanding of the ISD process plays a key role in whether clients implement formal or informal modes of control. In particular, a solid understanding of the process promotes the use of behavior control, while an incomplete understanding may result in the use of clan control.

Not all client liaisons possess a high level of knowledge and understanding of the ISD process, making it difficult for them to utilize behavior control. Yet behavior control mechanisms are embedded into

the systems development process and an accepted practice for managing IS projects (Kirsch 1996, 1997). This prompts the need to reexamine how firms could encourage the use of formal and informal modes of control among clients to encourage both forward progress on the project and the development of trusting, collegial relationships. One implication is that clients should be trained in the use of formal and informal control modes in order to improve their satisfaction with the process of managing projects and their confidence in their abilities to manage projects in the future. A second implication is to pair a client liaison that is less knowledgeable about the ISD process with a more knowledgeable individual; this pair can then act as co-project liaisons. A third implication is to recognize the importance of building and maintaining trusting, collegial associations across IS-client relationships.

Conclusion

This study examined the conditions under which client liaisons of ISD projects choose various modes of control. The results both confirm prior results and offer additional insights. Consistent with prior research, this study reaffirms the conditions governing the use of outcome and behavior controls. In addition, this research provides much needed empirical evidence about the use of self-and clan control modes. The results suggest that when behaviors are not easily observable to the client, or when outcomes are highly measurable, IS project leaders will exercise self-control. The findings also suggest that when behaviors are observable to clients who have little knowledge of the ISD process, those clients will implement clan control. Since high levels of knowledge are associated with the use of behavior control, the client's understanding of the ISD process is a key factor in determining type of control mode.

Researchers could extend these findings in several directions. First, it would be useful to extend conceptualizations of control to include both lateral and vertical relationships. Much of the current theoretical thinking assumes relationships are formally defined in the organizational hierarchy, but the client-IS pair is just one example of a relationship that

may not always be vertical. There are many unanswered questions related to the use and impact of control modes across lateral or peer-to-peer relationships. Second, this research follows the tradition in control research of examining modes of control independently. However, other studies have begun to examine combinations or portfolios of control modes (Kirsch 1997, Covaleski et al. 1998). More empirical research is needed to identify the types of portfolios that clients use, the conditions surrounding the use of specific portfolios, and the effectiveness of these alternative portfolios in practice. Third, in some organizations there is a trend toward the sharing of project leadership between IS leaders and client liaisons. While in this sample there was no evidence of project co-leadership, future studies should explicitly examine the exercise of control in the context of project co-leadership. Finally, there is relatively little empirical evidence about the relationship between modes of control and performance. Control may be exercised for a variety of reasons, such as to maintain forward progress on a project or to build and foster relationships (Kirsch 1997, Das and Teng 1998). Therefore, the effects of control ought to vary as well, and differentially impact such outcomes as project performance and relationship management. This proposition, however, is in need of empirical testing.

As senior executives expand the role of business professionals in the IS arena, they begin to understand that business managers need knowledge of and experience with IS practices. Thus, encouraging client liaisons to assume greater control and oversight of IS projects is becoming increasingly important, yet there is little empirical evidence about the managerial role that clients play on projects. This study sheds some light on the conditions under which clients use alternative control modes during ISD projects, and hopefully provides stimulation for future research in this area.

Appendix

Section I: Independent and Moderating Variables (Client Liaison Questionnaire).

Behavior Observability, defined as the extent to which the client liaison has access to information that reveals individual behaviors and actions.

1. While the project was ongoing, I spent considerable time and effort monitoring how well the IS project leader was meeting the project goals.

2. While the project was ongoing, I frequently participated in a formal review (with sign-off) where the project's actual progress towards its goals was checked.

3. Aside from formal review documents, I frequently received written reports from the IS project leader that specifically indicated progress toward the project's goals.

4. I continually assessed the behaviors and actions of the IS project leader during the course of the project.

Outcome Measurability, defined as the client liaison's ability to measure outcomes and results.

1. I had several sources of objective data that indicated how well the IS project leader met the project goals.

2. It was possible for me to determine whether the project was completed on time.

3. It was possible for me to determine whether the project was completed within budgeted costs.*

4. It was possible for me to determine whether the project was completed according to the users' satisfaction.

5. There were quantifiable measures depicting the extent to which project targets were achieved.

6. If I want to, I can accurately and reliably measure the extent to which the completed system met its goals.

Client's Understanding of the Information Systems Development Process, defined as the extent to which the client liaison understands the behaviors needed to transform inputs into outputs during the systems development process.

1. To what extent can you distinguish between effective and ineffective systems development actions on the project?

2. I have a solid understanding of the systems development process.

3. I have considerable knowledge about how to build and implement systems.

Section II: Dependent Variables (IS Project Leader Questionnaire).

Behavior Control: One mode of control in which the client liaison expects the IS project leader to follow articulated procedures and rules to transform inputs into outputs during the systems development process.

1. The client expected me to follow an understandable written sequence of steps toward the accomplishment of project goals.

2. The client assessed the extent to which existing written procedures and practices were followed during the development process.

Outcome Control: A second mode of control in which the client liaison expects the IS project leader to achieve specific project outcomes and targets, regardless of the particular behaviors and actions taken by the project leader.

1. The client placed significant weight upon timely project completion.

2. The client placed significant weight upon project completion within budgeted costs.*

3. The client placed significant weight upon project completion to the satisfaction of the client.

4. The client used pre-established targets as benchmarks for my performance evaluations.*

5. The client evaluated my performance by the extent to which project goals were accomplished, regardless of how the goals were accomplished.

Clan Control: A third mode of control in which the client liaison becomes part of a project team clan by instilling, embracing, and fostering shared values and goals among the project team, and common approaches to working on the project.

1. The client actively participated in project meetings to understand the *project team's* goals, values, and norms.

2. The client placed a significant weight on understanding the *project team's* goals, values, and norms.

3. The client attempted to be a "regular" member of the *project team*.

4. The client attempted to understand the *project team's* goals, norms, and values.

Self Control: A fourth mode of control in which the IS project leader autonomously defines goals and behaviors for the project.

1. I set specific goals for this project without the involvement of the client.

2. I defined specific procedures for this project's activities without the involvement of the client.

*Based on the instrument validation process, these items were deleted.

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