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Project Control, Coordination, and Performance in Complex Information Systems Outsourcing

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ABSTRACT
Information systems outsourcing has not only become prevalent but also involves an increasingly wide range of activities beyond the traditional programming, testing, documentation, and localization activities to include complex business-focused project planning, process design, requirements determination, and logical and physical systems designs. Such complex IS outsourcing often requires interactions among various stakeholders across different locations and cultures and therefore is much more difficult to manage than the traditional IS outsourcing. Coordination and control have been viewed as especially important project management strategies for managing project activities; however, little research has focused on how they relate to each other and how they collectively affect the performance of complex IS outsourcing projects. In this study, we examine the differential performance effects of outcome and behavior controls on coordination and show that the effect of outcome control on project performance is mediated by coordination.

KEYWORDS
Coordination; control; project performance; outsourcing; project management

Introduction
Information Systems (IS) outsourcing refers to the use of a third-party vendor that provides IS services to the client firm. It has become a prevalent business practice for organizations of varying sizes and industries. IS outsourcing has grown over the past three decades not only in numbers but also in scope.1 Most IS outsourcing activities in earlier periods involved traditional IS development activities such as programming, testing, documentation, and localization.2 However, IS outsourcing projects have become more complex with the inclusion of "higher-value activities" such as project planning, process design, requirements determination, and logical and physical systems designs.3,4

Traditional IS outsourcing projects typically involved activities such as programming, testing, and documentation associated with well-defined client requirements. Over the years, IS outsourcing projects have become more complex as the need for business-based activities such as project planning, process design, requirement determination, logical and physical designs has grown so that firms can compete more effectively in the global market.5 Accordingly, firms engaged in complex IS outsourcing activities tend to discover, define, and create client requirements. The nature of tasks and relationships between the different stakeholders for complex IS outsourcing projects are different from those of traditional IS outsourcing projects.6 Therefore, the management of complex IS outsourcing projects requires different project controls and coordination than that for the traditional IS outsourcing projects. In this research, we focus on complex IS outsourcing project control, coordination and performance relationships.

The many uncertainties that accompany complex IS outsourcing project activities make it difficult to clearly specify the detailed terms of the contract. Such low contract specificity7 makes it difficult for vendors to carry out these complex IS outsourcing project activities cost-effectively and with certainty. A vendor needs to devote resources to understand a client’s needs, then formalize and translate them into requirements and design documents that will enable the development of a functional system.8 With low contract specificity, a client organization cannot rely solely on vendor contracts to ensure project success, thus requiring greater project coordination and control.

While IS outsourcing continues to grow, outsourcing projects have experienced high failure rates.9 These failures can be attributed to "hidden costs" associated with the management of IS outsourcing projects.10 A national survey11 corroborates those hidden cost issues and highlights the two greatest challenges in IS outsourcing: project coordination and control. It has long been recognized that "software development is inherently a complex activity that is embedded with interdependencies…and entails significant coordination"12 and researchers have focused on "identifying the factors that lead to the choice of controls and not the results that come from the use of controls".13 Project coordination and control challenges are more pronounced in complex IS outsourcing practices due to the greater level of uncertainties associated with the crossing of organizational, cultural, and geographical boundaries, the need to engage in sense-making process that involves a new setting with a new set of business processes, and the difficulty of managing frequent changes that affect the final system. Thus, complex IS outsourcing provides a rich
context for studying project coordination and control and their effects on project performance.

This study makes two significant contributions resulting from a two-stage, time-phased survey of 204 complex outsourcing IS projects. First, we extend prior research on project coordination and control by offering a research model grounded in project coordination and control theories. We focus on project coordination and two formal control modes (i.e., behavioral control and outcome control), theorizing and then testing their relationships as well as differential effects on performance of complex IS outsourcing projects. Second, we offer a glimpse into a long-standing ambiguity in the literature concerning the relationship between control and project performance in complex IS outsourcing projects by offering empirical evidence that project coordination mediates the relationship between project control and project performance.

### Literature review and research model

#### Project coordination

Researchers have recognized project coordination as a useful theoretical lens and an important research issue for understanding interdependency challenges that impact IS projects in general and IS outsourcing project in particular. Unlike insourcing projects, IS outsourcing projects often cross organizational boundaries, cultural settings, multiple geographical boundaries and time zones, and thus pose additional challenges. Consequently, project coordination becomes a significant challenge as project performance increasingly depends on the cooperation of project stakeholders with different professional cultures, work practices, expectations, geographies, and time zones.

In the context of outsourcing arrangements, a smooth cooperation between vendor and client teams ensures that the work of all team members contributes towards achieving project goals. Project coordination thus involves knowledge exchange activities between a vendor team and a client team to ensure that project team members work towards meeting project goals – i.e., satisfy functionality requirements, deliver the system within budget and schedule, and meet quality standards. Such project coordination ensures that project team members agree to a common understanding of what they are analyzing, designing, and building. This suggests that vendor teams and client teams, especially the respective project managers, will share knowledge with one another as needed in order to deliver an information system that satisfies requirements and is completed within budget and schedule. Project coordination may be more prominent for managing complex IS outsourcing projects because the high uncertainty associated with planning, requirements, analysis and design activities will require frequent knowledge exchanges to complete tasks within established project budget and schedule.

Coordinating IS project activities between clients and vendors has been a topic of growing interest for both scholars and practitioners, and the effect of project coordination on project performance has been proposed in the IS literature. Sabherwal and Becerra-Fernandez found that project coordination played an important role in bridging communication gaps and facilitating the management of day-to-day activities. Gopal et al. found that coordination in a global software delivery context had a positive impact on software development performance. However, Srikanth and Puranam’s examination of 60 global software projects provides evidence that coordinating project activities across firm boundaries is prone to failure. Inconsistent findings observed in this area may be due to a focus on project coordination involving traditional IS outsourcing project activities rather than complex IS outsourcing project activities. Therefore, additional research on the effects of project coordination on project performance with an added focus on complex IS outsourcing project activities could shed light on the inconsistent empirical findings.

#### Project control

Client project managers are responsible for ensuring that their projects are progressing in conformance with the proposed budget, schedule, and objectives. They can assume leadership of IS projects through the exercise of control in dealing with the vendor project team. Project control refers to the set of mechanisms organizations use to motivate individuals to work in such a way that desired objectives are achieved. Project control has been recognized as important for managing projects.

According to control and agency theories, there are two modes of formal control available to managers to motivate and guide the activities of vendors: outcome and behavior controls. Outcome control involves the definition of specific desired task outputs. A manager’s focus when using outcome control is on defining appropriate targets, allowing vendors to decide how to meet those output targets. Thus, outcome controls are used to evaluate performance based on the extent to which the targets are met, rather than focusing on the processes used to achieve the targets.

In contrast, behavior control involves defining appropriate steps and procedures for vendors to follow as they perform their tasks. Thus, behavior control is used to evaluate performance based on the extent to which the vendor adheres to the prescribed procedures. Unlike outcome control, the underlying assumption behind the exercise of behavior control is that following prescribed steps and procedures will lead to favorable project performance. Thus, exercising behavior control minimizes deviation from the prescribed process and should therefore maximize the probability that the project will lead to a favorable outcome.

Project control literature suggests that outcome control affects project performance. Henderson and Lee’s study of IS design teams found that outcome control correlated positively with a team’s performance. Nidumolu and Subramani showed that a standard set of performance criteria improved project performance in software development. Gopal and Gosain’s study of IS outsourcing projects found that outcome control improved project performance. However, Tiwana and Keil found that outcome control did not enhance project performance for IS outsourcing projects.

Prior research has found a significant relationship between behavior control and project performance for insourcing
software development (e.g., 33) However, this relationship was not found to be significant when examining outsourcing software projects from either the client’s 32 or the vendor’s 31 perspective. These mixed findings highlight a need to gain a better understanding of project control and its impact on project performance, particularly in the context of complex IS outsourcing projects where high failure rates have been observed.

Research model

Our research model (Figure 1) proposes that outcome and behavior controls affect performance and these relationships are partially mediated by project coordination. It has been documented in theories of organizational behavior that integration and accomplishment of tasks or processes depend mainly on two constructs: coordination and control. 34 Though scholars tend to examine either project coordination (e.g., 15, 18) or project control (e.g., 12, 35) in isolation from one another, prior literature suggests that project coordination and control are interrelated in that control can support or undermine coordination 36, but they represent two distinct concepts. 21, 37 In software development projects, both project coordination and project control have been recognized as two significant and distinct activities (e.g., 36).

In the context of IS outsourcing projects, project control is the mechanism through which the client ensures that the vendor performs according to the agreed-upon specification of behaviors and outcomes. Outsourcing projects are contract-based engagements in which prescribed behaviors and outcome deliverables are defined based on agreements between the client and the vendor about how goals should be specified and measured, and how performance should be monitored. In contrast, project coordination is the exchange and communication of project information between vendor and client teams to distribute work among project members and to integrate dependent activities aimed at meeting project goals – a definition consistent with a summary of research on coordination which embodies (1) people working collectively, (2) interdependent tasks, and (3) achievement of a goal. 39

Prior research has shown that control mechanisms are effective for managing increased information processing requirements 40 and task interdependence. 41 Given that there often are variances between actual task progress and original project schedule as well as potential misunderstandings regarding task interdependencies, managers frequently rely on outcome and behavior controls to facilitate necessary information gathering and to ensure that output targets are met and prescribed procedures are followed. By managing and evaluating project deliverables and adherence to procedures, outcome and behavior controls would impact project performance. However, control should also affect project coordination. While outcome control provides information necessary to manage task interdependencies, behavior control facilitates the development of a shared mental model for task procedures, which enables the constant evaluation of project goals and compliance to procedures. The effects of outcome and behavior control are particularly pronounced in complex IS outsourcing project where task uncertainties force significant search process to produce the information needed to execute tasks. 42

It is well documented that the management of interdependent tasks in software development occurs through routine evaluation of project requirements and goals (i.e., project coordination) which effectively influences project performance. Indeed, the aim of project coordination is to improve performance. 43 Cray 44 contends that “[t]he pattern of coordination can be imposed through an act of control, but the resulting responsibilities are rooted in coordination.” Thus, we argue on the basis of prior research that outcome and behavior controls are positively associated with project performance and project coordination, and that project coordination mediates the relationships between outcome and behavior controls and project performance.

Since the use of control mechanisms has been proposed as an effective approach for managing increased task interdependencies and behavioral challenges 45, clients rely on control mechanisms to influence project coordination and performance. The use of outcome control requires a vendor to report project progress to a client based on agreed-upon outcome measures. Consequently, a client becomes aware of the project status which gives him/her the opportunity to evaluate whether interdependent tasks are carried out properly and, therefore, is able to take corrective measures if necessary. Working together and evaluating task interdependencies aids in making progress towards meeting project goals. For example, if the start of a task is dependent on the completion of three predecessor tasks, information about the status of the predecessor tasks enables a client to manage interdependent

![Figure 1. Research model.](image-url)
activities to ensure that the successive task is on target and on trajectory towards meeting project goals. Therefore,

Hypothesis 1: Outcome control positively impacts project performance, and project coordination mediates this relationship.

On the other hand, a client’s use of behavior control suggests that a vendor is obligated to share information regarding how they are conforming to predefined procedures. Such information and subsequent corrective actions force the vendor to maintain consistent and uniform processes through the development of a shared mental model for task procedures.\(^{36}\) Shared understanding among software team members about the process of completing a task improves coordination activities and helps the team to meet project specifications.\(^{37}\) For example, if a time-boxed approach to SCRUM is the preferred development methodology as opposed to the traditional Waterfall approach, a client can redirect a vendor through education and development of a common shared understanding should a vendor’s behaviors deviate from the iterative and incremental process prescribed by a client. Coordination of these activities is important to ensure that project goals are achieved which impacts overall performance.

Hypothesis 2: Behavior control positively impacts project performance, and project coordination mediates this relationship.

**Research methodology**

Data used for testing the hypotheses was collected through a field study based on surveys of managers of outsourced IS projects. To reduce threats from common methods bias/variance, two separate, time-phased, web-based surveys were administered.\(^{38,39}\) In the first survey, IS project managers were asked to provide responses about the antecedents (project coordination and project control). Two weeks following completion of the initial survey, the same IS project managers responded to a second survey regarding project performance measures.

**Study sample**

We surveyed the members of the Information Systems Specific Interest Group of the Project Management Institute (PMI-ISSIG), an international organization of IS project managers. To encourage participation, survey participants were entered into a drawing for a 33% chance to receive a $25 gift certificate of their choice selected from www.gifcertificates.com. Two reminders were sent two weeks apart after the initial PMI-ISSIG-sponsored e-mail was sent; similarly, two reminders were sent two weeks apart after the link to the second questionnaire was sent out to only those who responded to the first survey. Email addresses and project titles were captured from those participating in the first survey so that we could reliably send the second survey directly to the respondent with a reference to the project title.

Participation and project selection were based on three criteria. First, a portion or all of the IS project work had to be outsourced to a vendor. Second, outsourced IS projects had to have been completed during the last 12 months. Completion was considered important so that the respondents could respond to project performance questions. Twelve months was considered important to minimize recall bias and to ensure that respondents could accurately respond to the survey questions. Third, the completion of both questionnaires was required. This requirement also qualified respondents to participate in the drawing for a gift certificate.

For each project, the IS project manager was defined as the manager from the client’s organization responsible for the day-to-day management of the IS outsourcing project. Among the 245 first questionnaires received, 204 respondents (representing a total of 204 firms) completed the second survey (83.7% response rate).

The industry distribution of the 204 organizations is shown in Table 1. The size of the 204 projects varied in terms of project cost, duration, and project team size (see Table 2). Over 80% of projects in the sample involved packaged software implementation (33%), new software development (25%), or a major enhancement of existing software (24%). The primary development methodologies used were waterfall (N = 101), prototyping (N = 27), and object-oriented (N = 19) approaches with the projects focusing on Accounting/Finance, Sales, and Operations (distribution/logistics).

Among the 204 completed surveys, 198 respondents indicated the project lifecycle stage at which they outsourced their

<table>
<thead>
<tr>
<th>Industry</th>
<th>No. of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>5</td>
</tr>
<tr>
<td>Banking &amp; Finance</td>
<td>32</td>
</tr>
<tr>
<td>Communications</td>
<td>25</td>
</tr>
<tr>
<td>Computers &amp; Software</td>
<td>32</td>
</tr>
<tr>
<td>Consulting</td>
<td>24</td>
</tr>
<tr>
<td>Insurance</td>
<td>21</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>39</td>
</tr>
<tr>
<td>Medicine &amp; Health</td>
<td>19</td>
</tr>
<tr>
<td>Oil &amp; Petroleum</td>
<td>12</td>
</tr>
<tr>
<td>Publishing &amp; News</td>
<td>6</td>
</tr>
<tr>
<td>Real Estate</td>
<td>3</td>
</tr>
<tr>
<td>Restaurant &amp; Hotel</td>
<td>4</td>
</tr>
<tr>
<td>Transportation</td>
<td>18</td>
</tr>
<tr>
<td>Utilities</td>
<td>10</td>
</tr>
<tr>
<td>Wholesale &amp; Retail</td>
<td>12</td>
</tr>
<tr>
<td>Other</td>
<td>33</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>262*</td>
</tr>
</tbody>
</table>

* Organization conducts business in multiple industries.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Range</th>
<th>Median</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>N(^{b})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Duration</td>
<td>1–75</td>
<td>11.0</td>
<td>14.44</td>
<td>11.23</td>
<td>187</td>
</tr>
<tr>
<td>(months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Budget</td>
<td>5,000–650,000,000</td>
<td>590,000</td>
<td>6,633,489</td>
<td>49,457,272</td>
<td>175</td>
</tr>
<tr>
<td>($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS Team Members</td>
<td>2–180</td>
<td>13.0</td>
<td>21.13</td>
<td>25.73</td>
<td>190</td>
</tr>
</tbody>
</table>

\(^{b}\) Number of respondents.
project activities. Since our study focuses on complex IS outsourcing projects, our final analysis was based on 189 outsourced projects that involved both business-based and technology-based activities – i.e., Project Selection, Initiation, and Planning; Requirements Determination; Analysis and Design; Coding and Testing; Installation and Training/Documentation; and Maintenance.

Job titles of the respondents included Project Manager, Technical Manager, and Project Director. These respondents had 3 to 40 years of experience in IS with an average of 18.32 years (standard deviation of 7.46 years). The number of years in their current positions (at their current organizations) ranged from 1 to 27, averaging 4.85 years (standard deviation of 4.11 years).

### Survey development

Existing instruments were used or adapted to measure constructs wherever possible; scales for the dependent and the independent variables were derived from earlier work. Scale items and literature sources are shown in the appendix. The conceptualization and measurement of project performance in this study is consistent with prior project management literature investigating outsourced IS project performance, and includes whether the project was completed within schedule and budget, and to the client’s satisfaction.\(^{8,22,28}\) Measures of behavior and outcome control were based on scales described in Kirsch\(^{25,38}\) and colleagues.\(^{27}\)

Some measurement items for coordination have been proposed and used by prior researchers\(^{50,51}\); however, there is no agreed-upon, standard measurement for project coordination. Thus, in accordance with the literature, scale items for project coordination were adapted from the literature to capture the notion of management of interdependencies between activities that directly contribute to project goals – namely budget, schedule, and scope.\(^{21}\) The items focus on measuring the extent to which the client team and the vendor team are coordinated with respect to project goals.

Consistent with prior IS outsourcing research project, project size, and vendor reputation are included in the model to account for the use of formal controls and project coordination. Project size is commonly used as a control variable when examining project performance, and is measured by the total number of client and vendor IS professionals working on the project.\(^{31}\) We also included vendor reputation as a control. We interpreted vendors’ reputation and proven track record to mean that they established themselves as better-than-average performers, and such reputation should influence project performance (e.g.,\(^{52}\)).

We used a sorting procedure to qualitatively assess the face validity and the construct validity of the initial measurement items for our constructs.\(^{53}\) Eight doctoral students enrolled in the IS program of a large U.S. university participated in the sorting procedure as judges. Each item in the initial measurement pool was printed on a 3 × 5-in. index card. In the sorting procedure, each judge was asked to carefully read the card and place it in one of the constructs used in this study. An additional category, “too ambiguous/unclear,” was included for the judges to put a card into if they felt it did not belong to any of the predefined constructs. The overall hit ratio was 79.2%, indicating that the judges placed most of the items with their intended constructs. Based on the results and the feedback from the judges, we changed the wording of two items designed to measure behavior control.

### Instrument validation

Cronbach’s alpha was used as an indicator of internal consistency.\(^{54}\) Nunnally\(^{55}\) suggests 0.70 as an acceptable cut-off for reliability. Each item was measured on a scale of one to seven. As shown in Table 3, all of the scales had Cronbach’s alphas above the cut-off value of 0.70, suggesting that they are reliable.

To assess convergent and discriminant validity, we performed factor analysis. One indication of convergent validity is that all items of a scale load together on one factor; with loadings above 0.40. An indication of discriminant validity is relatively low cross-loadings of items on other factors. This study exceeds the factor analysis requirement of a sample size-to-number of items ratio of 10:1.\(^ {55}\) A Principal Components Analysis (PCA) with Varimax Rotation (with Kaiser Normalization) technique was used, and components with eigenvalues greater than one were extracted.

Table 4 displays the results of the factor analysis; five factors were extracted. The six items measuring outcome control did not load cleanly together; in particular, two items (1 and 3) had high cross-loadings and were judged to be problematic. Similarly, the five items measuring behavior control did not load cleanly together; in particular, two items (4 and 5) had high cross-loadings and were judged to be problematic. Therefore, these items were excluded from the data analyses. All other items for other constructs loaded cleanly as intended without significant cross-loadings. After excluding the four problematic items, all scales demonstrated both convergent and discriminant validity. Cronbach’s alpha for the revised behavior and outcome control scales were satisfactory (0.780 and 0.701, respectively). After completing reliability and validity tests, 189 completed matched-pair surveys were used in the final analysis.

### Table 3. Reliability and descriptive statistics.

<table>
<thead>
<tr>
<th>Construct</th>
<th>$ of items</th>
<th>N</th>
<th>Cronbach’s Alpha</th>
<th>Range</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Performance</td>
<td>6</td>
<td>189</td>
<td>0.937</td>
<td>1.00–7.00</td>
<td>4.45</td>
<td>1.73</td>
</tr>
<tr>
<td>Project Coordination</td>
<td>3</td>
<td>189</td>
<td>0.852</td>
<td>1.00–7.00</td>
<td>5.54</td>
<td>1.24</td>
</tr>
<tr>
<td>Outcome Control</td>
<td>4</td>
<td>186</td>
<td>0.701</td>
<td>1.75–7.00</td>
<td>5.27</td>
<td>1.10</td>
</tr>
<tr>
<td>Behavior Control</td>
<td>3</td>
<td>189</td>
<td>0.780</td>
<td>1.00–7.00</td>
<td>4.98</td>
<td>1.39</td>
</tr>
<tr>
<td>Vendor Reputation</td>
<td>2</td>
<td>189</td>
<td>0.877</td>
<td>1.00–7.00</td>
<td>5.17</td>
<td>1.40</td>
</tr>
</tbody>
</table>
Table 4. Factor analysis.

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Performance1</td>
<td>0.789</td>
<td>0.189</td>
<td>0.210</td>
<td>0.058</td>
<td>0.115</td>
</tr>
<tr>
<td>Project Performance2</td>
<td>0.795</td>
<td>0.180</td>
<td>0.131</td>
<td>0.062</td>
<td>-0.016</td>
</tr>
<tr>
<td>Project Performance3</td>
<td>0.818</td>
<td>0.180</td>
<td>0.131</td>
<td>0.038</td>
<td>0.111</td>
</tr>
<tr>
<td>Project Performance4</td>
<td>0.855</td>
<td>0.181</td>
<td>0.103</td>
<td>-0.022</td>
<td>0.187</td>
</tr>
<tr>
<td>Project Performance5</td>
<td>0.845</td>
<td>0.171</td>
<td>0.142</td>
<td>-0.096</td>
<td>0.253</td>
</tr>
<tr>
<td>Project Performance6</td>
<td>0.852</td>
<td>0.142</td>
<td>0.137</td>
<td>-0.007</td>
<td>0.314</td>
</tr>
<tr>
<td>Project Coordination1</td>
<td>0.218</td>
<td>0.823</td>
<td>0.089</td>
<td>-0.006</td>
<td>0.176</td>
</tr>
<tr>
<td>Project Coordination2</td>
<td>0.345</td>
<td>0.761</td>
<td>0.313</td>
<td>-0.012</td>
<td>0.005</td>
</tr>
<tr>
<td>Project Coordination3</td>
<td>0.247</td>
<td>0.788</td>
<td>0.171</td>
<td>0.070</td>
<td>0.144</td>
</tr>
<tr>
<td>Outcome Control2</td>
<td>0.096</td>
<td>0.277</td>
<td>0.669</td>
<td>0.213</td>
<td>0.081</td>
</tr>
<tr>
<td>Outcome Control4</td>
<td>0.174</td>
<td>0.311</td>
<td>0.580</td>
<td>0.191</td>
<td>0.128</td>
</tr>
<tr>
<td>Outcome Control5</td>
<td>0.167</td>
<td>0.246</td>
<td>0.783</td>
<td>0.043</td>
<td>0.138</td>
</tr>
<tr>
<td>Outcome Control6</td>
<td>0.181</td>
<td>0.083</td>
<td>0.699</td>
<td>0.070</td>
<td>0.086</td>
</tr>
<tr>
<td>Behavior Control1</td>
<td>0.053</td>
<td>0.080</td>
<td>-0.096</td>
<td>0.031</td>
<td>-0.048</td>
</tr>
<tr>
<td>Behavior Control2</td>
<td>0.018</td>
<td>0.024</td>
<td>0.266</td>
<td>0.024</td>
<td>0.130</td>
</tr>
<tr>
<td>Behavior Control3</td>
<td>0.117</td>
<td>0.056</td>
<td>0.324</td>
<td>0.071</td>
<td>0.066</td>
</tr>
<tr>
<td>Vendor Reputation1</td>
<td>0.266</td>
<td>0.168</td>
<td>0.114</td>
<td>0.059</td>
<td>0.901</td>
</tr>
<tr>
<td>Vendor Reputation2</td>
<td>0.383</td>
<td>0.132</td>
<td>0.091</td>
<td>0.079</td>
<td>0.823</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>0.6976</td>
<td>2.486</td>
<td>1.547</td>
<td>1.211</td>
<td>1.051</td>
</tr>
<tr>
<td>% Variance Explained</td>
<td>38.753</td>
<td>13.812</td>
<td>8.594</td>
<td>6.730</td>
<td>5.841</td>
</tr>
</tbody>
</table>

(1) Project Performance  
(2) Project Coordination  
(3) Outcome Control  
(4) Behavior Control  
(5) Vendor Reputation

Analysis

Correlations among the variables included in the research model are shown in Table 5. The results show a significant correlation between Project Coordination and Project Performance as well as a significant correlation between Outcome Control and Project Performance. Outcome Control also correlated significantly with Behavior Control and Project Coordination. Behavior Control, however, was not significantly correlated with Project Performance.

Before proceeding to test our research model, several tests were conducted to check the assumptions behind regression modeling. The first test assessed whether or not the error terms were normally distributed. For the dependent variable, residuals were plotted against their expected values. Each plot produced a reasonably straight line, suggesting that this assumption holds true.56 A second test checked for outliers. Scatter plots of each independent variable against each dependent variable were generated and examined. There were no outliers. Therefore, all data points were retained and we proceeded to test our research model.

In order to test our research model, we conducted a series of regressions using the Hayes and Preacher57 approach for mediation analysis. Specifically, we used the MEDIATE macro for SPSS which was obtained from Hayes’ website (http://www.afhayes.com/spss-sas-and-mplus-macros-and-code.html). MEDIATE was chosen for two reasons: (1) it has the ability to handle multiple independent variables simultaneously (and our research model has two independent variables), and (2) it uses a bootstrapping approach for testing the significance of indirect effects.

We chose the bootstrapping approach58,59 for testing the significance of indirect effects over the more traditional Sobel’s test of indirect effects. The bootstrapping approach is viewed as superior because Sobel’s test assumes that the sampling distribution of the indirect effect (ab) is normal, when in fact it is often skewed leading to biased estimates. Bootstrapping overcomes this problem. Bootstrapping involves repeatedly sampling with replacement from the data-set and estimating the indirect effect in each resampled data-set. By resampling thousands of times, the sampling distribution for ab can be approximated and used to construct confidence intervals for the indirect effect. In our analysis, we set the number of samples to 10,000.

Following the approach described above, we conducted three regressions: (1) the independent variables (Behavior Control and Outcome Control) and control variables (Project Size and Vendor Reputation) predicting the dependent variable (Project Performance), (2) the independent variables and control variables predicting the mediator (Project Coordination), and (3) the independent variables (IVs), the mediator, and the control variables predicting the dependent variable (DV). Mediation is established when the IVs are found to have significant effects on the DV and the mediator, respectively, in the first two regression equations. Further, if the IVs have significant effects on the DV in the presence of the mediator in the third regression equation, and the effects of the IVs on the DV are less in the third equation than in the first, then partial mediation is indicated (if these effects become insignificant in the third equation, full mediation is indicated). Table 6 shows the results of our mediation analysis. Tolerance and variance inflation factor scores indicated no multicollinearity problems.

Results

As indicated in Table 6, outcome control had a significant effect on both project performance (Model 1) and project coordination (Model 2), while behavior control did not have a significant effect on either. Project coordination had a significant effect on project performance (Model 3), and the effect of outcome control on project performance was significant even in the presence of the mediator (project coordination), though its effect was weakened relative to the direct effect observed in Model 1. These results suggest that the effect of outcome control on project performance is partially mediated by project coordination.

In order to test the significance of the indirect effects, we examined bias-corrected bootstrap confidence intervals. Consistent with the results of Model 1 and Model 2, we found that there was no statistically significant indirect effect of behavior control on project performance as the 95% confidence interval constructed for the indirect effect (−0.078, 0.029) contained zero. The indirect effect of outcome control on project performance, however, was 0.210, and this effect was found to be statistically significant as the 95% confidence interval (0.109, 0.337) did not contain zero.

Table 5. Correlations.

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Performance</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Coordination</td>
<td>0.517***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome Control</td>
<td>0.410**</td>
<td>0.470**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavior Control</td>
<td>0.068</td>
<td>0.109</td>
<td>0.359**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Vendor Reputation</td>
<td>0.517**</td>
<td>0.373**</td>
<td>0.304**</td>
<td>0.154*</td>
<td>1</td>
</tr>
<tr>
<td>Project Size</td>
<td>0.075</td>
<td>-0.012</td>
<td>0.132</td>
<td>0.149*</td>
<td>0.102 1</td>
</tr>
</tbody>
</table>

*p < 0.05 **p < 0.01
The results provide partial support for the proposed hypotheses (see Table 6). Specifically, Hypothesis 1 was supported; project coordination was found to partially mediate the relationship between outcome control and project performance. The indirect effect of outcome control on project performance was 0.210 while the direct effect in the presence of the mediator was 0.269. Based on our results, 44% of the total effect of outcome control on project performance was carried indirectly through project coordination. Hypothesis 2 was not supported; project coordination did not mediate the effect of behavior control on project performance. Indeed, based on our findings, behavior control had no significant effect on either project coordination or project performance. One of our control variables, vendor reputation, was found to be significant, suggesting that when a credible vendor is involved in the project, project performance increases.

**Discussions and implications**

While project coordination and control have been viewed by prior studies as two important project management constructs that can affect project performance, little is known about how project coordination and control are related to each other and how they collectively affect project performance especially for complex IS outsourcing projects. As IS project planning, requirements determination, and logical and physical systems designs activities continue to be outsourced, managing such complex IS outsourcing projects have become increasingly difficult. There is a critical need for empirical research that provides insights and practical guidelines to the organization on how to manage the high level of uncertainty involved in complex IS outsourcing projects.

Our research supports a mediating role of project coordination on the effect of outcome control on project performance. This finding extends the traditional view of outcome control only as a direct predictor of project performance by demonstrating an additional path through which outcome control affects project performance. It also suggests that project coordination and control are related to each other through a mediating path. Revealing the link between the two constructs is an important contribution to the extant theories of project coordination and control. In the context of project activities wrought with uncertainties, by constantly evaluating progress and performance against the project's schedule, budget, and scope targets, the project team detects performance gaps and recognizes issues and problems that need to be resolved. As a result, outcome control facilitates project coordination to ensure that the project stays on track towards successful completion.

However, our research does not support a mediating role of project coordination on the effect of behavior control on project performance. One plausible explanation is that behavior control increases the conformance of the project team’s behavior to pre-defined procedures and rules, but it does not necessarily facilitate coordination activities regarding project budget, schedule, and scope, especially in the context of IS outsourcing projects. Whereas behavior control reduces the variance in team behavior, it does not necessarily increase team members’ awareness of project goals. Taken together, our research suggests that outcome control and behavior control do not affect project coordination in the same way, and thus they play different roles in managing IS outsourcing projects. We suggest that these different roles are more pronounced in complex IS outsourcing projects because of the low contract specificity for the types of activities involved. This study advances our understanding of the role of outcome control, behavior control, and project coordination in project performance and suggests more complex relationships among them than prior studies have revealed.

Although the positive effect of project control on IS project performance seems to be generally accepted, much of the project control literature has focused on IS insourcing projects. As a result, the effect of project control on IS outsourcing project performance is not well known (e.g., 32). Our research suggests that outcome control has a direct positive effect on IS outsourcing project performance, whereas behavior control has no significant effect on project performance. Among the few studies examining outcome control and project performance, the results of our study are consistent with the main findings which demonstrate a positive and significant relationship between outcome control and project performance. The direct effect between outcome control and project performance is consistent with Gopal and Gosain 31 while the indirect effect found in our study may explain the insignificant result reported by Tiwana and Keil. 32 Moreover, it is possible that our results differ from those of Tiwana and Keil 32 given our focus on complex IS outsourcing projects that involved activities where coordination plays an important role in managing interdependencies across organizational
boundaries. We offer an explanation that about half of the total effects of outcome control on project performance was carried indirectly through project coordination.

In contrast, we did not find support for a direct effect of behavior control on project performance. Some prior studies also have not found a significant effect of behavior control on project performance. One plausible explanation is that when contract specificity is low, there exists ambiguity regarding what vendors need to adhere to. It could also be that appropriate evaluation information may not be available, project management methodology may differ often causing the vendor to execute their own approach, or behaviors may not be observable. Though we believe that these challenges could be mitigated through coordinating various project activities, our study shows that the indirect effect of behavior control on project performance was not significant.

Taken together, our research suggests that outcome control is effective for complex IS outsourcing projects. Importantly, when exercising outcome control, managers should take care to manage project interdependencies as nearly half of the project performance is attributed to the effectiveness of coordinating project activities. Without effective project coordination, the indirect effect of outcome control on project performance becomes weaker. Our results suggest that project managers should not blindly use project control methods; rather, they should use appropriate resources to implement outcome control and manage project coordination to improve project performance. Unlike IS insourcing projects where behavior control has been found to impact project performance, the results from this study suggest that managers do not benefit from exerting efforts to exercise behavior control in contemporary IS outsourcing projects.

Our study has limitations. First, the findings from our study may only reasonably generalize to the IS outsourcing project domain. The applicability of our results in other settings involving IS projects should be empirically assessed. The second limitation is that our research model did not include antecedents or moderators. We proposed and tested an uncomplicated research model given that our objective was to better understand the relationship between project coordination and control and their effects on project performance. Future studies are needed to extend our research model to include conditions such as behavior observability, outcome measurability, and knowledge of the transformation process that facilitate or moderate the findings offered in this study. Finally, our research model does not include informal control (clan and self) though we recognize its role in project control literature. Clan control is a team-based phenomena, and our interest revolved around controls where motivation is induced more from formal specifications as opposed to shared values and norms or self-regulated behaviors. Moreover, clan control is typically examined in a context where a clan (i.e., a team) is colocated allowing a project manager to influence their behavior. Nevertheless, more studies including informal controls and their relationships with project coordination and project performance are needed.

Conclusion

The purpose of this study was to enhance our understanding of the two key challenges faced by IS outsourcing projects: project coordination and control. Using project coordination and control theories along with IS outsourcing and information processing literatures, we developed a model that specifies the mediating role of project coordination in the relationship between project control and project performance. The results suggest that the effect of outcome control on project performance is partially mediated by project coordination whereas behavior control had no effect.

Our findings provide empirical evidence about the relationship between project coordination and control, and their relationship to project performance. The results also shed light regarding the mixed findings reported in previous studies related to project control. Finally, this study adds to the body of evidence about the importance of project coordination and control to explain project performance. The research community continues to examine project coordination and control in the IS outsourcing context as firms continue to seek to improve the project success rate. We hope our research serves as a stepping stone for furthering our understanding of how organizations can better utilize project coordination and control mechanisms to manage the increasingly complex IS outsourcing projects.

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References


Appendix
(Measures)

Project Performance:\(^8,22,61\)
Please indicate the extent to which you agree or disagree with each of the following statements about the outcomes of the activities performed by this vendor:

a. The activities performed by this vendor were completed within schedule.
b. The activities performed by this vendor were completed within budget.
c. The activities performed by this vendor satisfied contract requirements.
d. The activities performed by this vendor were of high quality.
a. Based on the activities performed by this vendor, we would choose the same vendor for future projects.
b. Based on the activities performed by this vendor, we would recommend this vendor to other project managers.

Project Coordination:\(^50,51\)
Please respond to each of the following statements about coordination with this vendor during the project. Extent to which your team and the vendor team were well coordinated with regard to

a. project scope
b. project schedule
c. project budget

Behavior Control:\(^25,27,38\)
Please indicate the extent to which you agree or disagree with each of the following statements about monitoring this vendor’s activities:

a. We expected this vendor to follow a written sequence of steps to achieve their goals.
b. We assessed the extent to which this vendor followed existing procedures during the project.
c. We enforced this vendor to adhere to written rules and procedures.
d. "We placed significant weight on project-related behaviors when assessing this vendor’s performance.
e. "We held this vendor accountable for how they behaved during the project.

Outcome Control:\(^25,27\)
Please indicate the extent to which you agree or disagree with each of the following statements about monitoring this vendor’s activities:

a. "We used pre-established targets as benchmarks to evaluate this vendor’s performance.
b. We placed significant weight on this vendor’s project completion within schedule.
c. "We placed significant weight on this vendor’s project completion within budget.
d. We placed significant weight on this vendor’s project completion to the satisfaction of the users.
e. We evaluated performance by the extent to which this vendor accomplished project goals.
f. The rewards for this vendor were linked to results.

Vendor Reputation:\(^53\)
Please indicate the extent to which you agree or disagree with each of the following statements prior to the start of this project:

a. This vendor had a good reputation.
b. This vendor had a proven track record.

Project Size:\(^31\)
In total, approximately how many people were directly involved in the project?
- Internal IS staff: _______
- External consultants/vendor staff: _______

* Dropped items.