

Deploying Common Systems Globally: The Dynamics of Control

Laurie J. Kirsch

Katz Graduate School of Business, University of Pittsburgh, Pittsburgh, PA 15260, lkirsch@katz.pitt.edu

In today's competitive environment, an increasing number of firms are building *common information systems*, which will be deployed globally, to support their strategic globalization initiatives. These systems are designed to meet the requirements of a diverse set of stakeholders with different business needs, priorities, and objectives. One managerial tool for addressing and reconciling such differences is control, which encompasses all attempts to motivate individuals to act in a manner that is consistent with organizational objectives. This paper examines two research questions. How do stakeholders exercise control during different phases of large IS projects? Why do control choices change across project phases? Results of two case studies suggest control is exercised differently for each phase. During the initial phase of a project, control is exercised as "collective sensemaking," in which both IS and business stakeholders utilize mostly informal mechanisms of control. During development, "technical winnowing" of mechanisms occurs such that control is vested primarily in IS managers, who structure hierarchical relationships with subordinates and who rely extensively on formal control mechanisms. Both IS and business stakeholders employ formal and informal mechanisms during implementation to exercise control as "collaborative coordinating." The results also suggest that changes in control choices from one project phase to another are triggered by factors in the project, stakeholder, and global contexts. As factors change across phases, so too do control choices. Further, problems that surface in one project phase trigger changes to controls in subsequent phases. These findings are integrated into a model of the dynamics of control. Implications of these results are drawn, and directions for future research are suggested.

Key words: organizational control; IS project management; information systems development; common information systems

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Introduction

Empirical research has identified a number of issues that contribute to the success and failure of large information systems (IS) projects. Many of these issues have little to do with the technology itself, but instead politics, motivation, and conflict arising from stakeholder interactions and relationships often derail projects (Markus and Benjamin 1996, Hartwick and Barki 1994, Robey et al. 1989). Though stakeholders may have divergent priorities and goals, their complementary skills and knowledge are essential to the success of IS projects. Thus, it is imperative that relationships among stakeholders are effectively managed to elicit their contribution and cooperation, and to facilitate project success (Kirsch et al. 2002, Clark et al. 1997).

One managerial tool for managing stakeholder relationships is control, which is viewed broadly to mean

any attempt to motivate individuals to behave in a manner consistent with organizational objectives (Cardinal 2001, Das and Teng 1998, Jaworski 1988, Ouchi 1979). Control is often thought to be dyadic in the sense that there is a "controller" (the person exercising control) and a "controllee" (the target of control). Control *modes* (e.g., behavior, outcome, and clan) are exercised via specific *mechanisms* such as financial incentives, rules and procedures, team-building approaches, and socialization practices.

Researchers examining control in the IS project context have typically targeted predefined controller-controllee dyads, emphasized control relationships within IS units, studied control modes needed to achieve predefined project goals such as on-time and within-budget system delivery, examined modes of control singly rather than simultaneously, and taken a "static" or "snapshot" view of control (e.g.,

Kirsch et al. 2002, Kirsch 1996, Henderson and Lee 1992).¹ While these studies have produced important insights, they are limited in terms of how well they capture control in a setting that is nonroutine, complex, and dynamic (Crisp 2002, Kirsch 1996). IS development projects are not static: from one project phase to another goals and priorities, the nature of the task, team membership, and business unit involvement may all change (Sambamurthy and Kirsch 2000, Markus and Benjamin 1996). Further, IS projects are often managed, either explicitly or implicitly, by both IS and business managers (Kirsch et al. 2002). Given this dynamic environment, multiple controls may be utilized by IS and business managers, and controls may change as the project progresses (Nidumolu and Subramani 2003–2004, Mähring 2002). Therefore, this study examines two specific research questions: How do stakeholders exercise control during different phases of large IS projects? and Why do control choices change across project phases?

These research questions are examined in the context of *common systems* that are deployed globally. Common systems are comprised of core software modules designed around common global requirements, and they can be augmented with local modules to support regional or local differences in laws, regulations, or work rules (Collins and Kirsch 1999). With increasing globalization, multinational firms often require common systems to support specific global initiatives (Lai 2001, Kuljis et al. 1998). Such systems enable and facilitate the coordination and integration of business processes that are worldwide in scope (King and Sethi 2001, Ives and Jarvenpaa 1991).

Projects organized around the global deployment of common systems represent a context in which issues of control are particularly salient. Deploying these systems requires the participation of multiple stakeholders representing different regions of the world (Kuljis et al. 1998, Karimi and Konsynski 1991). Because the locations are geographically dispersed and because stakeholders often have disparate business environments and priorities, communication

and cooperation may be difficult (Tractinsky and Jarvenpaa 1995) and reaching consensus can be problematic (Lai 2001, Ambrosio 1996). Understanding how to exercise control, which aligns stakeholder goals (Cardinal 2001, Eisenhardt 1985), fosters consensus and communication (Nidumolu and Subramani 2003–2004, Snell 1992), and reinforces common values (Ouchi 1979), may therefore be critical to the success of these efforts.

Background Literature

Researchers often study outcome, behavior, and clan controls, identified in Ouchi's (1978, 1979, 1980) seminal work on control. Outcome control is exercised when targets or goals are prespecified, individual outcomes are assessed, and rewards are based on whether the goals are achieved (Eisenhardt 1985, Ouchi 1978). To exercise behavior control, behaviors are prespecified, controllees are expected to engage in these behaviors to achieve specific goals, and rewards are based on how well the behaviors are followed (Das and Teng 1998, Eisenhardt 1985). Clan controls work by socializing individuals to a common set of norms and values (Birnberg and Snodgrass 1988, Ouchi 1979). Behavior that is consistent with these values and norms is rewarded, whereas inconsistent behavior is sanctioned (Ouchi 1979).

Control modes are generally differentiated as being either "formal" or "informal" (Crisp 2002), where the former are formally documented and initiated by management, and the latter are unwritten and often initiated by employees themselves (Jaworski 1988). The implication is that formal control modes are exercised with formal mechanisms, and that informal modes are exercised utilizing informal mechanisms (Birnberg and Snodgrass 1988, Ouchi 1980, Ouchi and Jaeger 1978). Consistent with Jaworski's distinction, researchers generally categorize behavior and outcome controls as formal control modes and clan control as informal (cf. Crisp 2002, Cardinal 2001, Kirsch 1996, Birnberg and Snodgrass 1988).

Though these definitions of control are typically adopted by researchers, there are overlaps and inconsistencies across the various conceptualizations. For example, some researchers argue that clan control is actually a form of behavior control, while others maintain these controls are distinct (Kirsch et al. 2002).

¹There are a few recent exceptions to note. For example, Choudhury and Sabherwal (2003) and Mähring (2002) conducted initial investigations into control dynamics, and the Kirsch et al. study (2002) focused exclusively on the IS-business client relationship rather than relationships between IS stakeholders.

Moreover, “control” is a multidimensional construct (Snell 1992), which can make classification problematic. As an example, behavior control is conceptualized in terms of formal mechanisms. If, in practice, appropriate behaviors are prespecified, a controllee is expected to follow the behaviors, but reward systems do not formally and explicitly link behaviors and rewards, is that an instance of formal behavior control?

How Control Is Exercised

In the context of deploying large systems, it seems likely that the exercise of control may not correspond exactly to theoretical conceptualizations (Mähring 2002). One study provides some evidence about this issue. Examining four large IS projects, Kirsch (1997) found that IS and business managers exercise control via a wide range of formal and informal mechanisms—from project plans to meetings to management by “walking around” to peer pressure. The mechanisms themselves were used to exercise either formal or informal controls. These findings are useful because they illustrate how the exercise of control may differ from theoretical conceptualizations. However, though the findings are suggestive of control dynamics, the study does not provide evidence that controls change as project phases change.

In a general sense, IS development projects can be viewed as progressing through three phases (O’Brien 2004). First is initiation or *requirements determination*, which refers to the definition of high-level goals and objectives, project scope, and boundaries. During *development*, the second phase, detailed requirements are identified, which is generally followed by design, coding, and testing. The third phase is *implementation*, during which preparations are underway to install the software, change business processes and workflows, and provide training. Because these phases differ in terms of type of task and personnel involved, control approaches might also vary. Indeed, in a study of outsourced projects, Choudhury and Sabherwal (2003) found that “relatively simple controls” were utilized at the beginning of the projects. The firms primarily relied on outcome controls during the initial phases of the projects, and, to a lesser extent, on behavior controls. There was little use of informal controls. As the projects progressed and experienced

performance problems, other controls—both formal and informal—were added.

To assess the generalizability of their results, Choudhury and Sabherwal (2003) call for research of control dynamics in different contexts. Focusing on in-house development projects (rather than outsourced projects) partially addresses this gap. Thus the first research question posed is: How do stakeholders exercise control during different phases of large IS projects?

Why Control Choices Change

Two recent studies provide evidence about why controls change during IS projects. The results of one suggest that the evolving nature of the controller-controllee relationship can lead to changes in controls (Mähring 2002). Findings from another suggest that vendor performance may be a significant factor in choosing additional controls as outsourced projects progress (Choudhury and Sabherwal 2003). In addition, Choudhury and Sabherwal posit that previously identified antecedents of control—categorized by Kirsch (1997) as task characteristics, knowledge and skills of the stakeholders, and role expectations—might also play a role in changing portfolios of control. Indeed, they find support for this proposition.

Though these studies offer important insights, neither explicated why controls change from one project phase to another. Given that task characteristics, team member composition, and business unit involvement may change dramatically as a project moves from phase to phase, it seems feasible that controls may change in response. Thus, this transition point between phases provides an opportunity to study the effects of contextual factors on changes in control, prompting a second research question: Why do control choices change across project phases?

To answer these research questions, this study focuses on *mechanisms* utilized to exercise control, rather than control modes. Examining formal and informal mechanisms is a way to enhance prior findings and to address the inconsistencies between theory and practice (Mähring 2002, Kirsch 1997). In a review of the literature, Eisenhardt (1985) observes that control consists of three dimensions or *elements*: measurement, evaluation, and reward. An examination of mechanisms used to measure, evaluate,

and reward should therefore facilitate a more precise understanding of the way in which control is exercised.

Measurement implies both specification and measurement (Eisenhardt 1985). With formal controls, target behaviors or outcomes are known and prespecified, which makes actual behaviors and outcomes measurable (Ouchi 1979). These controls align stakeholder goals (Cardinal 2001, Snell 1992): controllers specify desired outcomes or behaviors, and controllees agree to deliver those outcomes or engage in those behaviors, which will result in the desired outcomes. Measurement is an important aspect of informal control as well, but the emphasis is not on articulating specific behaviors and outcomes. Rather, stakeholders embrace common norms and values, obviating a need to specify detailed task-oriented behaviors (Das and Teng 1998, Birnberg and Snodgrass 1988). Precise goals are not typically known, but instead evolve over time. Desired end-states result from individuals behaving in a manner that is consistent with group norms and values (Ouchi 1979). Thus, what is specified and measured (though not explicitly) are norms, values, and behaviors.

A second element of control is *evaluation*, which refers to assessing aspects of performance (Eisenhardt 1985) and involves the exchange of information. The formal control literature emphasizes the use of formal written documents to maintain forward progress by assessing current status and making adjustments (Jaworski 1988, Ouchi 1979). The informal control literature assumes performance is a function of cooperative relationships, characterized by common values and norms (Birnberg and Snodgrass 1988, Ouchi 1980). Dialogues and discussions serve to socialize individuals to a set of values and norms or engender collegial and collaborative relationships. Evaluation is not against specified targets, but is instead subjective and personal (Ouchi and Jaeger 1978), focusing on whether behavior is consistent with shared values and norms (Das and Teng 1998) or whether relationships are built around shared norms and are therefore conducive to forward progress (Kirsch 1997).

A third element of control is *reward* (Eisenhardt 1985). Not surprisingly, the formal control literature focuses on the use of formal mechanisms (Whitley 1999), which tie rewards to achieving specific goals or

adhering to prespecified behaviors. In the informal control literature, rewards are not explicitly tied to task behaviors or goals, but instead are based on whether behavior is consistent with group values and norms (Das and Teng 1998, Ouchi 1980). In contrast to formal reward mechanisms such as paychecks, informal mechanisms (e.g., peer pressure) may not be very tangible (Kirsch 1997). Further, focus often shifts from individual performance to rewarding teamwork (Birnberg and Snodgrass 1988, Ouchi and Jaeger 1978).

To these three elements is added a fourth: *roles and relationships*. Control conceptualizations share a focus on the roles assumed by individuals involved in the control episode, as well as their structural relationship. In the case of formal controls, this typically translates to a focus on a particular controller-controllee dyad, with the individuals often in a superior-subordinate relationship (cf. Cardinal 2001, Snell 1992). Conceptualizations of informal controls do not generally delineate a specific dyadic or hierarchical relationship, but instead often focus on groups. A “clan,” for example, is a group of individuals dependent on one another and committed to achieving group goals, such as a team of doctors and nurses working closely together (Birnberg and Snodgrass 1988, Ouchi 1979). Though roles and relationships are an integral aspect of the exercise of control, they have not always been elaborated on in prior research. To understand the nature of the association between controllers and controllees, and its link to the exercise of control, in this study specific focus is afforded to roles and relationships, along with measurement, evaluation, and rewards/sanctions. All four elements of control are summarized in Table 1.

Research Design and Methodology

To investigate these research questions, a qualitative study was designed and conducted, guided by the process described in Eisenhardt (1989). Though characterizing herself as a positivist, Eisenhardt draws from grounded theorists and interpretivists, as well as positivists, in developing her theory-building process. In a similar manner, this study also relies on Yin (1994), Miles and Huberman (1994), and Strauss and Corbin (1990) to supplement and support Eisenhardt’s process. The approach taken here might best be characterized as “scientific realism” or “soft

Table 1 The Elements of Control as Conceptualized in the Literature

Element of control	Formal controls	Informal controls
Measurement	<ul style="list-style-type: none"> • prespecified and formally documented goals and/or behaviors are available • control modes align the goals of controller and controllee • goals and/or behaviors are measurable 	<ul style="list-style-type: none"> • few prespecified behaviors or procedures available • implicit specification and measurement of group values and norms • goals evolve over time • desired end-states result when individual behavior is consistent with the shared norms and values
Evaluation	<ul style="list-style-type: none"> • information about rules, procedures, behaviors, and goals exchanged • information is exchanged in formal, written documents such as standard operating procedures or status reports • evaluation assesses whether behavior is resulting in forward progress 	<ul style="list-style-type: none"> • information about norms, values, and expectations exchanged • socialization, training, discussions, dialogs, and meetings serve as mechanisms of information exchange • goal of evaluation is to build and foster collegial relationships characterized by common values and norms
Rewards and sanctions	<ul style="list-style-type: none"> • based on following specified rules or achieving specified targets • formal organizational mechanisms include pay, bonuses, promotion, or demotion 	<ul style="list-style-type: none"> • based on acting in a manner that is consistent with group norms and values • mechanisms include group recognition and peer pressure
Roles and relationships	<ul style="list-style-type: none"> • focus is usually on dyads • controller and controllee are often in a formal superior-subordinate relationship or in a relationship that is consistent with the organizational hierarchy 	<ul style="list-style-type: none"> • often a work group or professional society • may be a <i>clan</i>, which is a group of individuals who are dependent on each other to accomplish their work and who are committed to achieving group goals

positivism" (Madill et al. 2000), meaning that the process is designed to reveal preexisting phenomena and relationships among them. This assumes that the phenomena under investigation are relatively stable and objectively exist, which is consistent with a positivist view. However, the approach is not limited to examining preidentified constructs, but is designed to surface other constructs as well, in the manner of interpretivists or grounded theorists. The hybrid approach used here is consistent with Eisenhardt's (1989) method and the Madill et al. (2000) arguments.

Focusing on the exercise of control within phases and changes across phases is known as temporal bracketing, a strategy for making sense of "eclectic" process data, which is especially useful when "there is a certain continuity in the activities within each period and there are certain discontinuities at its frontiers" (Langley 1999, p. 703). In this study, it seems likely that changes in controls will be quite discernable as the projects transition across phases because significant changes in context (e.g., changes in task or personnel) can occur at these boundaries. Further, bracketing allows the "examination of how actions of one period lead to changes in the context that will affect action in subsequent periods" (p. 703). Systems development phases offer a means of bracketing

because actions taken during one phase (e.g., excluding user groups from requirements determination) can lead to changes in the context (e.g., increased resistance) that affect action taken in a subsequent phase (e.g., deploying incentives during implementation to encourage adoption of the system). Though this study examines control events, it also surfaces factors influencing control choices. Langley (1999) argues that studying factors, along with events, is crucial "to identify the effect of a contextual variable on the evolution of events" (p. 693).

Sites

The data come from case studies of two IS projects, which are part of a broader study investigating global IS (for details, see Collins and Kirsch 1999). The research design is an embedded case study design (Yin 1994) in which a project phase is the smallest unit of analysis. The two cases represent a literal replication strategy meaning that similar results are expected in each case (Yin 1994).

The two sites, called Credit and Shipments, were chosen for similarities on dimensions important to this study, consistent with a literal replication strategy. The systems are in-house, custom-developed common applications designed for global deployment. In both

Table 2a Data Collection for Credit Project

Telephone interviews*	On-site interviews*	Documentation**
Senior IS Manager, 11/96, 1/2 hour Senior IS Manager, 12/96, 1 hour	Senior IS Manager, 5/97, 1.5 hours Manager of Analysis and Q/A, 5/97, 1 hour Systems Development Manager, 5/97, 1.5 hours Global Implementation Manager, 5/97, 1 hour Global Training Manager, 5/97, 1 hour	Project summary, 4/97
Product Delivery Manager, 12/98, 1/2 hour		

* Entry indicates the interviewee's role in the firm, date of interview, and length of interview.

** Entry indicates the type of documentation reviewed and date of initial review.

cases, a U.S.-based project team was responsible for developing the core system. Both firms have a history of successfully building in-house applications, and both have large internal IS units. At the time of data collection, neither project was completed. This was felt to be important so that the dynamics of the team interactions and management approaches would be fresh and thus easily captured. However, it was also felt that the projects should have been ongoing for at least six months to get beyond initial stages of establishing project teams, procedures, and processes. Both projects met these criteria and are described in Appendix A.

Data Collection

Prior to on-site data collection, telephone interviews were conducted with senior IS managers to gain an understanding about the firm, the IS department, and the project itself, and to identify appropriate interviewees. Subsequently, individual interviews were conducted on-site in April and May 1997. At each interview, a scribe took notes and asked clarifying or follow-up questions. Interviews were tape recorded and later transcribed. The author listened to the tapes, verifying the transcriptions and supplementing them with the scribe's notes. The interviews were rich and detailed, and yielded more than 250 pages of transcriptions. Interview data were augmented with project documentation, which was valuable for verifying project objectives, roles, responsibilities, and progress to date. A Credit project summary document, describing the business problem, project mission and objectives, technical architecture, and customer access to the global system, was made

available to the author. Two versions of Shipment's project plan were also provided—at the beginning of the data collection effort and six months later. The detailed plan documented the project scope, statement of work, development strategies, methodologies, and status. In total, more than 125 pages of project documentation and field notes were gathered.

A list of interviewees and project documents is shown in Tables 2a and b; the table entries are arranged to highlight the timing of the data collection effort. In both cases, IS stakeholders associated with the development of the core system were interviewed, including senior managers, project managers, and individuals responsible for or heavily involved in some key aspect of the project (e.g., development or training). In addition, the Manager of Analysis and Q/A (Credit) and Senior Systems Advisor (Shipments), who acted as user liaisons in their respective projects, were interviewed. Though these liaisons were officially part of the IS organizations, their roots and prior work experiences were in the business operations and thus they were able to represent the users' views. Adding to the user perspective were the User Representative (Shipments) and the Product Delivery Manager (Credit), to whom the IS and user personnel reported. All of these individuals were located in the United States.

Interview questions focused on the project's history and background, individual and team roles and responsibilities, and control approaches.² Other employees of the firm, though not project participants

² Interview questions are available from the author on request.

Table 2b Data Collection for Shipments Project

Telephone interviews*	On-site interviews*	Documentation**
CIO, 12/96, 3/4 hour IS Managing Director, 12/96, 1 hour	IS Managing Director, 4/97, 1 hour Senior Systems Advisor, 4/97, 1 hour Senior Technical Advisor, 4/97, 1.5 hours Senior Business Application Analyst, 4/97, 1 hour Systems Development Manager, 4/97, 1.5 hours Technical Advisor, 4/97, 1 hour Senior Programmer Analyst, 4/97, 1 hour User Representative, 4/97, 1 hour	Project plan and status, 4/97
Systems Development Manager, 7/97, 1/2 hour Systems Development Manager, 10/97, 1/2 hour		Project plan and status, 10/97

* Entry indicates the interviewee's role in the firm, date of interview, and length of interview.

** Entry indicates the type of documentation reviewed and date of initial review.

(and not shown in Tables 2a and b), were also interviewed as the opportunity arose, and company material such as annual reports and websites was reviewed. While these additional interviews and company material did not contribute to the triangulation of the project facts, they did add to an understanding of the firm and its environment, which in turn increased the overall understanding of the context in which the projects were undertaken. Yin (1994) provides a number of recommendations for establishing construct validity and reliability. As detailed in Appendix B, these recommendations were generally followed.

Analysis

A multistep analysis process was used. The interview transcripts were read several times by the author to become immersed in the data, which is a critical step in the analysis process (Eisenhardt 1989). To address the first research question, comments pertaining to the measurement of behaviors and outcomes, evaluation, rewards, and sanctions were highlighted. Beside each marked passage, notations were made as to what roles stakeholders assumed and the nature of their relationship. The project phase was also noted. The transcripts were then read again, and passages related to changes in control choices were highlighted. These passages represent the data for answering the second research question.

The next step involved the use of matrices to organize and analyze the corroborated data (Miles and Huberman 1994). To answer the first research question, a set of three matrices per project was constructed: one each for measurement, evaluation, and reward/sanction data. These data were then coded to identify specific control mechanisms. This coding was guided by prior research, which documents a wide range of mechanisms used to exercise control of IS projects (Kirsch 1997). Every mechanism was then coded as "formal" or "informal" depending on whether the mechanism had been documented and management initiated (Jaworski 1988). Finally, for every passage inserted into the six matrices, the project phase, individual roles and relationships were noted.

To answer the second research question, two matrices (one per project) were constructed containing comments related to reasons for changes in controls as projects passed from requirements determination to development, and from development to implementation. For each entry the nature of the change to a control element was described. Conceptual labels were then applied to the passages to explain why changes occurred. This coding, known as open coding (Strauss and Corbin 1990), was guided by the literature because task characteristics, role expectations, knowledge and skills, and vendor performance have all been identified as triggers of change (Choudhury and Sabherwal 2003). However, as Eisenhardt (1989)

suggests, the coding was not constrained by the literature to uncover new phenomena. Open coding was followed by axial coding (Strauss and Corbin 1990), which is a process of linking similar concepts into categories. Generating a theory from these data by integrating and relating categories is called selective coding (Strauss and Corbin 1990).

Results

In this section, within-case analyses are presented to examine *how* various controllers utilize control elements to exercise control, and *why* controls change as projects progress through their phases.

How Credit Stakeholders Exercise Control During Different Project Phases

Requirements Determination. The goals of the Credit project were unclear at the outset of this phase. The stakeholders wrestled with the extent to which the business process should be reengineered, the overall design of a common system, and the feasibility of various technical solutions. In time, though, IS and business stakeholders collectively defined project goals and identified global requirements for the new system. To do so involved intense discussions (“We have to work very closely with each other,” Manager of Analysis and Q/A). These discussions and debates provided an opportunity to build understanding of and empathy for others’ situations, and paved the way for a common system:

Some of the drivers came out of representatives from each of the locations, regional managers that came together, in Hong Kong, in [the United States], wherever, to talk about, what do I need the system to do? How do we make this better? How do I streamline my profits? How do I have this one system? (Senior IS Manager, Credit).

Eventually, the stakeholders became committed to the idea of a common solution, and they negotiated global requirements. Finding common ground was taxing though because there were no existing procedures to guide them. The Manager of Analysis and Q/A commented, “It was challenging on all our parts. But we had to do it. We’re all working towards one goal, and the goal is to have a global system. It’s not easy.” For the most part, the tenor of their meetings was collaborative and collegial. Though they debated how to

reengineer the letters-of-credit business process, stakeholders came to appreciate the importance of the system and their relationship became one of peers and partners. Evaluation was subjective, and no formal organizational rewards or sanctions were associated with completing this project phase. Rather, stakeholders were motivated because they “are excited with the system” (Manager of Analysis and Q/A).

Development. The goal of this phase—to build a system—was much less ambiguous than the prior phase’s, and, for the most part, behaviors for achieving this goal were known to Credit stakeholders. For example, the U.S.-based team followed a fairly common life-cycle methodology to code the application. The Systems Development Manager described their homegrown approach:

We have a fairly standardized development, analysis, requirements gathering, review process that we just basically evolved to, having used the experience of the people on the team. There’s no specific [vendor] methodology that we use.

The project team was organized hierarchically, and there was relatively little interaction with users. Work assignments, goals, and adjustments tended to flow from IS managers to subordinates, often formally documented in memos or project management tools, and supplemented with informal mechanisms such as ad-hoc meetings. Evaluation tended to be formal: the Systems Development Manager held “formal daily meetings” with his subordinates, explaining that “I keep fairly abreast of what these guys are up to.” The progress of local (regional) development teams was also assessed because their work impacted the U.S.-based team. Much of this assessment occurred via e-mail, websites, meetings, and telephone calls:

A lot of management effort went into controlling the process, which is hard work. I mean, it’s six o’clock in the morning conference calls, it’s eleven o’clock at night conference calls (Systems Development Manager, Credit).

Formal rewards and sanctions were evident, as at least some performance evaluations were based on on-time, within-budget deliverables. The Systems Development Manager explained his process, “I’ve broken my group down into a number of functional areas. . . . The managers there are working on a set

of objectives, which is set on a monthly basis.” The Systems Development Manager himself was formally held accountable for meeting specific project objectives, such as meeting schedule time estimates.

Implementation. During this phase, specific, clear goals were identified and communicated to team members. Further, implementation activities were documented in established procedures and plans:

Without a doubt, one of the most important elements is your project plan. You have to have structure. . . . It goes back to my three C’s: commitment, communication, control (Global Implementation Manager, Credit).

The Global Training Manager also emphasized the need for formal planning (“As we go into each country, I just verify with [regional managers] that this is the training plan”) to control and coordinate activities.

Evaluation of progress tended to be formal and task-oriented, and individuals were held responsible for following detailed plans. As the Global Implementation Manager explained, “We’ve assigned a project manager to each project that is responsible for developing [and] executing the detailed work plan, to ensure that all of the steps that need to be done are identified.” Though formal evaluation mechanisms were used, informal ones were also highly valued, as evident in this example provided by the same manager:

You learn more, and you agree to more things outside the office than you do [in the office]. I’ll give you a good example. At this operations managers meeting in Asia in February, we had karaoke night. It was all the folks from [the United States], all the folks from Asia, and the folks from Europe. You break down a lot of barriers. . . . Because you have to be here twelve hours a day, you’ve got to have some fun. And fun translates into relationships. And that night—the karaoke night—went further to build relationships than anything else we’d done.

And I did the same thing in Europe. We had a bowling night, because I had people from Germany and Hong Kong, and [the] U.K., and Milan, and all over the place. We were all trying to work through some of the difficult concepts of implementation. So, we had a bowling night. And I’m a terrible bowler. Getting up there and making an idiot of yourself—it goes a long way to building those relationships. And once you’ve built them, you pick up the phone and you send an e-mail, and the reception is much better.

Social events therefore served multiple purposes, including the exchange of information, relationship building, and maintaining implementation progress. Not only were relationships among IS professionals valued, but so too were relationships between IS and business managers. Though the business managers’ roles were distinct from IS, their involvement was crucial to ensure that changes were made to business processes (i.e., changes in work flow, task details, and procedures). Given the interdependencies of the IS and business tasks, cooperative relationships were viewed as critical to ensuring implementation success.

How *Shipments* Stakeholders Exercise Control During Different Project Phases

Requirements Determination. During this phase, stakeholders found the goal—to identify requirements for a common import/export processing system—quite ambiguous. Stakeholders were unsure how to conceptualize a common, global solution, and they struggled to define the core part of the system versus the “local adaptations.” Project goals were fluid and there were few, if any, procedural guidelines for determining common, global requirements. As a result, the stakeholders spent considerable time trying to decide what the system should be. The Senior Systems Advisor explained:

There were six people chosen to [review the business process in Europe], and I was one of those persons. We went over there, and we literally spent a month traveling around to all the places. . . . We did that, and we wrote a white paper then: What did we learn, what did we see, and what did we think needs done?

Evaluation was focused on whether stakeholders were coming to a shared understanding about the project. During meetings and discussions, stakeholders reiterated the purpose and need for a common system, and exerted some pressure on those involved to behave in a manner that would be conducive to building a common system. For example, representatives from some countries did not want to attend meetings with representatives from other countries, largely due to historical animosities. Senior management encouraged, cajoled, and pressured individuals to attend.

Business and IS managers participated in this phase, treating each other as peers. Responsibility for

forging global requirements was shared among the group. The Senior Systems Advisor characterized it this way: “I like to think of it that we’re a team and that we’re all responsible.” Formal rewards and sanctions were not tied to the determination of requirements. Instead, team-building sessions and meetings served to incent stakeholders to embrace common values. The System Development Manager explained various approaches for generating this level of commitment and shared goals: “We’ve had kick-off meetings. We’ve had users come in We had a user from Europe that came in just to talk to this group, to tell them what this project is going to do for Europe.”

Development. In comparison to the prior phase, the goals of development were much better understood, although the Shipments team experienced some difficulty articulating appropriate behaviors. The team decided to follow an “incremental” approach to development, with which they had no experience and no methods (“We don’t have set procedures laid out,” Senior Technical Advisor). Instead, a process evolved as this phase unfolded (“We’re in the process of a process being defined,” Senior Programmer Analyst). Not only did they define new procedures, but they also defined new roles. For example: “This is really kind of a new approach . . . where they have a user representative sitting and working within the IT department” (User Representative, Shipments). As this phase proceeded, though, each increment came to be viewed as a small project to which familiar and existing approaches could be applied and to which a project team could be formally assigned.

During this phase, formal evaluations of progress were conducted, for example, formal reviews took place on a biweekly and quarterly basis. Information was exchanged via formal reports, meetings, and Lotus Notes. Formal progress evaluations were supplemented with informal communication exchange, including e-mail, phone calls, and meetings. As the User Representative commented, “Almost everyday we have some type of informal meeting.” The IS Managing Director provides another example:

I typically do the walk around management style and check up with people, both the checking up from a technical standpoint and also checking up from a user standpoint, the user liaison, to get their feelings on how they feel that things are progressing.

Rewards were based, at least in part, on performance: “There’s a direct link [between pay and performance]” (Senior Technical Advisor). Though the team was hierarchically organized, the selection of individuals who can accept responsibility and perform without constant observation was deliberate:

I want people to be responsible. I guess that’s why I tend to work and concentrate on “Here’s your mission” and show them the value of that and let them live up to that. And of course I’ve selected people for the team who do that very well (Systems Development Manager, Shipments).

The role of strong collegial relationships in augmenting formal measurement, evaluation, and rewards was a common theme at Shipments. For example, the Systems Development Manager felt that collocation was especially important for building relationships because team members:

. . . can start thinking the same. You can develop your own habits, because you kind of tend to adapt to the people around you and what they do and the time they take breaks and their kind of work ethics. I’d like for everybody to do it together. Learn about each other, work together, begin to appreciate differences That just helps people work together.

Implementation. A range of implementation goals was clearly specified for the Shipments project. The Senior Systems Advisor emphasized that “January will be our production implementation date” and that top management’s goals were reduced costs or increased revenues. Though goals were specified, the behaviors for achieving those goals were not. For example, the IS Managing Director explained that a “main driver” for the system “is having something on the shelf that you can fairly easily integrate into a new location.” However, the Shipments project team did not have a set of preexisting behaviors to accomplish this objective, though they did have well-defined procedures for implementing other types of systems.

As the team moved toward the installation of the first increment, measurement and evaluation became increasingly formal. The Technical Advisor and Senior Technical Advisor defined a variety of procedures and policies, including the use of project management software templates and reports. In addition, several stakeholders noted the explicit link between performance and rewards.

Collegial relations between IS and business stakeholders served to reinforce common values and to ensure forward progress during this phase. This relationship building extended to the end-users:

You can't walk in and say, "We want to do it this way." They'll kick you out on your ear. You're just in trouble. It's a relationship you have to build up over years (Senior Systems Advisor, Shipments).

IS managers seemed to desire shared accountability with the business stakeholders for successful implementation, but they also sensed that accountability might rest solely with IS. For example, though he expressed his belief in shared responsibility, the IS Managing Director at Shipments also noted that, "If we're talking about the actual system implementation, building a system and implementing it, I own responsibility for that."

Table 3 provides a summary of how control elements were utilized across the phases of the Credit and Shipments projects. Next is a discussion of why control choices change over each project's life cycle.

Why Controls Change Across Phases of the Credit Project

Requirements Determination to Development. Moving into development brought a change in task characteristics for the Credit project. Where determining requirements for a common system was unstructured and novel, development was more straightforward and better understood. The Systems Development Manager noted that the requirements phase is "much, much more complex than what development is." The change to a more structured and familiar task allowed them to utilize existing formal mechanisms of measurement and evaluation during development such as standard methods, formal reviews, and meetings—approaches that they have been "doing for a certain amount of time" and that they are using "with experience." In addition, new formal measurement mechanisms, such as change control procedures, were defined to supplement existing ones. Finally, because specific development activities could be identified and delegated, additional formal mechanisms of control were utilized: project teams with superior and subordinate roles clearly delineated and rewards tied to specific deliverables and behaviors.

Requirements determination and development are interdependent tasks as the output of the former becomes the input to the latter. To ensure developers built a product consistent with the goals, objectives, and requirements defined in the initial phase, Credit managers added measurement and evaluation control mechanisms as the project transitioned between phases. These included formal and informal mechanisms such as scheduled meetings and ad-hoc discussions to aid the knowledge transfer between stakeholders: "The developers need to understand the business need to understand coding and all the other stuff. You need to explain to them the business needs...meetings, constant meetings, discussions" (Manager of Analysis and Q/A, Credit).

After the project experienced performance problems in requirements determination, adjustments were made to control choices in development to bring the project back on track. For example, during the initial project stage, a system based on local, not global, requirements was built in Asia. This full-functioning system, which was not well received, was supposed to be a prototype to help define requirements. As a consequence, development was taken away from Asia and moved to the United States where developers were more closely monitored and activities more easily assessed and adjusted, i.e., formal mechanisms were added.

As the Credit project transitioned from requirements determination to development, different people became involved in the project. Changes in knowledge and skills drove changes in the control elements. For example, the Credit project experienced substantial turnover during requirements determination, leading to a loss of tacit knowledge as well as knowledge about how to find pertinent information in the "rooms of reams of documentation" (Senior IS Manager), knowledge needed for subsequent phases: "I actually lost somebody last week who was one of three of the last people who actually worked on this from the beginning. It was a big loss because he was a big part of the continuity for us" (Senior IS Manager, Credit). Subsequently, project specifications and procedures were formally documented, and formal reports were utilized.

During requirements determination, the stakeholders embraced a common goal. However, the development phase brought different stakeholders, and their

Table 3 The Elements of Control as Observed During the Project Phases

Control element	Requirements determination		System development		System implementation	
	Credit	Shipments	Credit	Shipments	Credit	Shipments
Measurement	<ul style="list-style-type: none"> • Few prespecified behaviors or procedures exist • Discussions and debates identify common values, norms, acceptable behaviors • Project goals are fluid and evolving 	<ul style="list-style-type: none"> • Few prespecified behaviors or procedures exist • Discussions and debates identify common values, norms, acceptable behaviors • Project goals are fluid and evolving 	<ul style="list-style-type: none"> • Development goals are well defined • Existing and new development procedures and methods are applied to the project 	<ul style="list-style-type: none"> • Development goals are well defined • Some development procedures and techniques are known, but some evolve as project proceeds 	<ul style="list-style-type: none"> • Implementation goals are well defined in plan • Implementation procedures and techniques are known and applied to the project 	<ul style="list-style-type: none"> • Implementation goals are well defined in plan • Few prespecified behaviors exist for implementing a common system, though some procedures apply
Evaluation	<ul style="list-style-type: none"> • Focus on whether behavior is consistent with values and norms, stakeholders are learning and compromising, and commitment to project is building • Evaluation occurs during meetings and discussions 	<ul style="list-style-type: none"> • Focus on whether behavior is consistent with values and norms, stakeholders are learning and compromising, and commitment to project is building • Evaluation occurs during meetings and discussions 	<ul style="list-style-type: none"> • Focus on whether behavior is resulting in forward progress • Status reports, meetings, reviews are formal sources of information • E-mails, websites, meetings, and calls are informal sources of information 	<ul style="list-style-type: none"> • Focus on whether behavior is resulting in forward progress, and on state of relationships • Project plans, reports, meetings are formal sources of information • E-mails, walking around, calls are informal sources 	<ul style="list-style-type: none"> • Focus on whether behavior is resulting in forward progress, and on state of IS-user relationship • Project plans, status reports, calls, meetings are formal information sources • Social events are informal sources 	<ul style="list-style-type: none"> • Focus on whether behavior is resulting in forward progress, and on state of relationships • Project plans, reports, meetings are formal sources of information • E-mails, calls are informal sources
Rewards and sanctions	<ul style="list-style-type: none"> • Few formal rewards/sanctions • Discussions reward and reinforce common values and shared norms • Group is intrinsically motivated to succeed 	<ul style="list-style-type: none"> • Few formal rewards/sanctions • Discussions and meetings reinforce and reward values and norms • Group shares responsibility for outcomes 	<ul style="list-style-type: none"> • Rewards are linked to meeting-specific goals • Responsibility for day-to-day activities is delegated 	<ul style="list-style-type: none"> • Rewards are linked to meeting-specific goals • Responsibility is delegated • Some selection of individuals who can work autonomously 	<ul style="list-style-type: none"> • Rewards are linked to following plans • Responsibility is delegated • Social events reward and reinforce common values and norms 	<ul style="list-style-type: none"> • Rewards are linked to meeting project and business goals • Collegial relationships reinforce common values and norms
Roles and relationships	<ul style="list-style-type: none"> • IS-user partnership evolves • IS and users participate 	<ul style="list-style-type: none"> • Strong IS-user partnership • IS and users participate 	<ul style="list-style-type: none"> • IS team is hierarchically organized • Users rarely participate 	<ul style="list-style-type: none"> • IS team is hierarchically organized • User liaison is assigned 	<ul style="list-style-type: none"> • IS and user teams are distinct • IS and users work cooperatively to coordinate tasks 	<ul style="list-style-type: none"> • IS and user liaison work cooperatively to coordinate tasks • Distinct teams for installation

goals were not aligned. Consultants hired for development work, for example, did not exhibit the level of commitment that in-house team members did:

They don't want the aggravation of being part of the team, of being put under pressure. That doesn't work for us. My other team members are under pressure. They are under deadlines for deliverables; they are working under different time zone issues (Systems Development Manager, Credit).

Consequently, the Systems Development Manager opted to hire as many consultants as possible as full-time Credit employees, which allowed him to utilize the same formal control mechanisms for measurement, evaluation, and reward that were used with other in-house employees. Using these controls mechanisms, he was able to motivate the consultants to work in a manner consistent with the organization's objectives.

Development to Implementation. Just as development and requirements determination are interdependent tasks, so too are development and implementation: "The implementation schedule dictates my schedule" (Systems Development Manager, Credit). Thus, to aid the transition between phases to facilitate cooperation and coordination among stakeholders, formal plans and policies were put in place:

The control is your project plan. You know, making sure that you have got a well thought-out, detailed plan, by country, because all the steps, the resources assigned, who's doing what to whom, and you know what your fall-back position is if somebody slips (Global Implementation Manager, Credit).

When the implementation phase was underway, differences in priorities surfaced that were not evident in earlier phases. For example, some non-U.S. units did not place as high a priority on installing the system as the U.S. units. In response, the Senior IS and Global Implementation Managers added informal mechanisms (e.g., travel) emphasizing "facial contact" to cultivate understanding of the units' differing business environments and commitment to globally deploying the system. The Global Implementation Manager also spent considerable time "building a partnership" to sell the need for a global deployment.

Though most stakeholders were collocated during development, this changed as the project moved into implementation and local units became involved in

preparing their sites for installation. The U.S.-based teams experienced the effects of time and place differences: "There's this distance that's set up between you that just acts as a natural barrier" (Global Training Manager, Credit). Because of these barriers, the managers changed their control choices, adding both formal evaluation mechanisms, such as routinely scheduled conference calls, and informal mechanisms promoting more face-to-face time. These mechanisms encouraged collegial relationships and mutual understanding, and reinforced project goals.

Differences in culture that were not evident during development became quite salient during implementation, in large part because the U.S.-based project team was forced to interact with an increasing number of individuals from other countries and cultures. This ultimately led to adjustments in control. For example, one manager was frustrated that her formal role with its U.S.-vested authority did not transfer to Asia as the project proceeded into the implementation phase: "I have very direct control over what I do here in [the United States]. I do not have that control over in Asia" (Global Training Manager, Credit). To address this issue, she turned to informal mechanisms of "patience and diplomacy." Using persistence, patience, and tact in her dealings with the local stakeholders, the Global Training Manager was able to better overcome resistance from the Asian staff, and begin to cultivate their buy-in and cooperation.

Why Controls Change Across Phases of the Shipments Project

Requirements Determination to Development. Additional formal measurement and evaluation mechanisms were defined as the Shipments project moved into development and the task, as compared to requirements determination, became more structured and less ambiguous. Consequently, the Shipments team had a better grasp on what needed to be done and was able to specify project goals and objectives:

We broke that [scope statement] down into what we call increments, trying to get to small increments. And, working with our [development] folks, we had an agreement that each increment would be like a six-month deliverable (Senior Systems Advisor, Shipments).

Some of these mechanisms already existed, e.g., a development process, and some were newly designed for their incremental approach, such as reporting mechanisms and estimating techniques. Roles and responsibilities were also formalized during development as a team was assigned to each increment.

As the project proceeded into development, different people became involved, revealing different types of relationships, which sparked changes in control. For example, a history of a strong working relationship translated to a reliance on informal evaluation mechanisms and a collegial type of relationship:

The [user representative] and I are old pals... I'm kind of handicapped in that I can't persuade anyone of anything. I couldn't persuade somebody to leave a burning house. But I can persuade [the user representative] because he's been through it with me (Senior Programmer Analyst, Shipments).

The involvement of different stakeholders also introduced changes in the knowledge and skills brought to bear on the project, which influenced control choices. Moving into development, a user representative was physically placed with the team. Explaining his ability to understand and interpret technical documents and to participate in technical discussions (formal measurement and evaluation mechanisms), the user representative commented, "There's no doubt that having a development background helps me in this role."

Collocating the user representative also helped his manager, a project sponsor, overcome the geographic barrier of being in Europe. The user representative's U.S. location and formal relationship with the project team increased the sponsor's ability to assess project progress formally and informally:

She [project sponsor] wanted somebody here to kind of keep an eye on [the developers], if you will, to make sure that this project is continuously moving forward, and that the team is not getting distracted and pulled away on other projects and stuff like that. [I'm a] mini-watchdog (User Representative, Shipments).

Changing role expectations also influenced control choices. In contrast to how the requirements determination stakeholders viewed their roles and relationships, the Systems Development Manager did not see himself as a peer with his subordinates. Rather, he believed in empowering them to act autonomously

and to design their own procedures (i.e., a reliance on informal controls): "We want people to follow procedures, but we're not dictating to every single group how that procedure will be [designed]."

A lack of understanding of different cultures resulted in the addition of both formal and informal evaluation mechanisms: when communication with European counterparts became quite tense as the project moved into development, stakeholders added formal evaluation mechanisms (regularly scheduled conference calls) as well as informal ones (increased diplomacy in interactions). These mechanisms served to encourage stakeholders to set aside their individual differences, focus on the needs of the organization as a whole, and begin communicating, which ultimately moved the project forward.

Development to Implementation. As the Shipments project moved closer to installing the first increments, additional formal measurement and evaluation mechanisms were utilized. Because tasks were structured and well defined, stakeholders applied existing control mechanisms to implementation, including scheduled meetings, progress reports, project management software, and specific success criteria. New mechanisms were also designed to augment existing ones. For example, architecture and technology standards appropriate for a common, global system were developed and communicated to regional stakeholders, who were expected to adhere to them.

The need to manage the interdependent tasks of installing system changes and business process changes became critical during this phase, and this need triggered changes in control choices, in particular, efforts to sell a common solution to the local units. For example, the Technical Advisor noted the IS Managing Director's advice to "take this on the road" to generate excitement about the system and commitment to its success. The IS Managing Director himself explained a "partnership" between IS and business stakeholders, and between corporate and local constituencies. He envisioned global business ownership of the application, rather than corporate IS owning the application: "I think that's one of the biggest things that will probably determine the success of this...how do you kind of get some ownership on a global basis." To achieve this objective of global or shared ownership, the IS Managing Director

relied on informal mechanisms of personal contacts and relationships: “You have to work with them on a one-on-one basis.”

As the project moved into implementation, lack of knowledge and experience with the deployment strategy—the local installation of off-the-shelf core modules—influenced control choices. Stakeholders did not attempt to define precise behaviors or goals, but rather utilized informal measurement mechanisms: “We’re basically going to build parts, put it on the shelf, and have it there available for the local regions to use” (Technical Advisor, Shipments). Behind this approach was an expectation that the regions shared in the vision for the common system and would willingly decide when to implement the core modules and how to localize them for their own regions.

Role expectations again changed in this phase, causing changes in control. For example, the Technical Advisor described his expectations of formal roles and responsibilities for local and global teams:

For deployment, it makes more sense for the core people to go to the regions where the implementations are being done, where the equipment is being installed, and make sure that things are being done correctly there to support the components. . . . We’ll participate [in the implementation], but we’re not responsible for it. They will organize it, conduct it, produce the end result, but we will be there.

The transition to implementation highlighted priority differences among sites. Historically, the regional units had acted quite autonomously, and had not always been receptive to headquarters-driven initiatives. Thus, by design, the Shipments project was not packaged as a corporate initiative, but instead the European roots of this project were emphasized. The IS Managing Director explained:

I wanted to make sure that the focus right now is on Europe . . . for the first implementation. . . . Once we have more things to show and in place, actually working, where you see the benefits at a country level, then I think we [will] have a much better position and leveraging point to be able to say that this is something that needs to be done worldwide.

This reliance on informal channels is seen as a way to promote the system, as are formal measurement and evaluation mechanisms such as presentations

and “internationalization studies” to document and understand individual country processes:

Probably the biggest [challenge] that we’ve run into is that each country has defined their own procedures, standard operating procedures. And it’s different by country. . . . We have a team going out ahead of [the Shipment installation] to do standard operating changes across the world before we hit them with automation. . . . The countries tend to get rather, I don’t want to say defensive, but I can’t think of a better word: “This is mine. I have my relationship with customs that I’ve forged. Don’t mess with it.” We have to work through a lot of those issues too (Senior Technical Advisor, Shipments).

Table 4 summarizes the above discussion. The table depicts where formal and informal control elements were added and the reasons control elements changed across project boundaries.

Discussion and Implications

In this section, a theory of control dynamics is proposed to explain how control is exercised in each phase, and why control changes across phases. Implications for research and practice are also drawn, and suggestions for future research are offered.

How Control Is Exercised During Project Phases

As suggested in Figure 1 and Table 3, each project phase exhibits a unique pattern of control. When these projects began, stakeholders were unsure how to visualize a common system and how to design, develop, and deploy one. Project goals were fluid, and behaviors for determining common requirements were largely unknown. Shared norms and values developed as the group made sense of an ambiguous situation by learning, compromising, and negotiating a set of global requirements to reflect a common vision. No formal relationships were in place between controller and controllee; rather, IS and business stakeholders worked together to forge consensus on requirements. Evaluation was subjective and collaborative, stressing commitment to shared goals. Organizational rewards were not tied to specific behaviors or outcomes, but the stakeholders seemed to share responsibility for their success. Thus, during this phase, control can be characterized as “collective sensemaking” in which informal mechanisms of control are used jointly by IS and business stakeholders

Table 4 Reasons for Changes in Control Elements as Observed Across the Project Phases

	Requirements determination to development								Development to implementation							
	Credit				Shipments				Credit				Shipments			
	M	E	R/S	R&R	M	E	R/S	R&R	M	E	R/S	R&R	M	E	R/S	R&R
Project context:																
Task characteristics change*	F	F	F	F	F	F		F						F	F	
Tasks are interdependent	F&I	F&I											F		F	I
Project performance suffers*		F	F	F												
Stakeholder context:																
Knowledge & skills change*	F	F			F	F								I		
Nature of relationship evolves*						I		I								
Lack of common goals	F	F	F													
Role expectations change*								I								F
Global context:																
Priority differences surface										I		I	F	F		I
Geographic differences						F&I		F		F		I				
Time zone differences										F		I				
Cultural differences						F&I						I				

* This is consistent with findings from prior studies of the dynamics of control (Choudhury and Sabherwal 2003, Mähring 2002).

M = measurement control element; E = evaluation control element; R/S = reward/sanction control element; R&R = roles and relationships control element; F = formal control mechanism added; I = informal control mechanism added.

to clarify ambiguous project goals, reach consensus on a common business process, and negotiate a set of global system requirements.

As seen in Figure 1, control during development is an exercise of “technical winnowing,” as informal mechanisms are supplanted with formal ones and business managers are no longer prominent in the exercise of control. Much of the ambiguity and fuzziness of the previous phase disappeared, and focus shifted to achieving specific development goals. With a more structured and familiar task,

stakeholders drew on existing formal control mechanisms such as methodologies and reviews, which they supplemented with new formal mechanisms (e.g., new change control procedures) and a few informal ones (e.g., e-mails). Teams were structured with roles clearly delineated, and rewards were tied to specific objectives. Work assignments, expectations, and procedures flowed from IS manager to subordinate, and evaluation of progress was largely task focused and formal. Unless part of the project team, business managers played almost no role in the

Figure 1 Control Dynamics: How Control Is Exercised During Project Phases

Control element:	Collective sensemaking by IS & business stakeholders	Technical winnowing by IS stakeholders	Collaborative coordinating by IS & business stakeholders
Measurement	Informal mechanisms	Formal mechanisms supplemented with informal mechanisms	Formal mechanisms complemented with informal mechanisms
Evaluation	Informal mechanisms	Formal mechanisms supplemented with informal mechanisms	Formal mechanisms complemented with informal mechanisms
Rewards and sanctions	Informal mechanisms	Formal mechanisms	Formal mechanisms complemented with informal mechanisms
Roles and relationships	Informal mechanisms	Formal mechanisms	Formal mechanisms complemented with informal mechanisms

time → Requirements determination Development Implementation

exercise of control. Thus, in this phase, control is vested in IS stakeholders, who use a preponderance of formal mechanisms, supplemented with a handful of informal ones.

During implementation, there is also considerable reliance on formal control mechanisms such as detailed project plans, although these are complemented liberally with informal mechanisms such as ad-hoc meetings and social events. Though implementation goals were clear, behaviors were only partially known: some methods and procedures existed, but some evolved, particularly in response to novel implementation strategies such as “off-the-shelf” deployment of common modules. Formal and informal measurement, evaluation, and reward mechanisms were utilized by both IS and business stakeholders to ensure successful installations of technology and business process changes, but strong, collaborative relationships paved the way for coordinated efforts. During implementation, as reflected in Figure 1, control can thus be described as “collaborative coordinating,” with control efforts distributed between IS and business stakeholders and formal and informal mechanisms used in concert to achieve specific goals.

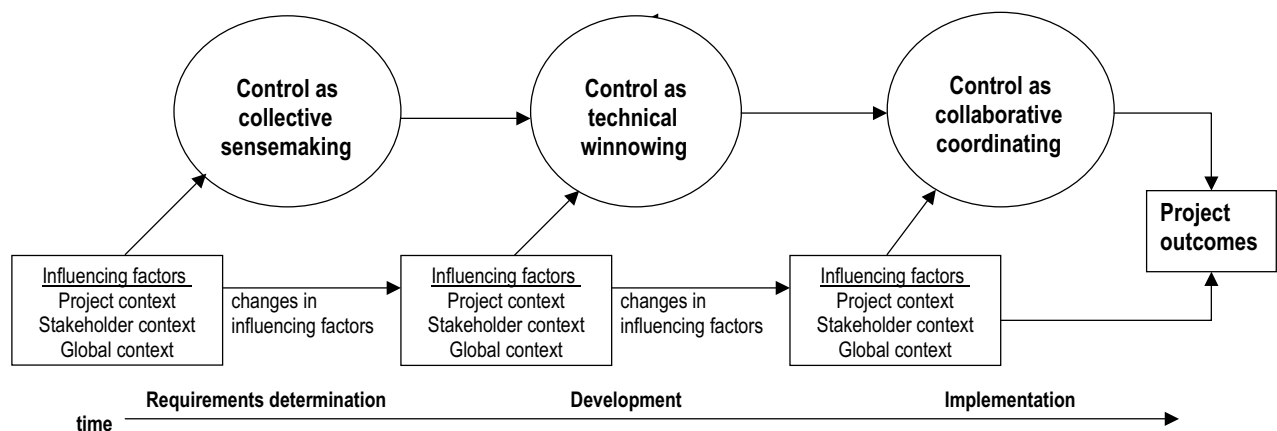
How control is exercised in these cases can be compared with prior evidence. Kirsch (1997) argues that controllers use preexisting mechanisms to implement formal modes of control, that if those mechanisms are not appropriate, controllers will design new ones to implement formal control, and that the formal controls will be supplemented with informal controls. Choudhury and Sabherwal (2003) and Mähring (2002)

also find that, initially, controllers predominantly rely on mechanisms of formal control. Though this description offered by Kirsch is consistent with the exercise of control in later stages, it does not mirror what occurred *at the beginning of these projects*, when both firms relied most heavily on informal control mechanisms. There are at least two explanations for these different findings. First, because none of these prior studies examined control choices for each project phase, it may be that controls exercised during the earliest initiation stage were not uncovered. Second, the two cases presented here represent new kinds of projects for these firms. Existing formal control mechanisms may not have been applicable or appropriate for the requirements determination phase as the stakeholders tried to grasp the scope and boundaries of their projects. Rather than designing new formal mechanisms, they rallied around the need for common systems, and informal control mechanisms proved effective as global requirements were eventually articulated. This result is consistent with other work (Kirsch et al. 2002), which suggests that when stakeholders lack knowledge about processes, they tend to rely on informal mechanisms of control.

Why Control Choices Change Across Project Phases

As shown in Figure 2 and Table 4, the results also suggest that a number of influencing factors in the project, stakeholder, and global contexts affect control choices in each phase. As projects unfold over time, these contextual factors can change. For example, over the life of a project, tasks can vary from novel (e.g., estimating effort needed to build a system

Figure 2 Control Dynamics: Why Control Choices Change Across Project Phases



using new, leading-edge technology) to more structured (e.g., building a test script). As tasks change, managers may vary their approaches, including their choice of controls, to compensate. Further, problems relating to the contextual factors can surface at one point in time, influencing control choices in subsequent time periods. For example, a particular location may express opposition to the system during development. In response, managers may develop new control mechanisms during implementation to engender cooperation from that site. Thus the fluidity and dynamism of the project context influence control choices. This is explored in more detail below. Finally, though not the focus of this study, but depicted in Figure 2, control choices as well as a host of other factors ultimately influence project outcomes.

The first set of influencing factors is related to the project context. As reflected in Table 4, three factors were observed: task characteristics, task interdependency, and project performance. As projects move from phase to phase, *task characteristics* change, causing changes in control mechanisms. Such characteristics include task structure and novelty, as well as the specificity of behaviors and goals. Moving from requirements determination to development and implementation, the task tends to become more routine, better understood, and more structured, which is an environment conducive to formal control (Snell 1992). Accordingly, an increased usage of formal mechanisms was observed in these cases after requirements were determined. Project *task interdependency* can also trigger changes in control choices to ensure knowledge flow and coordination across phases. In these cases, formal and informal control mechanisms were added to manage the interdependencies between requirements determination and development, and between development and implementation. A mix of formal and informal mechanisms continued into implementation, with informal ones given more prominence, possibly because, similar to the requirements determination phase, there is some novelty associated with the implementation of these global solutions. Thus, there may have been fewer formal mechanisms available and appropriate for the task. Finally, when projects experience *performance problems* in one phase, controllers responded by adding formal and informal controls in subsequent

phases in an effort to offset the problem. It is conceivable that they also make adjustments during the phase in which problems are first experienced, a finding noted by others (Choudhury and Sabherwal 2003). How to adapt controls, both within and across project phases, for different types of performance problems is a question for future research to examine.

As seen in Table 4, factors related to the stakeholder context (knowledge and skills, the nature of the relationship between stakeholders, the lack of common goals, and role expectations) also influence choice of control mechanisms. Over time, different people become involved in projects, changing the mix of *knowledge and skills*. More or less experience on the part of the stakeholders will likely result in the use of additional informal or formal mechanisms, respectively (Kirsch et al. 2002), as the stakeholders attempt to compensate for less knowledge about the task or leverage their expertise to exercise control. As projects progress through their phases, the *nature of the relationship* among stakeholders can evolve, prompting changes in control choices. Stakeholders who come to like and respect one another often discard formal mechanisms of control in favor of informal ones. Mähring (2002), observing a similar phenomenon, notes that trust between stakeholders plays a critical role “in the evolution of the control relationship” (p. 280): increased trust led to fewer formal controls and more informal controls. The relationship between trust and control, however, is not clear (Das and Teng 1998), and future research is needed to disentangle these constructs. *Lack of common goals* between stakeholders can also cause changes to be made as stakeholders attempt to realign goals, typically utilizing formal mechanisms such as contracts and pay-for-performance schemes to do so (Eisenhardt 1985). Finally, when stakeholders change, *role expectations* can vary, triggering adjustments in control mechanisms. When managers expect subordinates to manage their own processes, they exercise informal controls by granting individuals considerable autonomy; in contrast, when they expect a formal chain of command, they utilize formal mechanisms of control such as process specifications and formal evaluations of performance (Choudhury and Sabherwal 2003).

The last set of factors influencing choice of control mechanisms is related to the global context, in particular, priority differences among global locales, as well

as geographic, time zone, and cultural differences (see Table 4). As these differences surface, controllers often find existing controls inadequate and therefore make adjustments. For example, *priority differences* between organizational units stemming from different local environments and needs can be mitigated with additional informal controls that promote understanding and foster consensus on common goals, priorities, and values. *Geographic differences* as well as *time zone differences* can also trigger changes in control mechanisms. Difficulties arising because of these differences, such as communication barriers, can be partially addressed with the addition of formal and informal mechanisms to ensure cooperation and coordination (Carmel 1999). *Cultural differences* also became pronounced when the involvement and participation of individuals from multiple locations increased. The use of informal mechanisms such as face-to-face contact can help bridge these differences, as they engender learning about different cultures, improved relations, and ultimately project progress (Tractinsky and Jarvenpaa 1995). Future research is needed to more closely examine the role of the global context on control choices and impacts.

Implications for Research

Much prior research has (implicitly or explicitly) modeled control relationships for tasks that are repeatable and routine (Crisp 2002). However, an IS project may be neither, suggesting that existing theories of control may be more effectively applied to a smaller unit of analysis, such as a project phase. Indeed, the results of this study clearly show that because projects are not static and because project contexts change, controls can change as well. Future research can further refine and elaborate on the theory developed in this paper, examining the theory in other contexts and settings. In addition, studies are needed to determine the most effective mix of formal and informal mechanisms for exercising control of large, complex projects, and to consider the effect of evolving control choices on project outcomes.

An alternative approach to applying existing theories to more bounded tasks is to develop new theories of control that are appropriate for large, complex tasks. Focusing on control elements, and the formal and informal mechanisms with which they are

implemented, is a first step in this effort. The results presented provide evidence that existing assumptions about the theories of control may not always hold. For example, in this study, a focus on measurement and evaluation *outcomes* did not mean that *behaviors* were ignored. Similarly, the behaviors that formed the basis of evaluation and rewards during development and implementation were not always prespecified, but at times evolved. Methodologies, for example, were adapted in a flexible manner to allow for differences across projects. And though stakeholders eventually developed common goals, norms, and values as the requirements determination phase unfolded, they did not “share personal goals that are compatible with the goals of the organization” (Ouchi 1980, p. 138) at the start of the project phase. The results also suggest that, in contrast to the theoretical conceptualizations, any combination of formal and informal mechanisms might be utilized to exercise control. For example, in this study, formal rewards (e.g., linking pay to behaviors) were typically combined with both formal (e.g., scheduled reviews) and informal (e.g., ad-hoc meetings) evaluation mechanisms. Thus, to further knowledge about control in the context of complex and dynamic settings, additional studies are needed that move beyond current conceptualizations of behavior, outcome, and clan modes of control.

Implications for Practice

The results of this study suggest that managers of large IS development projects should structure control strategies for distinct project phases instead of for the project as a whole. In the case of novel projects, as experienced by these firms, managers may rely on informal control mechanisms before using existing or designing new mechanisms of formal control. As projects progress, differences in tasks and stakeholder involvement may trigger control changes. Second, this research highlights the importance of understanding the broader context in which a project exists. Factors beyond project tasks and stakeholder characteristics influence control choices. In this study, factors associated with the global context also influenced control choices; appreciating the nuances of this context will help stakeholders adjust their management approaches accordingly. For example, cross-cultural

training or exposure to different cultures will facilitate project progress when the project extends beyond borders (Carmel 1999, Tractinsky and Jarvenpaa 1995). In addition, the results highlight that control is not always vested in the hands of IS personnel, but that business managers can also play an important role. It is thus important to nurture cooperative and collegial working relationships between IS and business managers because these relationships may not exist prior to the start of a project. Finally, it is important to ensure that business managers are knowledgeable about development practices, so they can effectively exercise control (Kirsch et al. 2002, Mähring 2002).

Conclusions

Before offering concluding remarks, there are several limitations to note. This paper is based on just two case studies. However, an embedded case study design was employed to examine control across project phases, yielding a rich and illuminating dataset and achieving *theoretical saturation* (Strauss and Corbin 1990), the point at which incremental learning from additional data is minimal (Eisenhardt 1989). Second, this study focused on custom-developed applications, which may limit the generalizability of the findings. Despite the prevalence of packaged software, firms continue to build applications, and the findings here should be of interest and relevance to those firms. A third limitation is that the Shipments system had not yet been installed at the time of data collection. Because installations of the first increment were scheduled, however, it was possible to examine control elements as the system neared installation. Fourth, no individuals associated with the local (non-U.S.) teams were interviewed. The study's focus on control issues related to the core system, though, provides insight into perhaps the most challenging aspect of deploying common systems. Finally, the study was retrospective. However, careful steps were taken to establish reliability and validity of the data. Moreover, at the time of data collection, participants were still engaged in installing the systems, suggesting that project facts were fresh in their minds.

This study builds a model of the dynamics of control. The model suggests that as a project progresses through its phases, so too does control progress from

collective sensemaking to technical winnowing to collaborative coordinating. The model also posits that factors in the project, stakeholder, and global contexts influence control choices. As these factors change from phase to phase, control choices also change. Moreover, when a contextual problem is experienced in one project phase, controls change in subsequent phases. These findings offer insight to IS and business managers about how to structure control at different points in a project's life and why adjustments to their control choices may be required to respond to changing contexts. The results also provide a richer, more precise theoretical understanding of control in the context of large, complex tasks and will hopefully spur additional research.

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Appendix A. Case Study Sites

Credit. The Credit project was undertaken by a large financial institution, with headquarters in the United States and over 70,000 employees worldwide. At the time of data collection, the firm had just merged with another large financial institution. The effects of the merger were still being felt, as organizational structures, roles, processes, and systems were being redefined.

The goal of the Credit application is to support a global letters-of-credit business process. Letters of credit was traditionally viewed as a regional process and was supported by many different systems written for a variety of technical platforms. Supporting this myriad of applications was cumbersome. In time, the benefits of a standardized solution were recognized not only for IS, but for the bank's customers as well, who would have a standard product interface no matter where they transacted their business. During 1992 and 1993, a series of conversations was held to discuss a new system. Both IS and business managers were included because both groups reported through the same

structure in this part of the firm. The participants explored the possibility of installing packaged software or enhancing an existing system, but they were unable to find a suitable solution. Instead, they decided to build a new customized system.

Initially, the project was located in Asia, with management centered in the United States. This arrangement proved very costly, though, as stakeholders found communication and decision-making extremely difficult. Eventually, in early 1996, project activities were moved from Asia to the United States. A Systems Development manager was brought from the United Kingdom to form a core development team of 30 members in the United States to develop the common code. Local teams build interfaces and local adaptations. Implementation teams, comprised of individuals from the core team and local unit, are assembled for each installation, but overall responsibility for implementation rests with managers located in the United States. The Credit application, which will be implemented in 31 locations, had been deployed in several locations in Asia, the United States, the United Kingdom, and Germany at the time of data collection.

Shipments. A leader in logistics, this firm employs over 100,000 individuals and is headquartered in the United States. The organization structure is fairly thin, and the international regions have traditionally been quite autonomous. The purpose of the Shipments project is to support a strategic initiative aimed at reengineering import and export processing and lowering shipping costs. Its global focus, however, runs counter to the firm's culture of local independence.

The genesis of this project dates back to the early 1990s when individual countries began to examine, and in some cases undertake, the modernization of import and export processing. These efforts were combined into one global initiative, which officially started in 1996. The Shipments project was awarded to a corporate IS unit, located in a regional office in the United States. Given the enterprise-wide scope of this effort, and the firm's lack of experience in building such applications, the decision was made to adopt a piecemeal approach to development. The project was divided into 11 increments, each with its own schedule and budget. The final deliverable will consist of a set of core global components that business units can "take off the shelf," integrate with existing local applications, adapt as needed, and install locally.

There are multiple project teams associated with Shipments, including one core global team and technical and business teams for each increment. Besides these teams, there are local project teams, who are responsible for customization for language, regulations, and regional functionality such as electronic data interchange, and for long-term support of the system in their regions. The vision is to implement the Shipments application in 30 business units

in 14 countries. The first increment was targeted for installation in Europe in early 1998.

Appendix B. Establishing Reliability and Construct Validity

To establish reliability, Yin (1994) suggests using a case study protocol and developing a case study database. The case study protocol contains the instrument used to collect data, as well as the procedures to be followed in collecting data. For this study, the procedures included defining the type of site, selecting specific cases, determining whom to interview, and articulating how to conduct the interview. In addition, the protocol specified the interview questions. Yin also recommends establishing a case study database to organize and document the data. For this study, a file for each project was maintained, which consists of raw field notes, transcribed interviews, project documentation, and general information about each firm. The files also contain notes made as the study progressed, including points to clarify and impressions about the case study. Finally, the files contain case study write-ups created after data collection. These case write-ups are detailed, approximately 15-page reports that summarize the facts of the cases and the evidence related to major theoretical constructs of interest.

To establish construct validity, Yin suggests three tactics: multiple sources of evidence, establishing a chain of evidence, and asking key informants to review the draft case study report. In this study, multiple sources of evidence were collected by interviewing multiple people about the same phenomenon; project documentation was another source of evidence. This allowed for triangulation of the data (Madill et al. 2000, Eisenhardt 1989). To be included in the analysis, data gleaned from one source had to be confirmed by another person or document (Kirsch 1997).

Establishing a chain of evidence, Yin's second recommendation, also contributes to construct validity by allowing a reader to follow the research process from initial question to final conclusions. This chain of evidence is established by providing citations to relevant material from the case study database (Yin 1994), as is done in this paper. A chain of evidence is strengthened by also noting circumstances of each data collection activity, such as the time and place of an interview, and by linking the data collection activities to procedures outlined in the case study protocol (Yin 1994). These suggestions were followed. Specifically, the time, date, place, interviewee, interviewer, and scribe were noted for every interview conducted. The date each document was received and the source of the document were also recorded. Finally, the data collection activities adhered to the procedures outlined in the case study protocol.

Yin's final tactic for establishing construct validity is the review of draft case write-ups. These case study write-ups also constitute initial within-in case analyses (Eisenhardt 1989). Key informants—one familiar with the Credit project and two associated with the Shipments project—reviewed

the case write-ups that were prepared after data collection was completed. The Credit key informant asked for a few changes to more effectively disguise the firm. The modifications were made and subsequently approved by the informant. The key informants of the Shipments project reviewed the relevant case write-up for accuracy and approved the report.

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