

Control and Performance in IS Projects: A Meta-Analysis of Hierarchical and Market- based Control Relationships

Completed Research Paper

Konrad Dongus

Technische Universität München
Chair for Information Systems
Boltzmannstraße 3
D-85748 Garching
konrad.dongus@in.tum.de

Simon Ebert

Technische Universität München
Chair for Information Systems
Boltzmannstraße 3
D-85748 Garching
simon.ebert@in.tum.de

Michael Schermann

Technische Universität München
Chair for Information Systems
Boltzmannstraße 3
D-85748 Garching
michael.schermann@in.tum.de

Philip Yetton

Australian School of Business
The University of New South Wales
Kensington, NSW 3052, Australia
p.yetton@unsw.edu.au

Helmut Krcmar

Technische Universität München
Chair for Information Systems
Boltzmannstraße 3
D-85748 Garching
krcmar@in.tum.de

Abstract

Literature on IS project control distinguishes between hierarchical and market-based control relationships. Prior studies typically investigate one of these two forms of control relationships in isolation. Hence, little is known about the differences between hierarchical and market-based control relationships. Responding to this gap, we analyze how the effects of control modes on IS project performance differ in hierarchical compared with market-based control relationships. Specifically, we conduct a meta-analysis to compare the effects of control modes on IS project performance reported in research on hierarchical and market-based control relationships. The results suggest that the effects of behavior and self-control on performance differ between these two forms of control relationships. Based on our results, we derive implications for complementary and substitutive effects between control modes, and for interrelations among hierarchical and market-based control relationships.

Keywords: IS control, IS outsourcing, IS project management, IS project success, Meta-analysis, Governance

Introduction

There is an extensive literature on the relationship between control and information systems (IS) project performance. In this literature, control is defined as a process by which the controller provides guidance to the controllee (Goo et al. 2009) and aligns the controllee's with the controller's goals (Kirsch et al. 2002). The general finding is one of a positive effect of control on project performance (e.g., Chen et al. 2011; Henderson and Lee 1992; Liu et al. 2008).

This literature on IS project control can be partitioned into two research streams (Gopal and Gosain 2010; Kirsch et al. 2002). In one, hierarchical control relationships are the unit of analysis: A project manager controls the project team members within an organization (e.g., Henderson and Lee 1992). In the other stream, market-based control relationships are the unit of analysis: A client representative controls a vendor project manager when implementing an outsourcing strategy (e.g., Tiwana 2010).

Prior studies typically investigate these two forms of control relationships independently. Hence, hierarchical and market-based control relationships "are not explicitly separated in theoretical treatment" (Gopal and Gosain 2010, p. 961). The absence of a comparative analysis of these two research streams raises questions for both theory and practice.

In theory, the question is: What are the similarities and differences between hierarchical and market-based control relationships (Gopal and Gosain 2010). For practice, the question is: How should project managers and client representatives choose appropriate controls in hierarchical compared with market-based relationships (Choudhury and Sabherwal 2003; Kirsch 2004). We address these two questions by theoretically integrating the two research streams and estimating the effects of control on IS project performance for hierarchical and market-based control relationships.

We adopt meta-analysis to compare and contrast the effect of control on IS project performance in hierarchical and market-based control relationships. Our results provide strong support for the general claim that the effect of control on IS project performance differs between hierarchical compared with market-based control relationships. Building on our results, we derive implications on the structure of control portfolios in hierarchical and market-based control relationships. In addition, we explore interrelations among hierarchical and market-based control relationships to guide future IS project control research.

The remainder of this paper is structured as follows. In the next section, we review the literature on control in IS projects and derive four hypotheses for the effects of control on IS project performance. The third section describes the meta-analysis methodology, including the literature search, coding of studies, analysis, and limitations. The fourth section presents the results. The fifth section discusses the findings and implications for theory and practice. The last section presents our conclusions, highlighting the contributions.

Theoretical Background and Hypotheses

We begin by briefly reviewing the literature on control in IS projects. As background, this documents the literature on which we draw to develop four hypotheses covering the various effects of control on IS project performance in hierarchical and market-based control relationships. Taking this as our point of departure, we identify the critical differences between hierarchical and market-based control relationships. These are then used to develop hypotheses that specify how the effect of control on IS project performance differs between hierarchical compared with market-based control relationships.

Control in IS Projects

Control refers to "any process in which a person or group of persons or organization of persons [the controller] determines [...] what another person or group or organization [the controllee] will do" (Tannenbaum 1962, p. 239). This process incorporates formal (i.e., behavior and outcome control) and informal (i.e., clan and self-control) control modes. Behavior control provides guidance from the controller to the controllee on appropriate behavior and the processes to be followed (Goo et al. 2009). Outcome control aligns the controllee's with the controller's goals (Kirsch et al. 2002). Informal control modes are

used especially in cases where the controller is not able to exert formal control modes (Kirsch 1997), supplementing the formal control modes (Tiwana and Keil 2010).

Effective¹ use of each of the four control modes requires three essential activities: control specification, control evaluation, and control feedback, including rewards and sanctions (Ouchi 1977). The specific design of these activities is contingent on which of the four control modes is selected (Jaworski 1988; Kirsch 1997; Ouchi 1979).

First, behavior control requires the controller to specify procedures to be followed by the controllee (Ouchi 1977). These procedures include both technical and organizational procedures. The former include, for example, the development methodology (Choudhury and Sabherwal 2003) and programming methodologies (Nidumolu and Subramani 2003). The latter include, for example, work assignment, role definitions, and responsibilities (Henderson and Lee 1992). The controller evaluates whether the controllee follows the specified procedures, and rewards or sanctions accordingly (Kirsch 2004). Control theory proposes that effective behavior control is contingent on two conditions being satisfied. One is that the controller must be able to specify the appropriate behavior for the controllee (Ouchi 1979). The other is that the controller must be able to monitor that behavior (Kirsch 1996; Ouchi 1979).

Second, outcome control requires the controller to specify products and/or services to be delivered by the controllee (Ouchi 1977). Product-related or quality-based outcome control (Gopal and Gosain 2010) refers to the functional and nonfunctional requirements, which determine the expected level of performance (Henderson and Lee 1992). Process-related or efficiency-based outcome control (Gopal and Gosain 2010) refers to defined budgets and schedules (Kirsch 1996). At specified stages, the controller evaluates whether the controllee has achieved the specified outcomes, and rewards or sanctions accordingly (Kirsch 2004). Effective outcome control is contingent on the controller being able to measure the outcomes (Ouchi 1979).

Third, clan control requires the controller and the controllee to build a joint clan based on socialization around shared goals (Kirsch 1997; Ouchi 1980). These goals include shared norms, values, beliefs, trust, and mental models specifying appropriate behavior on the project (Srivastava and Teo 2012; Tiwana 2008). In discussions, dialogs, and meetings, the clan evaluates, often implicitly, whether a member's actions are consistent with the clan's promulgated values and beliefs (Kirsch 2004; Ouchi 1980). Based on this judgment, the clan rewards and sanctions the member. Rewards include group recognition. Sanctions include peer pressure (Kirsch 1997). Effective clan control is contingent on the project members, the clan, establishing strong group norms.

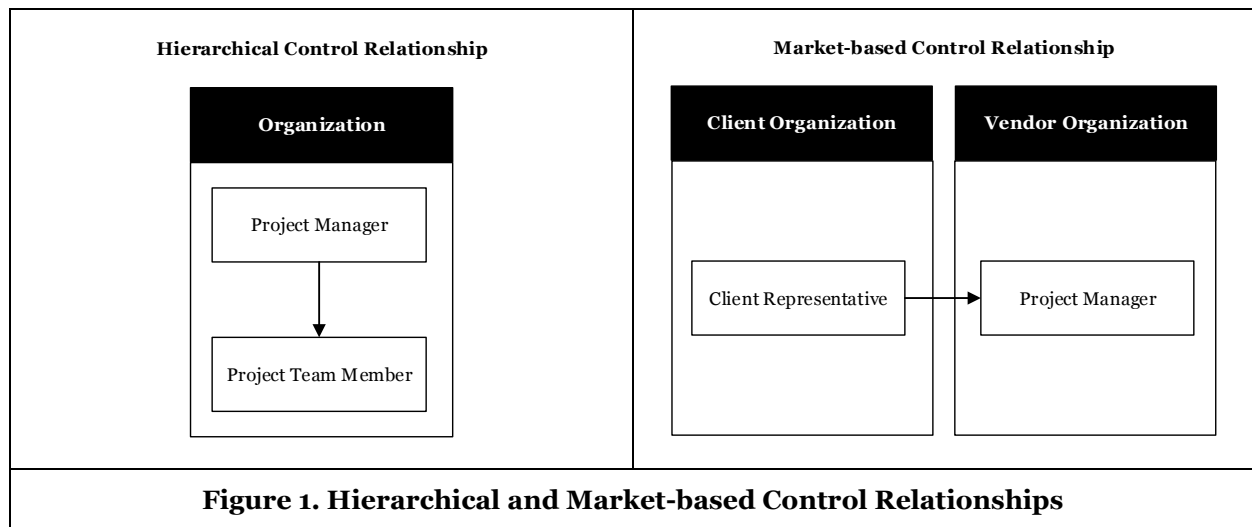
Fourth, self-control requires the controllee to specify both the goals and the actions required to achieve the goals (Henderson and Lee 1992; Kirsch 1996). Thus, self-control cannot be enforced by the controller but relies on the controllee (Kirsch 2004). During or after the project, the controllee evaluates whether they are following, or have followed, the specified actions and whether they are achieving, or have achieved, the specified goals (Kirsch and Cummings 1996). Based on this self-monitoring, the controllee rewards and/or sanctions him/herself (Kirsch and Cummings 1996). Effective self-control is contingent on two conditions being satisfied. One is that the controllee must have the autonomy to control his/her own actions (Kirsch et al. 2002). The other is that the controllee must possess the relevant expertise to specify the required actions and establish self-set goals (Henderson and Lee 1992).

Hierarchical and Market-based Control Relationships

The distinction between hierarchical and market-based control relationships is well established in the IS literature (e.g., Choudhury and Sabherwal 2003; Gopal and Gosain 2010; Kirsch et al. 2002). Hierarchical control relationships involve vertical/internal relationships between controllers and controlees. Typically, a project manager (superior) controls project team members (subordinates) within an organization (Henderson and Lee 1992; Ouchi 1977; Williamson 1979). Market-based control relationships involve horizontal/external relationships between controllers and controlees. Typically, a client representative controls a vendor project manager. Figure 1 depicts these differences. In practice, hierarchical and market-

¹ Throughout this paper, the term *effective* is used to describe positive effects on IS project performance.

based control relationships are not mutually exclusive and may exist simultaneously (Gopal and Gosain 2010).



To investigate hierarchical control relationships, prior research has adopted Ouchi's (1977; 1979; 1980) seminal work on hierarchical control (e.g., Guinan and Faraj 1998; Henderson and Lee 1992; Klein et al. 2006). Kirsch et al. (2002) argue that the prior theoretical thinking in IS project control had been limited to organizational hierarchies, in which a superior controls a subordinate, and call for future research on the use and impact of control in market-based control relationships.

Responding to that call, research has investigated market-based control relationships in IS projects (See, for example, Keil et al. 2013; Nagpal et al. 2011; Srivastava and Teo 2012). However, within this literature, hierarchical and market-based control relationships "are not explicitly separated in theoretical treatment" (Gopal and Gosain 2010, p. 961). For example, Choudhury and Sabherwal (2003) analyze control in outsourced IS projects but do not explicitly distinguish between hierarchical and market-based control relationships.

In this paper, we explicitly model the similarities and the differences between hierarchical and market-based control relationships in IS projects. Five differences are identified and examined. Table 1 summarizes these differences. First, an organizational boundary between the controller and the controllee exists in market-based control relationships, where the controller and the controllee are members of different organizations. In hierarchical control relationships, the controller and the controllee are both members of the same organization. Organizational boundaries restrict the effective transfer of information between organizations (Tushman 1977). Thus, organizations engage in boundary spanning to realize effective information transfer (March and Simon 1958). For example, Gopal and Gosain (2010) report a moderating effect of boundary spanning activities on the relationship between control and IS project performance.

Second, the controller's legitimate authority over the controllee is higher in hierarchical control relationships, where the project manager is the superior of the project team members (Henderson and Lee 1992). In contrast, legitimate authority is lower in market-based control relationships (Ouchi 1979). Prior literature argues that the relationship between control and IS project performance is contingent on the controller's legitimate authority (Tiwana 2008; Tiwana and Keil 2007).

Third, the controller's knowledge of the transformation process is higher under conditions of hierarchical control, in which the project manager is the controller, compared with market-based control relationships, in which the client representative is the controller. In hierarchical control relationships, the project manager holds high technical expertise, developed by conducting a large number and variety of IS projects (Levina and Ross 2003). In market-based control relationships, the client representative has limited technical knowledge because they frequently lack an in-depth understanding of IS development (Keil et al.

2013). Knowledge of the transformation process is a critical antecedent of control (Ouchi 1979) and is posited to influence the effectiveness of control (Choudhury and Sabherwal 2003; Kirsch et al. 2002).

Fourth, controllee behavior observability refers to the controller's ability to monitor the controllee's behavior (Kirsch 1996). This is critical to the application of agency theory to control theory (Eisenhardt 1985; Jensen and Meckling 1976). Controllee behavior observability is higher in hierarchical compared with market-based control relationships. In hierarchical control relationships, the project manager can frequently directly observe the behavior of the project team members (Henderson and Lee 1992). In contrast, in market-based control relationships, it is difficult for the client representative to observe the behavior of the project manager and project team members (Choudhury and Sabherwal 2003). Dibbern et al (2008) extend this finding to the offshoring context. They argue that the distance between the client and the vendor makes monitoring project team behavior by the client representative difficult and costly.

Fifth, shared values and beliefs are frequently higher in hierarchical compared with market-based control relationships. In hierarchical control relationships, shared values and beliefs are developed through the close and permanent working relationship between the project manager and the project team members (Henderson and Lee 1992). In addition, since the controller and the controllee belong to the same organization, they are more likely to share the same values and beliefs (Tiwana and Keil 2010). In market-based control relationships, shared values and beliefs are lower because prior interactions are frequently limited or non-existent (Choudhury and Sabherwal 2003).

Table 1. Differences between Hierarchical and Market-based Control Relationships		
Characteristics	Hierarchy	Market
Organizational boundary between controller and controllee (March and Simon 1958)	No boundary	High boundary
Controller's legitimate authority over the controllee (Ouchi 1979)	High	Low
Controller's knowledge of the transformation process (Ouchi 1979)	High	Low
Observability of controllee behavior (Eisenhardt 1985)	High	Low
Shared values and beliefs (Ouchi 1979)	High	Low

The Effects of Control Modes on IS Project Performance

Based on the distinctions in Table 1, we hypothesize how the effects of control modes on IS project performance differ between hierarchical compared with market-based control relationships. IS project performance is broadly categorized in terms of efficiency and effectiveness (Hoegl and Gemuenden 2001; Wallace et al. 2004). The efficiency dimension refers to the extent to which the project is well managed – that is, process performance (Hoegl and Gemuenden 2001). The effectiveness dimension refers to the extent to which the project outcomes meet quality expectations – that is, product performance (Henderson and Lee 1992). Gopal and Gosain (2010) argue that the efficiency and effectiveness dimension are interrelated. Accepting their argument, we study the effects of control modes on the combined performance dimensions.

Behavior control involves the controller specifying procedures that must be followed by the controllee (Ouchi 1979). Since the controller's main interest is a successful project, she/he attempts to specify performance-enhancing procedures (Tiwana and Keil 2010). This positive effect of behavior on project performance is subject to three conditions. First, specifying performance-enhancing procedures requires the controller to be knowledgeable about the transformation process (Ouchi 1979). The controller in hierarchical control relationships compared with market-based control relationships has a higher knowledge of the transformation process (Henderson and Lee 1992; Keil et al. 2013). So, the specified procedures are unlikely to be performance-enhancing in market-based control relationships.

Second, specifying procedures requires the controller to have legitimate authority over the controllee (Ouchi 1980). Legitimate authority is higher in hierarchical control compared with market-based control

relationships (Tiwana 2008). So, specifying procedures is not legitimate in market-based control relationships.

Third, monitoring behavior is difficult in market-based control relationships because it requires the behavior to be observable (Eisenhardt 1985). Behavior observability is higher in hierarchical control compared with market-based control relationships (Tiwana and Keil 2010). So, monitoring behavior is easy and low cost in hierarchical but difficult and high cost in market-based control relationships. Formally:

Hypothesis 1 (H1): There is a positive effect of behavior control on IS project performance in hierarchical but not in market-based control relationships.

Outcome control requires that the controller specifies the project outcomes to be delivered by the controllee (Ouchi 1979). IS project control literature neither argues, nor presents evidence on, why the differences should affect the controller's ability to specify and evaluate project outcomes. Instead, this literature frequently reports positive effects of outcome control on IS project performance in both hierarchical control relationships (e.g., Gopal and Gosain 2010; Maruping et al. 2009) and market-based control relationships (e.g., Choudhury and Sabherwal 2003; Tiwana 2008; Tiwana 2010). Formally:

Hypothesis 2 (H2): There is a positive effect of outcome control on IS project performance in hierarchical and in market-based control relationships.

Clan control requires that the controller and the controllee share social values and beliefs (Ouchi 1980). The assumption is that clan members share information, communicate, adopt best practices, and constantly evaluate and provide feedback on each other's work (Kirsch et al. 2010). These processes generate high levels of commitment, and mutual learning and collaboration (Gopal and Gosain 2010), which positively affect project performance (Lee 2001).

We argue that this positive effect of clan control on IS project performance is higher in hierarchical compared with market-based control relationships. The non-existent organizational boundary in hierarchical control relationships facilitates the sharing of values and beliefs between the project manager and the project team members (Henderson and Lee 1992). In contrast, the organizational boundary in market-based control relationships impedes the sharing of values and beliefs between the client representative and the project manager (Tiwana and Keil 2010). So, clan control is more effective in hierarchical compared with market-based control relationships. Formally:

Hypothesis 3 (H3): There is a positive effect of clan control on IS project performance that is higher in hierarchical compared with market-based control relationships.

Self-control requires that the controllee specifies the goals and the actions required to achieve the goals (Kirsch and Cummings 1996). Self-control is effective in cases where the controller does not prescribe goals using outcome control and/or actions using behavior control (Henderson and Lee 1992). With regard to goals, as hypothesized in H2, the controller is able to prescribe outcomes in both hierarchical and market-based control relationships. Thus, in both forms of control relationships, outcomes prescribed by the controller invalidate individual goals specified by the controllee. With regard to actions, as hypothesized in H1, the controller is able to prescribe behavior only in hierarchical control relationships. In market-based control relationships, the controller is inhibited from leveraging the controllee's superior technical expertise, granting autonomy to the controllee (Choudhury and Sabherwal 2003). In addition, the controllee's technical expertise in market-based control relationships allows them to effectively specify their own actions (Levina and Ross 2003). Formally:

Hypothesis 4 (H4): There is a positive effect of self-control on IS project performance in market-based but not in hierarchical control relationships.

Methodology

We adopted meta-analysis to investigate the relationship between control modes and IS project performance in hierarchical and market-based control relationships. Meta-analysis is a quantitative technique to integrate research findings from individual empirical studies (Glass 1976; Hedges and Olkin 1985; Hunter and Schmidt 1990; Hunter and Schmidt 2004). This methodology is especially appropriate for our research because it allows us to integrate and compare research findings from existing studies that focused exclusively on either hierarchical or market-based control relationships.

Literature Search

We searched the literature for quantitative empirical research studies reported in conference and journal papers (including forthcoming papers), dissertations, reports, and working papers. The intent of meta-analysis is to gather *all* relevant studies to estimate the true effects: the "results that would be obtained in an infinitely large, perfectly designed study or sequence of such studies" (Hunter and Schmidt 2004, p. 31). It follows that all studies are included whether they have been published in high quality journals or whether they have been published at all. Unpublished studies are especially important to address the so-called "file drawer problem", which refers to the issue that papers reporting non-significant results may not be published (Rosenthal 1979). Disregarding such studies would bias the true effect. Thus, an exhaustive literature search is essential to a meta-analysis (Cooper and Hedges 1994).

To conduct a comprehensive literature search, we adopt Webster and Watson's (2002) three step procedure: keyword search, backward search, and forward search. Although the first step may also take place in databases that contain unpublished studies (e.g., WorldCat Dissertations), this search approach is not sufficient to overcome the file drawer problem. Therefore, recent meta-analyses in IS (e.g., Sharma and Yetton 2007; Wu and Lederer 2009) suggest a number of additional literature searches, for example sending requests in mailing lists.

Consequently, we performed four complementary literature searches to minimize the potential file draw validity threat. First, we conducted a systematic keyword search in the following databases²: Association for Computing Machinery (ACM) Digital Library, Business Source Premier, IEEE Xplore, ProQuest ABI/INFORM, ProQuest Dissertations and Theses, Journal STORAGE (JSTOR), ScienceDirect, Association for Information Systems Electronic Library (AISEL), and WorldCat Dissertations and Theses³. The keyword search yielded 9,472 articles. Second, we conducted backward and forward searches. Backward search involves reviewing the references of the relevant studies; forward search means identifying studies that reference a relevant study (Webster and Watson 2002). Backward searches yielded only articles that were already found in the keyword search; forward searches did not yield additional articles. Third, we searched for working papers and forthcoming journal papers by screening the websites of 56 key authors identified in the previous steps, conducting keyword searches in Google, and searching the Social Science Research Network (SSRN). This led to the inclusion of one additional article. Fourth, we sent requests for unpublished working papers on several mailing lists (e.g., AISworld and AOM OCIS) and received three replies.

To be included in our meta-analysis, each study must meet three criteria. First, the study's unit of analysis is a hierarchical or market-based control relationship in IS projects. 60 studies met the first criterion. Second, the study measures project performance and at least one control mode as defined in the previous section (i.e., behavior, outcome, clan, or self-control). 24 studies met the second criterion. Third, the study includes the statistical information required to conduct meta-analysis: the correlation coefficient between control mode and performance, and the sample size⁴. 21 studies met the third criterion.

In total, the literature search revealed 24 studies that fulfill the first two criteria. We removed three studies because they do not fulfill the third criterion and four studies because they are previous versions (e.g., conference papers, dissertations, working papers, and journal papers based on the same sample) of journal

² Following Sabherwal et al. (2006), we used one or more of several keywords related to control (i.e., "control", "formal", "informal") and one or more of several keywords related to IS projects (i.e., "information system", "information technology", "software").

³ These databases included the major journals and conference proceedings in the IS and management discipline such as Management Information Systems Quarterly (MISQ), Information Systems Research (ISR), Journal of Management Information Systems (JMIS), Management Science (MS), Academy of Management Journal (AMJ), Strategic Management Journal (SMJ), International Conference on Information Systems (ICIS), Americas Conference on Information Systems (AMCIS), European Conference on Information Systems (ECIS), and Hawaii International Conference on System Sciences (HICSS).

⁴ When these statistics were missing, we contacted the corresponding author of the study with a request to share the missing statistics with us. This led to an inclusion of two additional studies providing five independent effect sizes.

papers that are also included in the meta-analysis. In sum, our meta-analysis includes 17 studies based on 17 independent samples, reporting 86 effect sizes for a total sample size of 1,705 IS projects^{5,6}.

Coding of Studies

For each study included in the meta-analysis, we extracted the following information: name and description of each variable measuring a control mode or project performance, the correlation coefficient between each control mode and project performance, the measurement error for each variable in terms of reliability coefficients, and the sample size for the study. In addition, we coded whether the study's unit of analysis is a hierarchical or market-based control relationship.

Our coding of project performance comprises process- and product-related performance criteria⁷. Process-related performance criteria include adherence to budgets and schedules (e.g., Keil et al. 2013; Klein et al. 2006; Liu et al. 2008). Product-related performance criteria include quality of project outcomes and satisfaction with outcomes (e.g., Goo et al. 2009; Guinan and Faraj 1998; Maruping et al. 2009). This conceptualization of project performance is consistent with the literature on IS project control (Gopal and Gosain 2010; Henderson and Lee 1992; Heumann et al. 2012; Srivastava and Teo 2012).

Our coding of control modes was very restrictive. We coded a variable as behavior, outcome, clan, and self-control in cases only in which the variable was explicitly conceptualized according to Ouchi (1979) and/or Kirsch (1997)⁸. Other concepts were not coded as control. For example, goal specificity (e.g., Rasch and Tos 1992) was not coded as outcome control, and social integration was not coded as clan control (e.g., Aladwani 2002). We deliberately conducted this coding restrictively to ensure that the conclusions of our results can be directly attributed to control theory in IS projects.

Analysis

We conducted subgroup-analyses to investigate the effects of control modes on performance in hierarchical and market-based control relationships. Therefore, the studies included in the meta-analysis were partitioned into two subgroups: hierarchical and market-based control relationships. For each subgroup, we corrected the effect sizes and calculated several meta-analytic outcomes.

Effect sizes are the “chief coins of the meta-analytic realm” (Rosenthal and DiMatteo 2001, p. 59) and represent the unit of meta-analysis. The effect sizes were obtained in the form of zero-order Pearson product-moment-correlation coefficients, which are among the most generally accepted effect size metrics in management (e.g., Geyskens et al. 2009) and IS literature (e.g., He and King 2008; Joseph et al. 2007). Being a scale-free measure, correlation coefficients are easy to interpret (Rosenthal and DiMatteo 2001). Fisher z-transformation was not applied because it creates a bias that can inflate the obtained estimates (Schmidt et al. 1988). Consequently, our meta-analytic calculations result in conservative estimates of the relationships between control and performance.

Dependent effect sizes occur when a study reports more than one correlation coefficient for a specific relationship. In these cases, we averaged the corresponding correlation coefficients (Hunter and Schmidt 2004; Palmatier et al. 2006). This avoids biased estimates that would result from including dependent effect sizes in a meta-analysis (e.g., He and King 2008; Palmatier et al. 2006). In total, 86 initial effect sizes were combined to 43 independent effect sizes.

The effect sizes were corrected for measurement error (Hunter and Schmidt 2004). Specifically, each correlation coefficient was divided by the product of the square root of the reliability coefficients for the

⁵ Represented in the references section by asterisks.

⁶ Distributed across publication type as follows: Journals (12), conference proceedings (4), dissertations (1), and working papers (2). Distributed across years as follows: 1992 (1), 1998 (1), 2006 (1), 2007 (2), 2008 (3), 2009 (3), 2010 (2), 2011 (3), 2012 (2), 2013 (1).

⁷ As a robustness check, we conducted separate analyses for the effects of control modes on process- and product-related criteria of project performance, respectively. The results showed no significant differences.

⁸ A table mapping the coded variables from each study included in the meta-analysis to the constructs is presented in the Appendix (Table 3).

control mode and the project performance variable. If a measurement was based on a single-item or a proxy variable, we adopted a conservative standard of 0.8 for the reliability coefficient (Bommer et al. 1995; Dalton et al. 2003; Dalton et al. 1998; Dalton et al. 1999; Jiang et al. 2012; Sleesman et al. 2010).

We used the random-effects model developed by Hunter and Schmidt (2004), which is consistent with recent meta-analyses in IS (e.g., Joseph et al. 2007; Sabherwal et al. 2006). Weighting the correlation coefficients by sample size and reliability, we calculated the following meta-analytic outcomes for each relationship: the number of effect sizes (k), the total sample size (N), the average corrected correlation (expected rho; $\bar{\rho}$), the standard deviation of rho (SD_{ρ}), the 95 percent confidence interval around the expected rho ($CI_{\bar{\rho},.95}$)⁹, the 80 percent credibility interval around the expected rho ($CR_{\bar{\rho},.80}$), the percentage of variance that is accounted for by statistical artifacts ($\%V$), and Cochran's (1954) chi-square test for heterogeneity (Q_{within}).

While some of the meta-analytic outcomes are self-explanatory (e.g., k and N), others might need some explanation. Regarding the expected rho, positive (negative) values indicate a tendency for higher (lower) project performance for a higher extent of the corresponding control mode. Regarding the 95 percent confidence interval around the expected rho, a confidence interval excluding zero denotes a statistical significant relationship. In contrast, if a confidence interval includes zero, the relationship is not significant. The remaining three outcomes assess the generalizability of the results. Regarding the 80 percent credibility interval around the expected rho, a credibility interval that is large or includes zero inhibits the generalizability of the expected rho. Regarding the percentage of variance that is accounted for by statistical artifacts, a value less than 75 percent suggests a heterogeneous relationship (Hunter and Schmidt 2004). Finally, regarding Cochran's (1954) chi-square test for heterogeneity, a significant value suggests that the expected rho does not generalize.

We conducted two tests to assess whether the effects of control modes on performance are significantly different between hierarchical and market-based control relationships (Borenstein et al. 2009). First, we conducted an ANOVA-like test based on a decomposition of Cochran's (1954) chi-square statistic for heterogeneity (see, e.g., Park and Shaw 2013). In the analysis reported here, a relationship with a significant $Q_{between}$ -statistic is interpreted to show that the effect size is different between hierarchical and market-based control relationships. Second, we conducted a two-sample Z-test (see, e.g., Quinones et al. 1995). A relationship with a significant Z-statistic suggests that the effect size is different between hierarchical and market-based control relationships.

Limitations

Meta-analysis is subject to several potential validity threats. Here, we discuss four of the most frequently identified threats. First, while we conducted an extensive literature search, the possibility remains that we did not identify all relevant studies. In addition, some studies do not report the necessary statistics and, thus, are not included in the meta-analysis. However, considering the extensive nature of our literature search, we are confident that our results are not subject to a major validity threat from any missing studies.

Second, the file-drawer problem is a potential threat to any meta-analysis. It refers to the potential bias that the results of unpublished studies and the results of published studies are systematically different (Rosenthal 1979). As indicated in the methodology section, our literature search includes conference papers, dissertations, and working papers. Specifically, seven of the 17 studies fall into one of these categories. Thus, we are confident that the file-drawer problem is not a major potential validity threat to our results.

Third, the meta-analytic calculations are based on a small number of effect sizes. A small number of effect sizes does not bias the estimates of the expected rhos. However, it does affect the reliability of the estimates of the standard deviation of the rhos that are used to calculate the credibility intervals (Hunter and Schmidt 2004). Therefore, we additionally estimated Hunter and Schmidt's (2004) 75 percent rule and Cochran's (1954) chi-square test for heterogeneity. There is no evidence of bias in the findings. In addition, other

⁹ We used Hunter and Schmidt's (2004) formula for individually corrected correlation coefficients to calculate the standard error of the estimated average correlations: $SE_{\bar{\rho}} = SD_r/\sqrt{k}$.

meta-analyses in IS (e.g., Joseph et al. 2007) are based on a similar number of effect sizes. We conclude that the limited number of studies is not a potential major validity threat to our results.

Fourth, our meta-analytic results are corrected for only three artifacts present in individual studies: sampling error, measurement error of control modes, and measurement error of project performance. Hunter and Schmidt (2004) list eleven artifacts that can affect the value of outcome measures and specify procedures to correct for them. However, correcting for these artifacts requires statistical information that is rarely available in individual studies. Thus, these corrections are beyond the scope of this meta-analysis.

Results

The results in Table 2 support *H1: There is a positive effect of behavior control on IS project performance in hierarchical but not in market-based control relationships*. The positive effect of behavior control on IS project performance is significant in hierarchical control relationships ($\bar{\rho} = .40, CI_{\bar{\rho},95} = .29$ to $.52$) and is non-significant in market-based control relationships ($\bar{\rho} = .16, CI_{\bar{\rho},95} = -.03$ to $.36$). In addition, the effect of behavior control on IS project performance is significantly higher in hierarchical compared with market-based control relationships ($Q_{between} = 14.37^*, Z = 2.08^*$).

The results in Table 2 support *H2: There is a positive effect of outcome control on IS project performance in hierarchical and in market-based control relationships*. The positive effect of outcome control on IS project performance is significant in hierarchical ($\bar{\rho} = .40, CI_{\bar{\rho},95} = .28$ to $.51$) and market-based control relationships ($\bar{\rho} = .35, CI_{\bar{\rho},95} = .24$ to $.46$). In addition, the effect of outcome control is not significantly different in hierarchical compared with market-based control relationships ($Q_{between} = 0.38, Z = 0.54$).

The results in Table 2 partially support *H3: There is a positive effect of clan control on IS project performance that is higher in hierarchical compared with market-based control relationships*. Consistent with H3, the positive effect of clan control on IS project performance is significant in hierarchical ($\bar{\rho} = .36, CI_{\bar{\rho},95} = .25$ to $.46$) and market-based relationships ($\bar{\rho} = .26, CI_{\bar{\rho},95} = .12$ to $.39$). In addition, this effect is higher in hierarchical compared with market-based control relationships ($\bar{\rho} = .36$ and $\bar{\rho} = .26$, respectively). However, the difference is non-significant ($Q_{between} = 1.01, Z = 1.11$).

	<i>k</i>	<i>N</i>	$\bar{\rho}$	<i>SDρ</i>	<i>CI$\bar{\rho},95$</i>	<i>CR$\bar{\rho},80$</i>	% <i>V</i>	<i>Q$_{within}$</i>	<i>Q$_{between}$</i>	<i>Z</i>
Behavior control	13	1321	.28	.23	.14 : .42	-.01 : .57	.18	63.67*	14.37*	2.08*
– Hierarchy	5	607	.40	.09	.29 : .52	.28 : .52	.50	8.35		
– Market	8	714	.16	.26	-.03 : .36	-.16 : .49	.18	40.95*		
Outcome control	12	1100	.37	.09	.29 : .45	.26 : .49	.61	15.96	0.38	0.54
– Hierarchy	5	496	.40	.07	.28 : .51	.30 : .49	.68	5.92		
– Market	7	604	.35	.10	.24 : .46	.23 : .47	.59	9.67		
Clan control	12	936	.27	.15	.16 : .39	.08 : .47	.41	25.72*	1.01	1.11
– Hierarchy	3	174	.36	.00	.25 : .46	.36 : .36	2.11	1.20		
– Market	9	762	.26	.17	.12 : .39	.04 : .47	.35	23.51*		
Self-control	6	374	.17	.17	-.01 : .35	-.05 : .38	.46	12.09*	7.10*	2.97*
– Hierarchy	3	208	.00	.10	-.21 : .21	-.13 : .13	.70	4.18		
– Market	3	166	.35	.00	.25 : .44	.35 : .35	3.27	.81		

k: number of effect sizes; *N*: total sample size; $\bar{\rho}$: expected rho; *SD ρ* : standard deviation of rho; *CI $\bar{\rho},95$* : 95% confidence interval around the expected rho; *CR $\bar{\rho},80$* : 80% credibility interval around the expected rho; %*V*: percentage of variance that is accounted for by statistical artifacts; *Q $_{within}$* : Cochran’s chi-square statistic for variance in a sample or subsample; *Q $_{between}$* : Cochran’s chi-square statistic for variance that is explained by the partitioning into subsamples; *Z*: Z-statistic *: *p*-value < 0.05.

The results in Table 2 support *H4: There is a positive effect of self-control on IS project performance in market-based but not in hierarchical control relationships*. The positive effect of self-control on IS project performance is significant in market-based control relationships ($\bar{\rho} = .35$, $CI_{\bar{\rho},.95} = .25$ to $.44$) and is non-significant in hierarchical control relationships ($\bar{\rho} = .00$, $CI_{\bar{\rho},.95} = -.21$ to $.21$). In addition, the effect of self-control is significantly higher in market-based compared with hierarchical control relationships ($Q_{between} = 7.10^*$, $Z = 2.97^*$).

Discussion

The results provide strong support for the general claim that the effects of control modes on IS project performance differ between hierarchical compared with market-based control relationships. Below, we begin by reviewing the findings how the effects on IS project performance of the four control modes, namely, behavior, outcome, clan, and self-control, differ between hierarchical compared with market-based control relationships. Drawing on these findings, we examine the implications for theory and practice under two headings. Under one, we contribute to the IS project control literature on complementary and substitutive effects between control modes in hierarchical compared with market-based control relationships. Under the other, we introduce the concept of control chains to explore the interrelations among hierarchical and market-based control relationships.

Findings

There is a positive effect of behavior control on IS project performance in hierarchical but not in market-based control relationships (Hypothesis 1). This supports our assertion that, in market-based control relationships, the controller's low knowledge of the transformation process (Keil et al. 2013), the absence of legitimate authority over the controllee (Tiwana 2008), and difficulties in observing the behavior of the controllee (Tiwana and Keil 2010) limit the controller's potential to improve project performance using behavior control.

There is a positive effect of outcome control on IS project performance in hierarchical and in market-based control relationships (Hypothesis 2). It is possible to specify and evaluate outcomes in both hierarchical control relationships (e.g., Gopal and Gosain 2010; Maruping et al. 2009) and market-based control relationships (e.g., Choudhury and Sabherwal 2003; Tiwana 2008; Tiwana 2010).

Contrary to our expectations, the positive effect of clan control on IS project performance is not significantly higher in hierarchical compared with market-based control relationships (Hypothesis 3). Values and beliefs can be shared when bridging organizational boundaries (Choudhury and Sabherwal 2003; March and Simon 1958). However, the difference in the effect sizes (hierarchical $\bar{\rho} = .36$ compared with market-based $\bar{\rho} = .26$) indicates some support for our arguments underpinning Hypothesis 3. We would expect this difference to decrease as the number of IS projects increases that a vendor conducts for a particular client. The projects facilitate project collaboration, and increase trust and shared knowledge, between the client and the vendor (Ethiraj et al. 2005; Gefen et al. 2008).

There is a positive effect of self-control on IS project performance in market-based but not in hierarchical control relationships (Hypothesis 4). In hierarchical control relationships, deploying self-control is bounded by the frequent use of outcome and behavior control (Henderson and Lee 1992). In market-based control relationships, granting autonomy to establish self-control leverages the vendor's (compared with the controller's) higher knowledge of the transformation process (Choudhury and Sabherwal 2003).

Complementary and Substitutive Effects of Control Modes

Our results indicate complementary and substitutive effects between the control modes on IS project performance. These effects of control modes on IS project performance are contingent on the two distinct ways by which the control modes influence controllee actions. One is that control modes provide guidance to the controllee (Goo et al. 2009). The other is that control modes align the controllee's with the controller's goals (Kirsch et al. 2002).

While behavior control provides guidance to the controllee (Goo et al. 2009), outcome control aligns the controllee's with the controller's goals (Kirsch et al. 2002). Thus, behavior and outcome control have

complementary effects on project performance. With regard to clan control, our results do not allow us to draw conclusions about complementary or substitutive effects.

Self-control allows the controllee to specify their own goals and/or actions required to achieve the goals (Kirsch 1996). Self-set goals are effective only if goals are not already prescribed by outcome control (Henderson and Lee 1992). Thus, with regard to goals, self-control substitutes outcome control in the effect on project performance. Self-set actions are effective only if actions are not already prescribed by behavior control (Henderson and Lee 1992). Thus, with regard to actions, self-control substitutes behavior control in the effect on project performance.

These complementary and substitutive effects between control modes on project performance have important normative implications for structuring portfolios of control, in which the controller combines complementary control modes and chooses between substitutive control modes (Choudhury and Sabherwal 2003). Among the substitutive control modes, the controller should choose the most effective one.

The controller's choice between the substitutive options of prescribing goals to the controllee using outcome control and relying on self-set goals by the controllee using self-control is a general one. Prescribed goals by the controller are generally more effective than individual goals set by the controllee (Kirsch 1997).

The controller's choice between the substitutive options of prescribing actions to the controllee via behavior control and relying on self-set actions by the controllee via self-control is contingent on the controller's knowledge of the transformation process. If the controller's knowledge of the transformation is high, prescribed behavior by the controller is more effective than individual actions set by the controllee (Henderson and Lee 1992). In contrast, if the controller's knowledge of the transformation process is low, individual actions set by the controllee are more effective than prescribed behavior by the controller (Hoberg et al. 2013; Levina and Ross 2003).

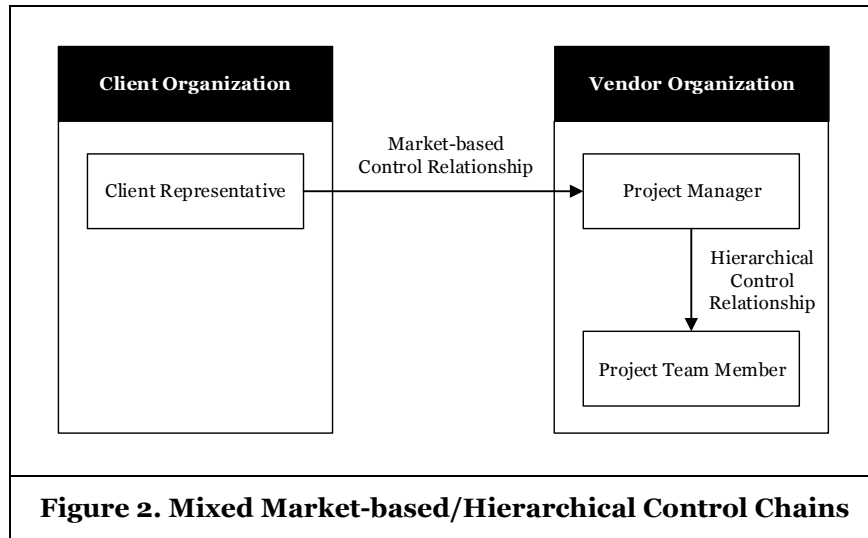
How contingency on the controller's knowledge of the transformation process influences the structure of control portfolios differs in hierarchical compared with market-based control relationships. In hierarchical control relationships, the controller's knowledge of the transformation process is high (Henderson and Lee 1992). Thus, the controller should choose behavior control over relying on self-set actions by the controllee via self-control.

In contrast, in market-based control relationships, the controller's knowledge of the transformation process is low (Keil et al. 2013). Thus, the controller should rely on self-set action by the controllee via self-control instead of implementing behavior control. This implication is in line with research that suggests that clients can increase the success of IS projects by focusing on leveraging the vendor's capabilities instead of tightly monitoring vendor behavior (Hoberg et al. 2013). Our results suggest that, in market-based control relationships, clients should focus on establishing outcome control but give up behavior control in favor of self-control to leverage the vendor's capabilities.

In practice, we speculate that in hierarchical relationships, the project manager should employ output control (set challenging goals), behavior control (establish effective project processes) and clan control (build a cohesive team with high performance norms). In market-based relationships, specifically, when outsourcing an IS project, the client representative should employ output controls (negotiate challenging goals in the outsourcing contract), self-set actions (choose an experienced vendor with expertise/knowledge of similar projects) and clan control (build strong relational governance structures with the vendor).

Interrelations among Hierarchical and Market-based Control Relationships

As described above, outsourced IS projects are not exclusively managed by either hierarchical or market-based control relationships (Gopal and Gosain 2010). Instead, hierarchical and market-based control relationships form a chain of control. The client representative (as the controller in the market-based control relationship) represents the initiating actor in the control chain, the project manager (as the controllee in the market-based and controller in the hierarchical control relationships) is a mediating actor, and the project team members (as the controllees in the hierarchical control relationship) are the receiving actors of the control chain (Figure 2).



To interpret our results with respect to the interrelations among hierarchical and market-based control relationships, we apply Ouchi's (1978) transmission of control framework as a theoretical lens. Here, we define transmission of control as the process by which a control mode specified by a client representative (in the market-based part of the control chain) is passed through by the vendor project manager to their project team members (in the hierarchical part of the control chain).

First, our results indicate, that the behavior control mode does not transmit through the chain of control. The use of behavior control by the client representative in the market-based part of the control chain limits the vendor in leveraging their higher knowledge of the transformation process (Choudhury and Sabherwal 2003). Bringing the vendor to deviate from established practices will decrease the vendor's ability to efficiently perform an IS project (Hoberg et al. 2013). More specifically, the vendor project manager would be limited in his ability to efficiently control the behavior of the project team members. As our results suggest, the use of behavior control by the client representative in the market-based part of the control chain has no significant effect on project performance. This result extends Ouchi's (1978) finding that behavior control does not transmit consistently through a multiple-level hierarchical control chain to mixed market-based/hierarchical control chains.

Second, our results indicate that the outcome control mode transmits through the chain of control. The project manager is able to effectively transform the client's contractually specified outcome measures into internal outcome controls. Our results suggest that both, the use of outcome control by the client representative in the market-based part of the control chain and the use of outcome control by the project manager in the hierarchical part of the control chain have a positive effect on project performance. This result is consistent with Ouchi (1978), who finds that outcome control transmits consistently through a multiple-level hierarchical control chain. Hence, our results suggest generalizability to mixed market-based/hierarchical control chains.

Third, our results indicate that the clan control mode transmits through the chain of control. The project manager is able to effectively promulgate the client representative's values and beliefs within the existing clan in the vendor organization. Our results suggest that both, the use of clan control by the client representative in the market-based part of the control chain and the use of clan control by the project manager in the hierarchical part of the control chain have a positive effect on project performance.

Fourth, our results indicate, that the self-control mode does not transmit through the chain of control. As our results suggest, the use of self-control by the project manager in the hierarchical part of the control chain has no significant effect on project performance. Instead, we assume that the positive effect of self-control on project performance in the market-based part of the control chain can be realized because granting autonomy to establish self-control enables the client to benefit from the vendor's experience from a large number of similar projects (Choudhury and Sabherwal 2003; Levina and Ross 2003). Thus, the

vendor project manager would be enabled to efficiently control the behavior of the project team members in the hierarchical part of the control chain.

Modeling portfolios of control modes as control chains in market-based control helps to formally specify the differences and similarities between hierarchical and market controls. Future research should investigate extending the unit of analysis from individual control modes in a portfolio of control modes to a chain of control modes. This would involve formally modeling and testing Ouchi's (1978) concept of the transmission of control between actors.

Conclusions

This paper analyzes how the effects of control modes on IS project performance differ between hierarchical compared with market-based control relationships. Prior literature in IS project control has focused exclusively on one of these forms of control relationships. To the best of our knowledge, our study is the first to jointly investigate hierarchical and market-based control relationships. Comparing these two forms of control relationships allows us to detect differences with regard to the effectiveness of specific control modes. Building on our results, we discuss how the structure of control portfolios differs between hierarchical compared with market-based control relationships. In addition, we explore how hierarchical and market-based control relationships are interrelated.

The contributions of this study are threefold. First, we demonstrate how the effects of control modes on IS project performance differ in hierarchical and market-based control relationships. Outcome and clan control enhance IS project performance in both forms of control relationships. Behavior control enhances IS project performance only in hierarchical control relationships, and self-control enhances IS project performance only in market-based control relationships. Our findings present a novel contribution to IS project control literature, which speculates that there are differences between forms of control relationships (Choudhury and Sabherwal 2003; Gopal and Gosain 2010; Kirsch et al. 2002) but does not explicitly examine the difference. We, thereby, complement prior studies that exclusively investigate either hierarchical (e.g., Henderson and Lee 1992; Maruping et al. 2009) or market-based (e.g., Mao et al. 2008; Tiwana 2010) control relationships in IS projects.

Second, drawing on our results, we derive implications about how the structure of control portfolios differs between hierarchical compared with market-based control relationships. These implications extend previous studies on the structure of control portfolios (Choudhury and Sabherwal 2003; Kirsch 1997; Tiwana 2010) by highlighting the differences between control portfolios in hierarchical compared with market-based control relationships. In addition, extant literature predominantly focuses on the complementary and substitutive effects between formal and informal control at an aggregated level (with the notable exception of Tiwana 2010). Our implications extend this literature by focusing on complementary and substitutive effects at the more granular level of control modes (i.e., behavior, outcome, and self-control).

The third contribution is in introducing the concept of control chains to explore the interrelations among hierarchical and market-based control relationships. An important topic that, so far, has been neglected by extant IS literature. To explore these interrelations, we adopt Ouchi's (1978) transmission of control framework as a theoretical lens. Our propositions guide future research to address important gaps in the IS project control literature.

Acknowledgements

Support for this project was provided by the German Research Foundation (DFG SCHE 1805).

Appendix

Table 3. Mapping of Study Variables to Constructs			
Reference	Study variable	Construct	Justification^a
Beimborn et al. (2009)	CONTROL_REP	Outcome control	p. 2727
Beimborn et al. (2009)	CONTROL_PROV	Outcome control	p. 2727
Beimborn et al. (2009)	CONTROL_BANK	Behavior control	p. 2727
Beimborn et al. (2009)	SQ_reliability	IS project performance	Service quality
Beimborn et al. (2009)	SQ_responsiveness	IS project performance	Service quality
Goo (2010)	Service level objectives	Clan control	p. 188
Goo (2010)	Process Ownership Plan	Clan control	p. 188
Goo (2010)	Service Level Contents	Clan control	p. 188
Goo (2010)	Future demand management plan	Behavior control	p. 188
Goo (2010)	Anticipated change plan	Behavior control	p. 188
Goo (2010)	Feedback plan	Behavior control	p. 189
Goo (2010)	Innovation Plan	Behavior control	p. 191
Goo (2010)	Communication plan	Outcome control	p. 189
Goo (2010)	Measurement charter	Outcome control	p. 189
Goo (2010)	Conflict Arbitration	Outcome control	p. 189
Goo (2010)	Enforcement	Outcome control	p. 192
Goo (2010)	Satisfaction with Output Quality	IS project performance	Goo and Nam (2007, p. 243)
Gopal and Gosain (2010)	Software process control	Behavior control	p. 965
Gopal and Gosain (2010)	Outcome control-quality	Outcome control	
Gopal and Gosain (2010)	Outcome control-efficiency	Outcome control	
Gopal and Gosain (2010)	Collaborative culture (clan)	Clan control	p. 967
Guinan and Faraj (1998)	Team Self-Control	Self-control	
Guinan and Faraj (1998)	Team Performance	IS project performance	
Haney (2009)	Behavior Control	Behavior control	
Haney (2009)	Outcome Control	Outcome control	
Haney (2009)	Clan Control	Clan control	
Haney (2009)	Product Performance	IS project performance	
Haney (2009)	Resource Overruns	IS project performance	Reverse coded
Henderson and Lee (1992)	Managerial Outcome Control	Outcome control	
Henderson and Lee (1992)	Managerial Behavior Control	Behavior control	
Henderson and Lee (1992)	Team-Member Self-Control	Self-control	
Henderson and Lee (1992)	Team-Member Outcome Control	Clan control	p. 760

Henderson and Lee (1992)	Efficiency	IS project performance	
Henderson and Lee (1992)	Effectiveness	IS project performance	
Heumann et al. (2012)	Clan Control	Clan control	
Heumann et al. (2012)	Self-Control	Self-control	
Heumann et al. (2012)	IS Offshoring Project Performance	IS project performance	
Keil et al. (2013)	Behavioral control	Behavior control	
Keil et al. (2013)	Outcome control	Outcome control	
Keil et al. (2013)	Clan control	Clan control	
Keil et al. (2013)	Self-control	Self-control	
Keil et al. (2013)	Process performance	IS project performance	
Klein et al. (2006)	Project performance	IS project performance	
Klein et al. (2006)	Management behavioral control	Behavior control	
Klein et al. (2006)	Management outcome control	Outcome control	
Liu et al. (2008a)	Software process standardization	Behavior control	p. 891
Liu et al. (2008a)	Project performance	IS project performance	
Mao et al. (2008)	Control	Behavior control	p. 490
Mao et al. (2008)	Project quality	IS project performance	p. 491
Mao et al. (2008)	Cost control	IS project performance	p. 491
Maruping et al. (2009)	Outcome control	Outcome control	
Maruping et al. (2009)	Self control	Self-control	
Maruping et al. (2009)	Component complexity	IS project performance	Reverse coded
Maruping et al. (2009)	Coordinative complexity	IS project performance	Reverse coded
Maruping et al. (2009)	Dynamic complexity	IS project performance	Reverse coded
Nagpal et al. (2011)	Clan controls	Clan control	
Nagpal et al. (2011)	Specialized Behavior controls	Behavior control	
Nagpal et al. (2011)	General Outcome controls	Outcome control	
Nagpal et al. (2011)	Specialized Outcome controls	Outcome control	
Nagpal et al. (2011)	Modularity	IS project performance	p. 10
Srivasta and Teo (2012)	Relational governance	Clan control	p. 123
Srivasta and Teo (2012)	Quality performance	IS project performance	
Srivasta and Teo (2012)	Cost performance	IS project performance	
Tiwana (2010)	Systems development ambidexterity	IS project performance	p. 125
Tiwana (2010)	Outcome control	Outcome control	
Tiwana (2010)	Behavior control	Behavior control	
Tiwana (2010)	Clan control	Clan control	

Tiwana and Keil (2007)	Relational governance	Clan control	p. 628
Tiwana and Keil (2007)	Outcome control	Outcome control	
Tiwana and Keil (2007)	Process control	Behavior control	p. 625
Tiwana and Keil (2007)	Alliance performance	IS project performance	
Wiener et al. (2012)	Clan control	Clan control	
Wiener et al. (2012)	Behavior control	Behavior control	
Wiener et al. (2012)	Outcome control	Outcome control	
Wiener et al. (2012)	Project performance	IS project performance	

^a In cases where the mapping is not immediately obvious from the study variable name, we included the page number of the reference in which the author(s) of the reference conceptualize the study variable according to Ouchi (1979) and/or Kirsch (1997).

References¹⁰

- Aladwani, A. M. 2002. "An Empirical Examination of the Role of Social Integration in System Development Projects," *Information Systems Journal* (12:4), pp. 339-353.
- Bommer, W. H., Johnson, J. L., Rich, G. A., Podsakoff, P. M., and Mackenzie, S. B. 1995. "On the Interchangeability of Objective and Subjective Measures of Employee Performance: A Meta-Analysis," *Personnel Psychology* (48:3), pp. 587-605.
- Borenstein, M., Hedges, L. V., Higgins, J. P. T., and Rothstein, H. R. 2009. *Introduction to Meta-Analysis*. Chichester, UK: John Wiley & Sons.
- Chen, C. C., Liu, J. Y.-C., and Chen, H.-G. 2011. "Discriminative Effect of User Influence and User Responsibility on Information System Development Processes and Project Management," *Information and Software Technology* (53:2), pp. 149-158.
- Choudhury, V., and Sabherwal, R. 2003. "Portfolios of Control in Outsourced Software Development Projects," *Information Systems Research* (14:3), pp. 291-314.
- Cochran, W. G. 1954. "The Combination of Estimates from Different Experiments," *Biometrics* (10:1), pp. 101-129.
- Cooper, H., and Hedges, L. V. 1994. "Research Synthesis as a Scientific Enterprise," in *The Handbook of Research Synthesis*, H. Cooper and L.V. Hedges (eds.). New York, NY: Russell Sage Foundation, pp. 3-14.
- Dalton, D. R., Daily, C. M., Certo, S. T., and Roengpitya, R. 2003. "Meta-Analyses of Financial Performance and Equity: Fusion or Confusion?," *Academy of Management Journal* (46:1), pp. 13-26.
- Dalton, D. R., Daily, C. M., Ellstrand, A. E., and Johnson, J. L. 1998. "Meta-Analytic Reviews of Board Composition, Leadership Structure, and Financial Performance," *Strategic Management Journal* (19:3), pp. 269-290.
- Dalton, D. R., Daily, C. M., Johnson, J. L., and Ellstrand, A. E. 1999. "Number of Directors and Financial Performance: A Meta-Analysis," *Academy of Management Journal* (42:6), pp. 674-686.
- Dibbern, J., Winkler, J., and Heinzl, A. 2008. "Explaining Variations in Client Extra Costs between Software Projects Offshored to India," *MIS Quarterly* (32:2), pp. 333-366.
- Eisenhardt, K. M. 1985. "Control: Organizational and Economic Approaches," *Management Science* (31:2), pp. 134-149.
- Ethiraj, S. K., Kale, P., Krishnan, M. S., and Singh, J. V. 2005. "Where Do Capabilities Come from and How Do They Matter? A Study in the Software Services Industry," *Strategic Management Journal* (26:1), pp. 25-45.
- Gefen, D., Wyss, S., and Lichtenstein, Y. 2008. "Business Familiarity as Risk Mitigation in Software Development Outsourcing Contracts," *MIS Quarterly* (32:3), pp. 531-551.
- Geyskens, I., Krishnan, R., Steenkamp, J.-B. E., and Cunha, P. V. 2009. "A Review and Evaluation of Meta-Analysis Practices in Management Research," *Journal of Management* (35:2), pp. 393-419.

¹⁰ The studies included in the meta-analysis are represented by asterisks.

- Glass, G. V. 1976. "Primary, Secondary, and Meta-Analysis of Research," *Educational Researcher* (5:10), pp. 3-8.
- Goo, J., Kishore, R., Rao, H. R., and Nam, K. 2009. "The Role of Service Level Agreements in Relational Management of Information Technology Outsourcing: An Empirical Study," *MIS Quarterly* (33:1), pp. 119-145.
- Goo, J., and Nam, K. 2007. "Contract as a Source of Trust - Commitment in Successful IT Outsourcing Relationship: An Empirical Study," *40th Hawaii International Conference on System Sciences 2007*, Waikoloa Village, HI.
- *Gopal, A., and Gosain, S. 2010. "The Role of Organizational Controls and Boundary Spanning in Software Development Outsourcing: Implications for Project Performance," *Information Systems Research* (21:4), pp. 960-982.
- *Guinan, P. J., and Faraj, S. 1998. "Reducing Work Related Uncertainty: The Role of Communication and Control in Software Development," *Proceedings of the 31st Hawaii International Conference on System Sciences*, Kohala Coast, HI, pp. 73-82.
- He, J., and King, W. R. 2008. "The Role of User Participation in Information Systems Development: Implications from a Meta-Analysis," *Journal of Management Information Systems* (25:1), pp. 301-331.
- Hedges, L. V., and Olkin, I. 1985. *Statistical Methods for Meta-Analysis*. Orlando, FL: Academic Press.
- *Henderson, J. C., and Lee, S. 1992. "Managing I/S Design Teams: A Control Theories Perspective," *Management Science* (38:6), pp. 757-777.
- *Heumann, J., Wiener, M., and Remus, U. 2012. "Power Distance in Information Systems Offshoring Projects: A Control Theory Perspective," *Proceedings of the 33rd International Conference on Information Systems*, Orlando, FL.
- Hoberg, P., Yetton, P., Leimeister, S., and Krcmar, H. 2013. "Three Antecedent Factors That Shape Successful BPO Contracts," *Proceedings of the 13th Annual Conference of the European Academy of Management*, Istanbul, Turkey.
- Hoegl, M., and Gemuenden, H. G. 2001. "Teamwork Quality and the Success of Innovative Projects: A Theoretical Concept and Empirical Evidence," *Organization Science* (12:4), pp. 435-449.
- Hunter, J. E., and Schmidt, F. L. 1990. *Methods of Meta-Analysis: Correcting Error and Bias in Research Findings*, (1st ed.). Newbury Park, CA: Sage Publications.
- Hunter, J. E., and Schmidt, F. L. 2004. *Methods of Meta-Analysis: Correcting Error and Bias in Research Findings*, (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Jaworski, B. J. 1988. "Toward a Theory of Marketing Control: Environmental Context, Control Types, and Consequences," *The Journal of Marketing* (52:3), pp. 23-39.
- Jensen, M. C., and Meckling, W. H. 1976. "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics* (3:4), pp. 305-360.
- Jiang, K., Lepak, D. P., Hu, J., and Baer, J. C. 2012. "How Does Human Resource Management Influence Organizational Outcomes? A Meta-Analytic Investigation of Mediating Mechanisms," *Academy of Management Journal* (55:6), pp. 1264-1294.
- Joseph, D., Ng, K.-Y., Koh, C., and Ang, S. 2007. "Turnover of Information Technology Professionals: A Narrative Review, Meta-Analytic Structural Equation Modeling, and Model Development," *MIS Quarterly* (31:3), pp. 547-577.
- *Keil, M., Rai, A., and Liu, S. 2013. "How User Risk and Requirements Risk Moderate the Effects of Formal and Informal Control on the Process Performance of IT Projects," *European Journal of Information Systems* (22:6), pp. 650-672.
- Kirsch, L. J. 1996. "The Management of Complex Tasks in Organizations: Controlling the Systems Development Process," *Organization Science* (7:1), pp. 1-21.
- Kirsch, L. J. 1997. "Portfolios of Control Modes and IS Project Management," *Information Systems Research* (8:3), pp. 215-239.
- Kirsch, L. J. 2004. "Deploying Common Systems Globally: The Dynamics of Control," *Information Systems Research* (15:4), pp. 374-395.
- Kirsch, L. J., and Cummings, L. L. 1996. "Contextual Influences on Self-Control of IS Professionals Engaged in Systems Development," *Accounting, Management and Information Technologies* (6:3), pp. 191-219.
- Kirsch, L. J., Ko, D.-G., and Haney, M. H. 2010. "Investigating the Antecedents of Team-Based Clan Control: Adding Social Capital as a Predictor," *Organization Science* (21:2), pp. 469-489.
- Kirsch, L. J., Sambamurthy, V., Ko, D.-G., and Purvis, R. L. 2002. "Controlling Information Systems Development Projects: The View from the Client," *Management Science* (48:4), pp. 484-498.

- *Klein, G., Beranek, P., Martz, B., and Jiang, J. 2006. "The Relationship of Control and Learning to Project Performance," *Cybernetics and Systems: An International Journal* (37:2-3), pp. 137-150.
- Lee, J.-N. 2001. "The Impact of Knowledge Sharing, Organizational Capability and Partnership Quality on IS Outsourcing Success," *Information & Management* (38:5), pp. 323-335.
- Levina, N., and Ross, J. W. 2003. "From the Vendor's Perspective: Exploring the Value Proposition in Information Technology Outsourcing," *MIS Quarterly* (27:3), pp. 331-364.
- Liu, S., Keil, M., Rai, A., Zhang, J., and Chen, T. 2008. "How User and Requirement Risks Moderate the Effects of Formal and Informal Controls on IT Project Performance," *Proceedings of the 29th International Conference on Information Systems*, Paris, France.
- *Mao, J.-Y., Lee, J.-N., and Deng, C.-P. 2008. "Vendors' Perspectives on Trust and Control in Offshore Information Systems Outsourcing," *Information & Management* (45:7), pp. 482-492.
- March, J. G., and Simon, H. A. 1958. *Organizations*. New York: Wiley.
- *Maruping, L. M., Venkatesh, V., and Agarwal, R. 2009. "A Control Theory Perspective on Agile Methodology Use and Changing User Requirements," *Information Systems Research* (20:3), pp. 377-399.
- *Nagpal, P., Lyytinen, K., and Boland, R. 2011. "Which Control Strategies and Configurations Affect Performance? Evidence from Large Scale Outsourcing Arrangements," AAA 2012 Management Accounting Section (MAS) Meeting Paper.
- Nidumolu, S. R., and Subramani, M. R. 2003. "The Matrix of Control: Combining Process and Structure Approaches to Managing Software Development," *Journal of Management Information Systems* (20:3), pp. 159-196.
- Ouchi, W. G. 1977. "The Relationship between Organizational Structure and Organizational Control," *Administrative Science Quarterly* (22:1), pp. 95-113.
- Ouchi, W. G. 1978. "The Transmission of Control through Organizational Hierarchy," *Academy of Management Journal* (21:2), pp. 173-192.
- Ouchi, W. G. 1979. "A Conceptual Framework for the Design of Organizational Control Mechanisms," *Management Science* (25:9), pp. 833-848.
- Ouchi, W. G. 1980. "Markets, Bureaucracies, and Clans," *Administrative Science Quarterly* (25:1), pp. 129-141.
- Palmatier, R. W., Dant, R. P., Grewal, D., and Evans, K. R. 2006. "Factors Influencing the Effectiveness of Relationship Marketing: A Meta-Analysis," *Journal of Marketing* (70:4), pp. 136-153.
- Park, T.-Y., and Shaw, J. D. 2013. "Turnover Rates and Organizational Performance: A Meta-Analysis," *Journal of Applied Psychology* (98:2), pp. 268-309.
- Quinones, M. A., Ford, J. K., and Teachout, M. S. 1995. "The Relationship between Work Experience and Job Performance: A Conceptual and Meta-Analytic Review," *Personnel Psychology* (48:4), pp. 887-910.
- Rasch, R. H., and Tos, H. L. 1992. "Factors Affecting Software Developers' Performance: An Integrated Approach," *395-413* (16:3), pp. 395-413.
- Rosenthal, R. 1979. "The File Drawer Problem and Tolerance for Null Results," *Psychological Bulletin* (86:3), pp. 638-641.
- Rosenthal, R., and DiMatteo, M. R. 2001. "Meta-Analysis: Recent Developments in Quantitative Methods for Literature Reviews," *Annual Review of Psychology* (52:1), pp. 59-82.
- Sabherwal, R., Jeyaraj, A., and Chowa, C. 2006. "Information System Success: Individual and Organizational Determinants," *Management Science* (52:12), pp. 1849-1864.
- Schmidt, F. L., Hunter, J. E., and Raju, N. S. 1988. "Validity Generalization and Situational Specificity: A Second Look at the 75% Rule and Fisher's Z Transformation," *Journal of Applied Psychology* (73:4), pp. 665-672.
- Sharma, R., and Yetton, P. 2007. "The Contingent Effects of Training, Technical Complexity, and Task Interdependence on Successful Information Systems Implementation," *MIS Quarterly* (31:2), pp. 219-238.
- Slesman, D. J., Conlon, D. E., McNamara, G., and Miles, J. E. 2010. "Cleaning up the Big Muddy: A Meta-Analytic Review of the Determinants of Escalation of Commitment," *Academy of Management Journal* (55:3), pp. 541-562.
- *Srivastava, S. C., and Teo, T. S. 2012. "Contract Performance in Offshore Systems Development: Role of Control Mechanisms," *Journal of Management Information Systems* (29:1), pp. 115-158.
- Tannenbaum, A. S. 1962. "Control in Organizations: Individual Adjustment and Organizational Performance," *Administrative Science Quarterly* (7:2), pp. 236-257.

- Tiwana, A. 2008. "Does Technological Modularity Substitute for Control? A Study of Alliance Performance in Software Outsourcing," *Strategic Management Journal* (29:7), pp. 769-780.
- *Tiwana, A. 2010. "Systems Development Ambidexterity: Explaining the Complementary and Substitutive Roles of Formal and Informal Controls," *Journal of Management Information Systems* (27:2), pp. 87-126.
- *Tiwana, A., and Keil, M. 2007. "Does Peripheral Knowledge Complement Control? An Empirical Test in Technology Outsourcing Alliances," *Strategic Management Journal* (28:6), pp. 623-634.
- Tiwana, A., and Keil, M. 2010. "Control in Internal and Outsourced Software Projects," *Journal of Management Information Systems* (26:3), pp. 9-44.
- Tushman, M. L. 1977. "Special Boundary Roles in the Innovation Process," *Administrative Science Quarterly* (22:4), pp. 587-605.
- Wallace, L., Keil, M., and Rai, A. 2004. "How Software Project Risk Affects Project Performance: An Investigation of the Dimensions of Risk and an Exploratory Model*," *Decision Sciences* (35:2), pp. 289-321.
- Webster, J., and Watson, R. T. 2002. "Analyzing the Past to Prepare for the Future: Writing a Literature Review," *MIS Quarterly* (26:2), pp. 8-23.
- Williamson, O. E. 1979. "Transaction-Cost Economics: The Governance of Contractual Relations," *Journal of Law and Economics* (22:2), pp. 233-261.
- Wu, J., and Lederer, A. 2009. "A Meta-Analysis of the Role of Environment-Based Voluntariness in Information Technology Acceptance," *MIS Quarterly* (33:2), pp. 419-432.