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OVERCOMING CROSS-ORGANIZATIONAL BARRIERS TO SUCCESS IN OFFSHORE PROJECTS

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Structured Abstract

Purpose – Advances in information technology coupled with the need to build resilience against disruptions by pandemics like COVID-19 continue to emphasize offshoring services in the software industry. Service-level agreements (SLAs) have served as a key mechanism for safeguarding against risk in offshore service arrangements. Yet, variations in service cost and quality persist. We open up the blackbox linking SLAs to offshore project outcomes by examining (a) how the provisions in these contracts affect the ability of project teams—the work unit primarily in charge of producing the offshored service—to achieve their objectives and fulfill client requirements and (b) how differences in contextual factors shape the effects of these provisions.

Design/methodology/approach – We incorporate the role of organizational work practice differences to understand the challenges that 270 offshore project teams faced in coordinating and integrating technical and business domain knowledge across organizational boundaries in offshore arrangements. The examined offshore IT projects were managed by a leading software vendor in India and several of its U.S. based clients over a three-year period.

Findings – We demonstrate that organizational work practice differences represent a barrier to offshore project success and that project team transition processes are an important mechanism for overcoming these barriers. Moreover, we find that transition processes represent key mediating mechanisms through which SLA provisions affect offshore project outcomes.

Originality/value – Our findings shed light on how SLAs shape software project teams' balance between activities aimed at meeting client needs and those aimed at containing costs.

Keywords Offshoring, Service level agreement, work practices, transition processes, client satisfaction

1. Introduction

The globalization of services has provided firms with the opportunity to capitalize on cost and quality advantages provided by vendors located in different countries. This shift in the sourcing of services beyond domestic borders is particularly evident in the offshoring of software services that are increasingly becoming important amid natural disasters and pandemics (Daftari, 2020). For instance, hiring offshore teams in regions that are not significantly impacted by COVID-19 or other major crises enables firms to save cost and diffuse enterprise risk (Daftari, 2020; Hamilton, 2020). Despite these purported advantages, client firms are experiencing significant variation in the quality of software services they receive from offshore vendors, and some client firms report significant hidden costs (Zheng and Wang, 2017) to remedy quality problems even after the systems have been implemented (Dibbern *et al.*, 2008). Contracts, which stipulate specific service level agreements (SLAs), have been the core mechanism through which client and vendor firms aim to achieve alignment in quality goals and expectations for software services (Chen and Bharadwaj, 2009; Goo *et al.*, 2009; Kranz*,* 2021; Nassimbeni *et al.*, 2012; Oshri *et al.*, 2015). However, even with SLAs in place, variations in quality continue to persist in offshore software projects (Rai *et al.*, 2009; Konning *et al.,* 2020). The fact that SLAs cannot resolve variation signifies a gap in our understanding about the complex interplay between SLAs and efforts by offshore project teams to coordinate and integrate knowledge, and how these efforts affect project teams. Such a complexity arises from differences in contextual factors that pertain to individuals in project teams (i.e., clients and knowledge workers) and their organizations (Konning *et al.,* 2020). Much of the variation in quality is attributable to challenges in coordinating and integrating knowledge across organizational and cultural boundaries (Gonzalez *et al.*, 2006; Hahn and Bunyaratavej, 2010; Levina and Vaast, 2008; Zahedi *et al.*, 2016). Without a proper understanding of context, the SLAs' prospect of resolving variations will be limited.

In an offshore context, SLAs represent a formal contract between a client firm seeking software services and a vendor firm providing software services (Goo *et al.*, 2009; Kranz*,* 2021; Oshri *et al.*, 2015).

Due to information asymmetry, these SLAs are designed *ex ante* to safeguard against risk and ensure aligned interests in delivering desired software services (Chen and Bharadwaj, 2009; Goo *et al.*, 2009). Offshore software project teams are the primary unit responsible for developing software for a client firm. Thus, although SLAs are typically developed between contracting firms, their impacts are felt by the project teams that develop the software product. These project teams, which are composed of knowledge workers with technical expertise, exist for the duration of a project and then disband (Cohen and Bailey, 1997). They often lack business domain knowledge to achieve project objectives and must therefore operate across organizational boundaries by interacting with members in the client firm (Rai *et al.*, 2009). The ability of project teams to coordinate and integrate knowledge across organizational boundaries is especially critical when strategic systems for complex organizational processes are being developed (e.g., customized systems for supply chain visibility or for the management of key inter-firm processes) since there are no off-the-shelf solutions for such requirements (Carmel and Agarwal, 2002).

Several theoretical gaps exist in our understanding of how SLAs affect the functioning and outcomes of offshore software project teams. Research on offshore software development broadly recognizes that consequential differences exist between the organizational work practices of client and vendor firms (e.g., Konning *et al.* 2020; Zahedi *et al.*, 2016). Except for recent empirical work that examined the role of project managers in reconciling some of these differences (Venkatesh *et al.*, 2018), however, there has been little attempt to integrate differences into theory development in this domain (Vial and Rivard, 2016). Considerations of differences in the way client and vendor firms operate is important, as they affect the ability of vendor firms to deliver software services effectively and have been shown to lead to cost overruns above what was initially budgeted for the project (Konning *et al*., 2020; Naor *et al.*, 2010; Rai *et al.*, 2009). Such differences are also a potential impediment to coordination and knowledge integration across organizational boundaries (Zahedi *et al.*, 2016). Second, although primary considerations in offshoring arrangements are client functional needs (Bunyaratavej *et al.*, 2007) and cost containment (Dibbern *et al.*,

2008; Konning *et al.*, 2019; Zheng and Wang, 2017), the literature has been largely silent on how SLAs and context introduce nuances that influence project outcomes. The focus to date has almost exclusively been on the direct link between SLAs and offshore service outcomes at the inter-organizational level. Such a research trend has been inherited from the tendency of empirical work on business services sourcing, the overarching research theme, to emphasize direct effects (Lacity *et al.*, 2017). However, in the case of offshore software projects, teams constitute the lower-level unit that is primarily responsible for constructing the deliverable. In order to meet client functional needs and contain costs, software project teams need to coordinate their resources effectively and work to integrate disparate knowledge domains across the client and vendor firm (Zahedi *et al.*, 2016). SLAs constitute the contractually stipulated context in which offshore software project teams must work to meet these objectives. Yet, how SLAs shape software project teams' balance between activities aimed at meeting client needs and those aimed at containing costs remains largely unknown.

Our objective is to fill these theoretical gaps in the offshoring literature by integrating research on SLAs with extant research on team processes and organizational work practices. Given our examination of offshore software project teams as the focal unit responsible for accomplishing project objectives, we draw on the literature on internal team processes (Marks *et al.*, 2001). This literature provides a useful lens for understanding the internal operations that enable offshore project teams to convert inputs into project outcomes (Cohen and Bailey, 1997; Ilgen *et al.*, 2005). Through this lens we are able to open up the blackbox linking SLAs to project outcomes through teamwork and uncover the important team-related mediating mechanisms that underlie the relationship between SLAs and project outcomes. We also draw on organizational culture theory (Hofstede *et al.*, 1990), which serves as a theoretically grounded lens for understanding differences in the organizational work practices of client and vendor firms in offshore arrangements (Konning *et al.*, 2020). This theory allows us to shed light on the challenges that offshore software project teams face when differences between client and vendor firm operations exist.

In the section that follows, we briefly outline the literature on SLAs in offshore software development. We then introduce our two core theoretical lenses—internal team process and organizational work practice—as a precursor to the research model.

2. Theoretical background and hypotheses

2.1. Offshore software projects

The offshoring of software development falls under the broad umbrella of service offshoring or IT/business services sourcing (Hahn and Bunyaratavej, 2010; Konning *et al.,* 2019). Offshoring of services such as software development enable firms to benefit from economies of scale that vendors possess while focusing on their own core competencies (Konning *et al.*, 2020; Tafti, 2005). Advances in digital technology have made it easier to manage the provision of such services across geographic boundaries (Lacity *et al.*, 2017). One distinguishing characteristic of software offshoring that makes it challenging to manage is that a significant knowledge gap exists between the vendor and client (Zahedi *et al.*, 2016). While vendors have the requisite technical knowledge to develop systems, they seldom have knowledge of the client's internal operations and business domain (Patnayakuni *et al.*, 2007). This is especially true for customized, strategic systems which are the focus of this research (Carmel and Agarwal, 2002). Such systems are for non-routine processes and services that do not have commercial off-the-shelf solutions (Carmel and Agarwal, 2002). Instead, they require the vendor to devote resources to understand the client's business domain, the idiosyncrasies of its operations and its unique requirements (Rai *et al.*, 2009; Venkatesh *et al.*, 2018). These knowledge gaps between vendor and client create coordination and knowledge integration challenges for the offshore software project teams who are charged with developing these complex systems (Levina and Vaast, 2008; Zahedi *et al.*, 2016). Further, these gaps create risk for client firms, which have limited information on vendor firms' ability to meet their needs and at reasonable cost (Gao *et al.*, 2010).

2.2. Organizational work practices

Organizational work practices provide an important lens for understanding similarities and differences in how organizations in a partnership operate (Konning *et al.*, 2020; Pothukuchi *et al.*, 2002). Differences in organizational work practices can mean the difference between success and failure in inter-organizational partnerships such as strategic alliances and joint ventures (Konning *et al.*, 2020; Naor *et al.*, 2010; Pothukuchi *et al.*, 2002). This is because such differences create barriers to effective cross-organizational collaboration, coordination, and knowledge integration (Bresman *et al.*, 1999; Zahedi *et al.*, 2016). In the case of offshore software projects, teams are charged with developing a product that supports the business operations of the client firm. Success in achieving such an outcome depends on the extent to which the project team can understand the work context for which the software is being constructed (Konning *et al.*, 2020; Maruping *et al.*, 2009; Nidumolu, 1995; Patnayakuni *et al.*, 2007). Moreover, although the building blocks for software construction remain fairly standard, each client organization can also be unique in terms of technologies that support work processes (e.g., legacy systems, database connectivity and data storage). As such, offshore software project teams need to be able to understand the client's work context and map the developed software to the client's business processes, business rules, and employee roles and responsibilities. Therefore, understanding the differences in the client's and vendor's work practices gives insight on the potential challenges that might exist for the offshore software project team in collaborating with the client firm to develop the knowledge about the client firm's work context for which the software solution is being developed.

Hofstede *et al.* (1990) conducted an extensive study of organizational work practices and identified six broad categories: (1) process-oriented versus result-oriented, (2) employee-oriented versus job-oriented, (3) parochial versus professional, (4) open system versus closed system, (5) loose control versus tight control, and (6) normative versus pragmatic. Hofstede *et al.* (1990) found these categories to be robust in classifying the various types of work practices that characterize organizations. Pothukuchi *et al.* (2002)

found that differences in these work practices between partnering firms influenced success in strategic alliances. Using qualitative case studies, Konning et al. (2020) identify process-oriented versus result-oriented, employee-oriented versus job-oriented, loose control versus tight control, and normative versus pragmatic (four out of six) as important factors in the context of outsourcing. Consistent with Konning et al. (2020), we focus on the first three categories due to their direct relevance to internal organizational work operations. Further, given the inherent motivation to exploit labor cost arbitrage through offshoring, we expect fewer differences between the client and the vendor in this category. Hence, we exclude normative versus pragmatic differences, but we control for the rest, as noted later in our data analyses. The three identified categories reflect key elements of internal organizational work operations, nature of information flow, and clarity of roles and responsibilities of employees —factors that are relevant to the construction of software which is built to process and integrate information. We draw on these inter-organizational work practice differences to shed some light on how the context in which offshore software project services are provided can affect economic outcomes (maintenance costs) and overall appraisal of quality of the system (client satisfaction). We develop the logic underlying the relationships shown in our model in Figure 1.

2.3. Software project team processes and project outcomes

Team processes are the actions through which project teams transform inputs into important team outcomes (Ilgen *et al.*, 2005). Although teams engage in a variety of processes in pursuit of their objectives, planning constitutes among the most important of these (Konning *et al.*, 2019; Mathieu and Schulze, 2006). In their theoretical taxonomy of team processes, Marks *et al.* (2001) identify transition processes as a critical dimension of how teams accomplish their objectives. *Transition processes* reflect a transition plan, shown to be one of the key predictors of project outcomes (Konning *et al.*, 2019), and involve planning and analysis activities aimed at outlining a clear path for how resources will be deployed, how roles will be assigned, how goals will be prioritized, as well as interpreting information and feedback from the environment and planning future courses of action—all in pursuit of team objectives (Marks *et al.*, 2001;

Schneider *et al.*, 2013). In offshore software projects, transition processes are a key mechanism through which project teams achieve success. As noted earlier, although technical aspects (e.g., syntax, database connectivity) of software construction tend to be standard, the integration of these aspects with client business domain knowledge is non-routine (Patnayakuni *et al.*, 2007) and, therefore, depends heavily on deliberate planning and management engagement (Gonzalez *et al.*, 2015). Through transition processes, offshore software project teams are able to clearly prioritize client requirements, identifying critical system functionalities and differentiating them from less important objectives. In executing transition processes, offshore software project teams also decompose overall system functionality into goals and sub-goals so that resources can be deployed more effectively. Such activities increase the likelihood that client requirements will be met, resulting in higher client satisfaction.

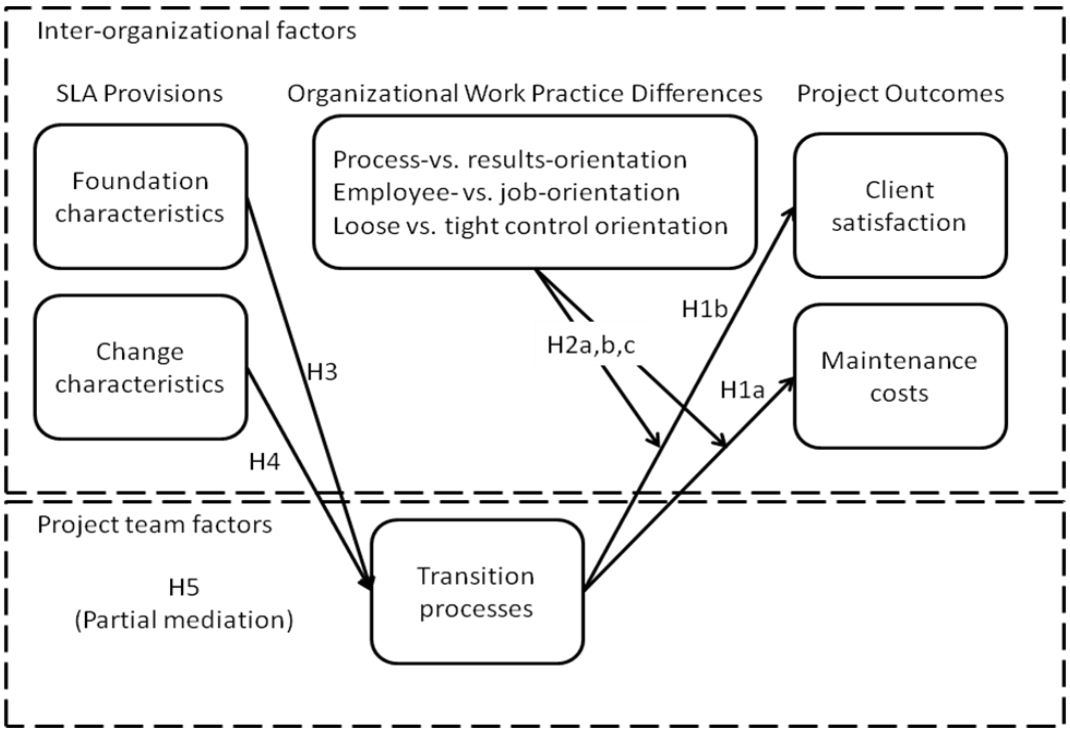


Figure 1. Research model

Transition processes are also expected to enable offshore software project teams to reduce maintenance costs in the long-term. A clear understanding of available resources allows project teams to more efficiently manage cycle times in deploying resources to achieve project goals and sub-goals (Harter

et al., 2000; Konning *et al.*, 2019). A priori delineation of project team responsibilities ensures that project teams avoid duplication of effort. Lack of clarity around roles and responsibilities can create process losses and risks the duplication of code and functionality—which increases defect rates and, consequently, maintenance costs (Banker *et al.*, 1998). Through contingency planning, project teams are able to develop alternative courses of action for accomplishing project goals and sub-goals. Given the turbulence associated with software projects, it is imperative that project teams have back-up plans for changes that might occur (Maruping *et al.*, 2009). Our focus on SLA provisions, necessary but insufficient conditions for success, emphasizes the need to examine transition processes. Specifically, deliberate, rather than reactionary, alternative plans are more likely to yield sound solutions that reduce maintenance costs (Konning *et al.*, 2019; Lee and Xia, 2010; Maruping *et al.*, 2009).

H1a*: Transition processes in offshore project teams will positively influence client satisfaction*.

H1b: *Transition processes in offshore project teams will negatively influence maintenance costs*.

2.4. Moderating role of organizational work practice differences

Differences in organizational work practices between the vendor firm and the client firm are expected to be a barrier to effectiveness for offshore software project teams (Jarvenpaa, 2016; Konning *et al.*, 2020). Because much of the success in offshore software projects hinges on integrating technical and business domain knowledge at the client-vendor boundary, having shared or common work practices is a core aspect of developing effective solutions for client firms. Common procedures for conducting work ensure that firms are able to economize on the cognitive resources and time that are required for transferring, interpreting and integrating complex information across organizational boundaries (Deng *et al.*, 2013; Pothukuchi *et al.*, 2002). As Walsham (2002) notes, a lack of mutual knowledge creates significant challenges to knowledge coordination and integration across boundaries. When offshore project team members have a common (and familiar) frame of reference with the client, they can more easily learn and translate requirements into functional software (Ethiraj *et al.*, 2005; Zahedi *et al.*, 2016). In contrast,

differences in organizational work practices pose a challenge to offshore project teams as they give rise to incompatibilities in how interactions are coordinated across organizational boundaries (Konning *et al.* 2020; Schneider *et al.*, 2013).

2.4.1. Differences in process- versus results-orientation

Process-oriented organizations tend to be focused on establishing and maintaining standardized procedures for accomplishing objectives and are more mechanistic in nature (Hofstede *et al.*, 1990). Emphasis is placed on *how* objectives are accomplished and faithful execution of established procedures, policies, and practices is expected to yield predictable outcomes (Flynn *et al.*, 1994; Konning *et al.*, 2020; Peng *et al.*, 2008). In contrast to process-oriented organizations, results-oriented organizations, which are more organic, place much more of an emphasis on outcomes (Hofstede *et al.*, 1990). In such organizations, work tends to be less structured and employees are evaluated solely on their output rather than how the output is achieved. Differences in the process- versus results-orientation between client and vendor firms create incompatibilities in the decomposition of goals and sub-goals, specification of core requirements, communication of expected system design and testing, which is disruptive to the knowledge integration and coordination that are necessary for project success (Rai *et al.*, 2009).

Transition processes in offshore software project teams should be more critical for success when client and vendor firms differ in their process- versus results-orientation. First, offshore project teams need to determine how to deploy resources to support integration of knowledge with regard to these different points of emphasis. For instance, differences in process-orientation may require resources to be directed toward business process modeling. Differences in results-orientation would require the offshore project team to invest effort in understanding key performance metrics, representational formats etc. for different aspects of the organization. Much more extensive deliberate planning (contingency and otherwise), analysis, feedback seeking, and goal prioritization need to occur when the client and vendor differ in these ways. Transition processes reduce much of the uncertainty associated with differences in process- and results-orientation

and help reduce the knowledge gap such differences create. The need for contingency planning and feedback seeking is also elevated when offshore project teams operate in unfamiliar circumstances (MacCormack *et al.*, 2001; Mathieu and Schulze, 2006).

H2a: *Differences between client and vendor firm process- versus results-orientation will moderate the relationship between offshore project team transition processes and project outcomes (client satisfaction and maintenance costs) such that the relationship will become stronger with increasing differences*.

2.4.2. Differences in employee- versus job-orientation

Employee-oriented organizations tend to place more of an emphasis on employee empowerment and well-being. Such organizational structures are more decentralized and focus on delegating decision-making rights to employees rather than higher levels of the organizational hierarchy (Hofstede *et al.*, 1990). In contrast, job-oriented organizations are more focused on centralizing decisions at higher levels of management. Core structural decisions are centered on job and departmental functions (Hofstede *et al.*, 1990). Differences in employee-orientation mean that there will be incompatibilities, on the part of the client, on whether decision rights should reside with the offshore project team and to what extent the team can be pushed to meet schedule and quality expectations. Incompatibilities with the vendor may also exist with regard to which level of the organizational hierarchy members of the offshore project team are most comfortable interacting with. Miscommunication and misunderstandings about such issues can create confusion about how to control the development process (Kirsch *et al.*, 2002; Konning *et al.*, 2020). Confusion can also emerge about the transfer of proprietary client knowledge and where decision rights regarding such issues reside (Tiwana, 2008).

Transition processes become an important mechanism for achieving project objectives when such differences exist. Through transition processes, offshore project teams are able to clearly identify where client decision rights reside, who to go for domain-specific knowledge, and where the boundaries of their own decision-making authority lie (Tiwana, 2008). With explicit planning, offshore project teams can also be

more deliberate about coordinating the timing of input from employees versus management at different points in the development process (Marks *et al.*, 2001). Collectively, these activities facilitate a more effective flow of information across organizational boundaries. It also prevents project teams from proceeding too far based on misguided information from the wrong source.

H2b: *Differences between client and vendor firm employee- versus job-orientation will moderate the relationship between offshore project team transition processes and project outcomes (client satisfaction and maintenance costs) such that the relationship will become stronger with increasing differences*.

2.4.3. Differences in loose versus tight control orientation

Organizations with a loose control orientation expend fewer, if any, managerial resources on monitoring of employee behavior and code of conduct (Hofstede *et al.*, 1990). Such organizations are characterized by a tolerance for individual autonomy and self-regulation in how employees approach their work. In contrast, tight-control organizations have rigid expectations for employee conduct with regard to punctuality, resource conservation, and formality (Hofstede *et al.*, 1990). Differences between a client and vendor in loose versus tight control orientation creates disjointed, rigid communication patterns between the offshore project team and the client (Konning *et al.*, 2020; Pothukuchi *et al.*, 2002). Offshore project teams accustomed to tight controls may face resistance in soliciting and coordinating input if they apply such controls in their interactions with client employees who operate under a loose control system. Offshore project teams that are accustomed to a loose control orientation are bound to raise the ire of client members who operate in a tight control system. Incompatible communication structures hamper success in complex, non-routine, information-intensive tasks (Tushman, 1979). Inter-organizational differences in control make communication, which is necessary for coordination and integration of knowledge, difficult.

Transition processes enable offshore project teams to overcome the barriers posed by differences in client and vendor control looseness/tightness. Feedback seeking and analysis gives project teams a better sense of how the client control environment is structured. Such information can be used to devise plans for

whether project goals and sub-goals need to be tracked on a rigid schedule or if such schedules need to be loosely specified depending on how closely the client monitors vendor activity (Choudhury and Sabherwal, 2003; Kirsch *et al.*, 2002). Contingency planning gives offshore project teams the flexibility to implement alternative plans for managing in control systems that differ from their own.

H2c: *Differences between client and vendor firm loose versus tight control orientation will moderate the relationship between offshore project team transition processes and project outcomes (client satisfaction and maintenance costs) such that the relationship will become stronger with increasing differences*.

2.5. Contract provisions and offshore software project team processes

Contracts serve as a major mechanism through which firms manage risk in software offshoring arrangements (Goo *et al.*, 2009; Nassimbeni *et al.*, 2012). As is the case with most inter-organizational transactions, the desire for contractual safeguards increases as exchange risks increase (Poppo and Zenger, 2002). A variety of schemes exist for classifying SLA provisions. Jensen and Meckling's (1992) control framework has broadly served as a basis for understanding the structure of contracts. Jensen and Meckling (1992) identify rewards and sanctions, rights and responsibilities, and performance management as the core facets that should be governed by organizational policies. Several classifications of contract provisions have emerged to understand the governance of offshore software project arrangements. Key provisions that have been identified include roles and responsibilities, monitoring, contingencies, and rewards and sanctions (Chen and Bharadwaj, 2009; Goo *et al.*, 2009; Ryall and Sampson, 2009; Sommer and Loch, 2009). Classical work identified and examined three types of provisions: foundations, change, and governance (Goo *et al.*, 2009), but more recent work continues to emphasize characteristics or underlying mechanisms that pertain to flexibility (i.e., change) and key roles and responsibilities (i.e., foundation) that are associated with team processes (e.g., Kranz, 2021) due to their direct relevance to and influence on team performance over time. Given our specific focus on offshore software project teams, we examine the influence of foundational and change provisions, as these have the potential to affect the

internal operations of these teams. Though important, governance provisions relate to how the inter-organizational relationship itself will be managed, rather than the nature of the work that project teams will do, and, hence are excluded from our model.

Foundation characteristics of SLAs outline key roles and responsibilities, process owners, and core goals for the offshoring arrangement (Chen and Bharadwaj, 2009; Goo *et al.*, 2009). Although these provisions are specified at the inter-organizational level, they are important building blocks for enabling offshore project teams to engage in transition processes. The identification of core objectives, including delivery schedules, key project milestones, and broad requirements provide a framework within which offshore project teams can plan more granular activities to accomplish objectives (Choudhury and Sabherwal, 2003). Clear designation of process ownership enables offshore project teams to plan what resources are needed, how resources will be deployed, and what roles and responsibilities will be assigned to project team members (Goo *et al.*, 2009; Kirsch *et al.*, 2002). In sum, the foundation characteristics of SLAs should promote transition processes in offshore project teams.

H3: *Foundation characteristics in SLAs will positively influence transition processes in offshore project teams*.

Change characteristics of SLAs identify what responsibilities the client and vendor have when unexpected contingencies emerge or potential opportunities for enhancing the relationship arise (Goo *et al.*, 2009; Sommer and Loch, 2009). Such provisions serve as an impetus for offshore project teams to engage in contingency planning. Indeed, Marks *et al.* (2001) underscore the necessity for teams to identify alternative plans and strategies in response to changes that might occur within the performance environment. Dynamic or unpredictable performance environments increase the need for such planning (Kranz, 2021; Schilke and Lumineau, 2018; Sommer and Loch, 2009). The inclusion of change provisions in SLAs creates such conditions by giving clients the option of changing existing requirements or adding new ones and teams with the framework to plan on how to respond to such changes. Thus:

H4: *Change characteristics in SLAs will positively influence transition processes in offshore project teams*.

Although prior research argues that contractual provisions directly influence project outcomes (e.g., Chen and Bharadwaj, 2009; Karten, 2004; Lacity *et al.*, 2017), we expect that their effects will be partially mediated by offshore project team processes. The provisions laid out in offshoring contracts between client and vendor set the context in which project teams must accomplish their objectives. Thus, it stands to reason that the consequent activities performed by offshore project teams—the work unit primarily responsible for delivering the agreed upon service to the client—would theoretically serve as the mechanism through which contractual provisions affect offshore project outcomes. Further, the temporal sequencing of contractual provisions, offshore project team processes, and project outcomes suggests that team processes serve as a mediating link.

H5: *The relationship between SLA characteristics and offshore project outcomes will be partially mediated by project team transition processes*.

3. Method

We tested our hypotheses in a field study of inter-organizational offshore software projects managed by a leading software vendor in India with Level-5 CMMi certification. Given the vendor's process capability level, we were able to control for variance in maintenance and client satisfaction due to differences in process maturation, a factor that has been shown to affect software project outcomes (Ravichandran and Rai, 2000). The vendor has managed numerous offshore software projects for clients in countries such as the U.S., Germany, and Japan. Next, we describe the sample, measurement, and data collection process.

3.1. Sample and participants

We conducted a field study of offshore IT projects managed by a leading software vendor in India and several of its U.S. based clients. Our sampling frame was 279 strategic IT projects completed over a three-year period, beginning July 2006. All of the projects were custom-developed by the vendor to the specific requirements of each U.S. client on respective projects. Examples of projects included a customer

relationship management system, supply chain management system for planning in collaboration with partners, and a human resource information system. We did not include simple projects that were primarily of an implementation variety in that they were out-of-the-box solutions from the vendor (e.g., systems for standardized billing and payroll processes). There were a total of 279 project teams for which we were able to obtain the complete data related to SLAs, team processes, work practice differences, maintenance costs, client satisfaction, and the various control variables across multiple archival sources.

3.2. Measurement

The online appendix shows the scales and measures used—we discuss them in this section.

3.2.1. Dependent variables

Although several project success metrics exist, we focus on two key project-level outcomes: maintenance costs and client satisfaction with project quality. Maintenance costs is an especially important indicator of software project success because it reflects a project team's effectiveness at developing a solution that meets client's requirements and does not require additional resources to be directed to meet client's requirements and remedy problems in the delivered solution (Banker *et al.*, 1998). As Rai *et al.* (2009) note, while it is important to manage project cost overruns in offshore projects, the risks of high maintenance costs after the project is completed and the software is implemented at the client site can be high. Client satisfaction is also a critical indicator of project success as it represents the extent to which the project team's deliverable meets user expectations for quality (Gonzalez *et al.*, 2015; Rai *et al.*, 2009).

Maintenance costs captured the expenditures that were incurred by the client after the completion of the project. We used the billed man-hours for the maintenance effort by the vendor, normalized by total project cost, as our measure of maintenance costs. Actual project cost were the expenses incurred for development and implementation (but prior to maintenance) and included three cost components: (a) billed man-hours for the development; (b) negotiated billed expenditures related to specialized software, training, conferences, visits to sites of customers or partners of client firms; and (c) additional expenditures incurred

by the client above and beyond the negotiated billed expenses. We note that maintenance costs is a distinct measure from project cost overruns; while maintenance costs represent the additional expenses incurred by the client to address quality problems (e.g., software defects, memory management, system reliability) after the completion of the project, project cost overruns is the difference between actual project costs and budgeted project costs (Nidumolu, 1995; Rai *et al.*, 2009). Therefore, maintenance costs capture the deficiencies in the quality of the developed software in addressing the actual needs of the client during routine use after implementation; it does not reflect the costs associated with extensions in functionality.

Client satisfaction with the final product was measured using a four-item scale by Nidumolu (1995) and also used by Rai *et al.* (2009) in the offshore software development context. The scale captures the extent to which the client is satisfied with the functional quality of the project deliverable. Clients provided ratings of their satisfaction with the final product approximately four months after the project team implemented the software. This provided an extended timeline over which the client could assess the quality of the product based on the repeated use of the software after its implementation. The reliability of the scale was .80.

3.2.2. Independent, mediating and moderating variables

SLA foundational characteristics was measured using a nine-item scale developed by Goo *et al.* (2009) that captures the extent to which the SLA contains provisions outlining service-level objectives, process ownership, and service-level contents. Going through SLA documentation, project managers rated the extent to which these types of provisions were included in the contract.

SLA change characteristics was measured using a six-item scale developed by Goo *et al.* (2009). The scale captures the extent to which SLA documentation contains clauses pertaining to future demand management and anticipated changes. Consistent with the measurement of foundational characteristics, project managers based their responses to the items on the clauses contained in SLA documentation.

Transition processes were measured using a three-item scale by Mathieu and Schulze (2006). The scale is a subscale of the nine-item team process scale and captures the extent to which the project team

engaged in mission analysis, goal specification, and contingency planning activities at various points during the project. Members of each offshore project team responded to these items. The reliability of the scale was .73. Since we wanted to obtain a reliable measure of project team activities by soliciting responses from multiple sources within the team, it was necessary to ensure that within-project team responses were consistent. We used the within-group agreement index ($r_{wg(j)}$) to determine the extent to which there was convergence in the individual responses greater than would be expected by chance (James and Brett, 1984). The average $r_{wg(j)}$ of over .70 across all project teams in the sample suggested that it was appropriate to aggregate team member responses to represent a team-level score (James and Brett, 1984). Hence, we averaged responses within each project team to compute a team-level score for transition process.

We captured differences in the three client-vendor work practices by using the Hofstede *et al.* (1990) work practices scales to measure each of these client firm work practices and vendor firm work practices. Specifically, we used three-item scales for the three work practices (process-s versus result-orientation, employee- versus job-orientation, loose versus tight control) and calculated the absolute difference in client and vendor responses on each work practice. The vendor's account manager provided responses for vendor work practices and the client's business unit managers provided responses for client work practices.

3.2.3. Control variables

We controlled for variations in the following three key software project characteristics: *project size*, *project complexity*, and *requirements uncertainty* (see Wallace *et al.*, 2004). We measured project size as lines of code; project complexity as the number of adjusted function points (which adjusts the count of function points by the total ratings of fourteen complexity characteristics related to system requirements and development environments (see Albrecht and Gaffney Jr., 1983); and requirements uncertainty as the number of formal written changes to requirements that were made to the contract. We obtained measures for these project characteristics' from archival project documents.

In addition to the three work practice differences that we included in our theory development and hypotheses, we specified two additional work practice differences (parochialism versus professionalism, open versus closed system) as control variables (Hofstede *et al.*, 1990). As with the other work practices, the measures for work practices for the vendor and client firm were obtained from the vendor's account managers and the client's business unit managers, respectively.

Finally, by selecting a vendor at Level-5 CMMi certification, we controlled for the process maturity of the vendor, as differences in process maturity can impact the success of software projects (Ravichandran and Rai, 2000). Finally, we controlled for firm history, measured as the number of previous projects that the vendor had completed for the client firm.

3.3. Procedure

Data were collected as the project activities were occurring in the real-world state over the lifecycle of development and maintenance of the offshore projects. We collected data on firm history from the project documentation, which included information on number of past projects that had been completed by the vendor for the client. We obtained data on SLA foundational characteristics and SLA change characteristics at the beginning of each project from the project managers based on their review of the SLA documentation. Measures for work practices that were completed by vendor's account managers and client's business unit managers for their respective firms were obtained from the project documents at the end of the development phase (and prior to the maintenance phase). Data related to the various project characteristics were also extracted from project documents at the end of the development phase of each project. Measures regarding team transition processes that were completed by project team members were obtained after the development phase of each project. Actual project costs were collected after the development phase was completed and prior to the initiation of the maintenance phase. Client satisfaction data were collected four months after project completion and maintenance costs were measured after the

conclusion of the maintenance phase of the project. The combination of subjective and objective data collection is a major strength of the procedure and enhances the validity of our results.

4. Analysis

4.1. Preliminary analysis

The validity of all multi-item scales with reflective items was examined using factor analysis. Loadings were greater than .70 and cross-loadings were less than .35 in all cases, thus supporting convergent and discriminant validity. The Cronbach alpha of each scale with reflective items was greater than 0.70, thus meeting threshold requirements for reliability. Given that the scales used were well-established and these results are consistent with reported findings, we do not provide detailed results in the interest of space. Table I presents the means, standard deviations, and correlations of the constructs in the model. The means of size, complexity and requirements uncertainty indicated that these projects were indeed quite complex. The collection of projects also exhibited quite a bit of a variance on these project characteristics.

TABLE I HERE

4.2. Model testing

We used hierarchical regression analysis to test the model. Table II presents the results of the model testing for both maintenance costs and client satisfaction as the dependent variables. Models 1 through 4 in both cases show various combinations of main effects as independent variables. In each case, various constructs related to service level agreements, team processes and work practice differences were significant. The variance explained in maintenance costs and client satisfaction by the main effects was up to 26% and 28% respectively. Consistent with hypothesis 1(a,b) and shown in Table II (model 2), we find that offshore project team transition processes are negatively associated with maintenance costs (β = -20, $p < .01$) and positively associated with client satisfaction (β = .17, $p < .05$).

TABLE II HERE

Hypothesis 2(a, b, c) predicted that organizational work practice differences would be a barrier to project success and that transition processes would be a stronger determinant of success as differences increase. It is worth observing that two of the organizational work practice differences (process- vs. results-orientation and loose vs. tight control orientation) are positively related to maintenance costs and negatively related to client satisfaction, suggesting that they, indeed, are a barrier to project success (see Table II, model 4). As the results of the interaction effects model (Table II, model 5) indicate, all three of the organizational work practice differences have a significant interaction effect on the relationship between transition processes and offshore project outcomes, contributing an additional 7% variance explained in both dependent variables. We plotted the interaction terms to understand the pattern of effects. As the interaction plots in Figure 2 and Figure 3 indicate, transition processes have a stronger negative influence on maintenance costs and a stronger positive influence on client satisfaction when organizational work practices of the client and vendor are different compared to when they are similar. Tests of simple slopes confirm this.

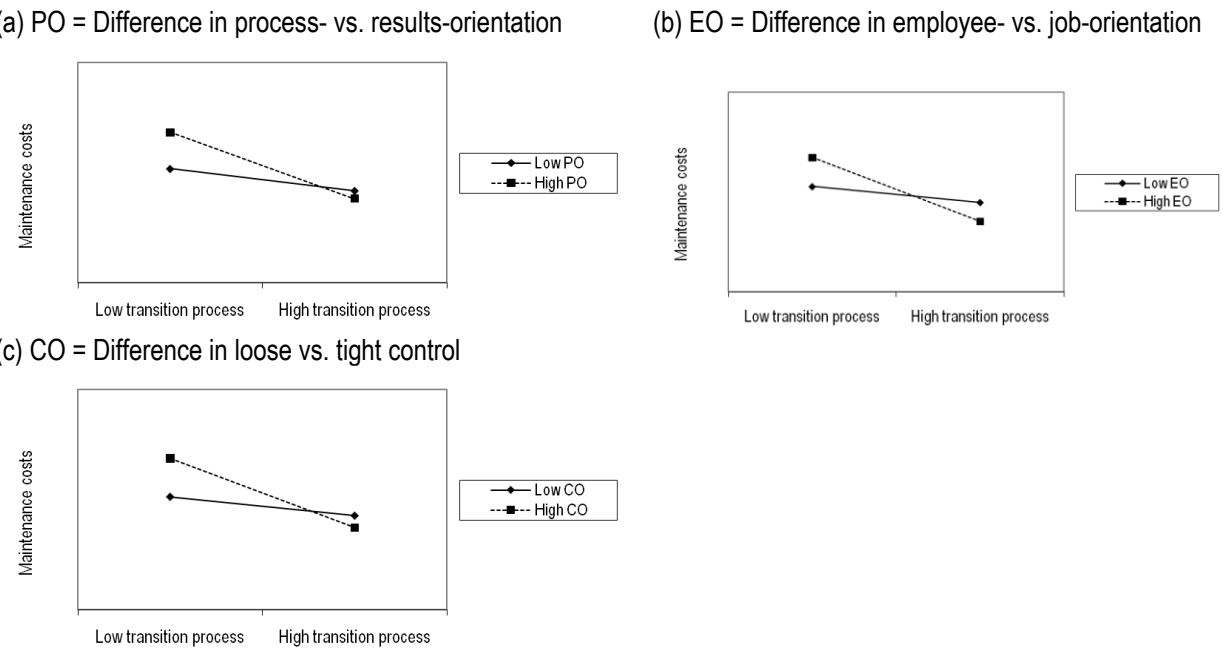
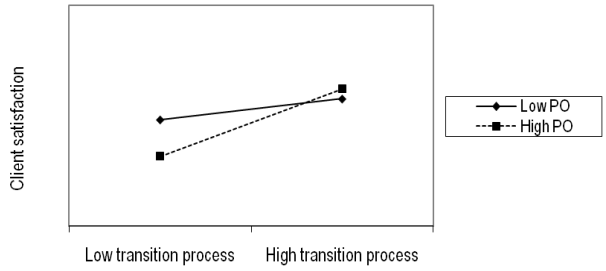
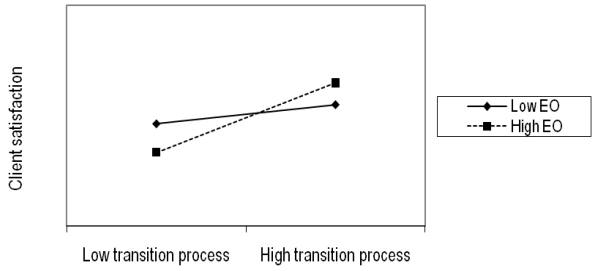


Figure 2. Plots of organizational work practice differences x transition process interactions predicting client satisfaction

(a) PO = Difference in process- vs. results-orientation



(b) EO = Difference in employee- vs. job-orientation



(c) CO = Difference in loose vs. tight control

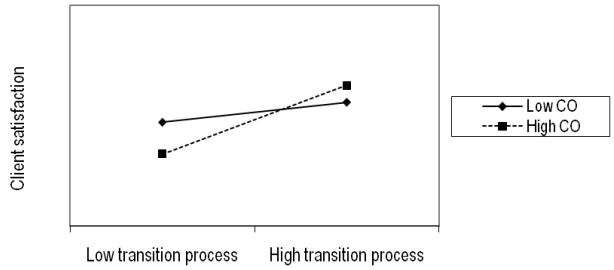


Figure 3. Plots of organizational work practice differences x transition process interactions predicting maintenance costs

Hypotheses 3 and 4 predicted that SLA foundation and change provisions, respectively, would be positively associated with transition processes in offshore project teams. As the results in Table III (model 2) show, SLA foundation characteristics (β = .20, $p < .01$) and change characteristics (β = .16, $p < .05$) are positively associated with transition processes, providing support for these hypotheses.

Finally, in hypothesis 5, we posited that transition processes would partially mediate the effects of SLA provisions on project outcomes. Having already established that transition processes are significantly associated with project outcomes and that the SLA provisions are both positively associated with transition processes, we also find in Table III (model 2) that SLA provisions are significantly related to maintenance costs and client satisfaction in the absence of the mediator. In the presence of the mediator, we find that the effects of the SLA provisions diminish in magnitude while remaining statistically significant (see Table II, model 4). A Sobel test indicates that the effects of foundational characteristics (maintenance costs: $z = -3.03$, $p < .01$; client satisfaction: $z = 2.59$, $p < .01$) and change characteristics (maintenance costs: $z = -$

2.01, $p < .05$; client satisfaction: $z = 2.07$, $p < .05$) are, indeed, partially carried through transition processes, lending support for our mediation hypothesis (MacKinnon *et al.*, 2002).

TABLE III HERE

5. Discussion

5.1. Value and contribution

Our study makes important theoretical contributions to our understanding of the management of offshoring projects—an area that is increasingly becoming critical as managers scramble to find ways to save cost and diffuse enterprise risk amid major pandemics and disasters (Daftari, 2020; Hamilton, 2020). It integrates the literatures on contractual provisions and on team processes to understand how SLAs affect project outcomes through the transition processes of the project team. It identifies that in addition to SLAs and team processes, the work practice differences between the client and vendor firm not only negatively influence key project outcomes but also increase the importance of team transition processes for achieving favorable project outcomes. Our study reveals that the effects of team transition processes on project outcomes are context-dependent and not universalistic—i.e., their effects are moderated by the differences in work practices between the client and vendor. We elaborate below on each of these contributions.

The existing body of knowledge tends to focus more on direct effects and less on indirect effects (Lacity *et al.*, 2017). Our model takes a step further by (a) incorporating an important mechanism that carries the effect of SLAs and (b) revealing contextual factors that shape the effects of transition processes. We integrate the literatures on SLAs (Chen and Bharadwaj, 2009; Goo *et al.*, 2009) and on team processes (Marks *et al.*, 2001; Vial and Rivard, 2016) to understand how team transition processes are influenced by SLA characteristics. While SLAs have been primarily examined from the vantage point of risk exposure and safeguards for each of the collaborating firms and from the perspective of the effect of SLAs on the inter-firm relationship, our study demonstrates that the foundational and change characteristics of SLAs influence the project team's transition processes. Our results suggest that SLAs which contractually specify

the goals of the project, roles and responsibilities of the client and vendor, and agreed-upon services levels for key activities establish important foundational parameters for the relationship which enable how work is conducted by the project team, specifically in terms of prioritizing goals, planning activities, and deploying resources. They also suggest that SLAs that contractually specify the contractual parameters for the two firms in the offshore arrangement to deal with unexpected contingencies (e.g., change in functional requirements or technologies) play an important role in enabling the team's transition processes. As such, they establish the change-related parameters within which the team's plans, resources, and activities can be revisited and revised during the course of the offshoring project (Sommer and Loch, 2009). Collectively, these results suggest that SLAs should not be interpreted simply as a mechanism to manage risks for the various parties in an offshore project but that they influence the key processes of the core work unit in offshore arrangements—the transition processes of the project team.

Our study integrates the role of organizational work practice differences as a barrier to the functioning of project teams. Differences in work practices or organizational culture have always been emphasized to understand outcomes (Konning *et al.*, 2020). Over time, however, we show that such differences emerge as contingencies that shape the effects of transition processes. We extend past work that has shown that team transition processes affect project outcomes (e.g., Maruping *et al.*, 2009; Mathieu and Schulze, 2006) and that work practice differences affect project cost overruns (Rai *et al.*, 2009) by showing that these factors have an interactive effect on both maintenance costs and client satisfaction (Buhman *et al.*, 2005). As such, our study reveals that the differences in the work practices with respect to three work practice differences (process- or results-orientation, employee- or job-orientation, and tight or loose control orientation) not only have a direct detrimental effect on maintenance costs and client satisfaction but that these differences enhance the need for team transition processes. Given that team transition processes are a crucial mechanism of the project team to integrate knowledge across client and vendor firm boundaries, our study has major implications for the boundary conditions on when these processes are most effective.

Our results suggest that team transition processes are most effective when the client and the vendor firm are different with respect to work operations (process vs. outcome orientation), the role of employees in decision-making and in the organizational system at large (employee vs. job orientation), and the flow of information (loose vs. control).

Our study extends past work that has focused on the short-term outcomes of offshoring arrangements by examining the implications of contract provisions, project team processes, and organizational work practice differences for client satisfaction and maintenance cost following the implementation of the project. Flexibility, change, and uncertainty have always been emphasized to understand outcomes (Konning *et al.*, 2019). However, addressing them as provisions in contracts or arrangements is necessary but insufficient. Without transition processes, it will be difficult to activate or implement such provisions. Hence, contract provisions, team processes, and work practice differences, together, influence both economic outcomes (maintenance costs) and client appraisals of the system that was developed after it has been used. The stability of the key relationships across these two dependent variables also points to the importance of focusing on macro (work practice differences and contractual provisions) and meso (transition processes of teams) paradigms in managing offshoring work successfully.

5.2. Strengths and limitations and directions for future research

Our study has important strengths. Theoretically, we integrated factors from the macro and meso paradigms and demonstrated that these factors together explain key outcomes in offshoring projects. Empirically, we used data from multiple sources (project archives, project team responses, organizational archives) and included both client overall appraisal of the quality of the system and maintenance costs as measures of project success. We also focused on strategic projects where knowledge needed to be integrated across the onshore client and offshore vendor site at the project level, providing insights into the management of offshoring for complex projects of this type. While our study has its strengths, it also has its limitations. We only focused on offshore projects between India vendor and U.S. clients and recognize that

the dynamics could very well be different with clients in other nations, given different national culture, different legal system, and different technology infrastructure. Future research could examine the changes in results when the context of the client is changed from one nation to another (Ai *et al.*, 2019; Hahn and Bunyaratavej, 2010; Naor *et al.*, 2010). In addition, we acknowledge that learning could occur over time through repeat projects between the client and vendor and that such learning could help overcome the negative effect of work practice differences on project outcomes. Future research could conduct longitudinal studies and deploy analysis to reveal richer insights over time, such as polynomial regression and response surface analysis (e.g., Brown *et al.*, 2012, 2014; Venkatesh and Goyal, 2010) and latent growth modeling (e.g., Bala and Venkatesh, 2013). Researchers could integrate time in theorizing about the meaning and evolution of project plans and processes (e.g., Venkatesh *et al.*, 2021) or relevant behaviors (e.g., Venkatesh *et al.*, 2006) that are expected throughout project lifecycles. Finally, researchers could extend our model to incorporate the role of leadership and additional outcomes, such as developer stress (Windeler *et al.*, 2017). For instance, leadership styles may alleviate the effects of differences across work contexts.

6. Conclusions

Our study shows that offshoring software projects are meaningfully evaluated in terms of maintenance costs and client satisfaction once the software has been implemented. By showing that these two key outcomes are influenced by characteristics of service level agreements, team transition processes, and work practice differences, our study suggests that significant theoretical advances in the offshoring domain can occur by integrating factors at the macro and meso-level to understand offshoring projects. Our study reveals that the foundational characteristics and change characteristics of SLAs impact team transition processes and that team transition processes are more important in reducing maintenance costs and increasing client satisfaction when work practice differences between the client and vendor firm are large.

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TABLES

Table I. Descriptive statistics and correlations (n = 279)

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Maintenance costs	29.30	11.20												
2. Client satisfaction	5.01	1.50	-.35***											
3. Project complexity	9,991	2,320	.28***	-.29***										
4. Requirements uncertainty	19.40	6.33	.33***	-.35***	.35***									
5. Project size	411,110	71,302	.35***	-.28***	.31***	.24***								
6. Firm history	3.55	1.22	-.15*	.16*	.20**	.20**	.23***							
7. Parochial vs. professional	43.50	12.80	.13*	-.14*	.08	.07	.01	.10						
8. Open vs. closed system	57.55	12.32	.13*	-.13*	.05	.08	.04	.11*	.13*					
9. Foundation characteristics	4.55	1.30	.23***	-.30***	-.13*	-.12*	-.13*	.13*	.12*	.10				
10. Change characteristics	4.80	1.28	.22***	-.28***	-.12*	-.12*	-.03	.12*	.10	.11*	.03			
11. Process orientation	61.20	17.51	.22***	-.22***	-.08	-.08	-.02	.01	.08	.04	.03	.10		
12. Employee orientation	57.38	15.66	.25***	-.20**	-.07	-.07	-.04	.05	.05	.03	.07	.11*	.07	
13. Loose control orientation	71.22	19.20	.26***	-.23***	-.05	-.04	-.02	.04	.04	.05	.02	.11*	.06	-.12*
14. Team transition processes	3.79	1.82	.24***	-.31***	-.29***	-.20**	-.21***	.08	.20**	.25***	.24***	.22***	.11*	.12*

Notes:
* p < .05; ** p < .01; *** p < .001.

Table II. Model predicting maintenance costs and satisfaction (n = 279)

	Maintenance Costs					Client Satisfa		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3
R2	.19	.23	.23	.26	.33	.20	.25	.25
ΔR2		.04	.00	.03	.07		.05	.00
Control Variables								
Project complexity	.13*	.10	.07	.06	.03	-.13*	-.07	-.05
Requirements uncertainty	.13*	.12*	.07	.07	.04	-.12*	-.11*	-.05
Project size	.08	.05	.04	.04	.02	-.05	-.04	-.03
Firm history	.10	.03	.02	.01	.01	-.07	-.02	-.02
Parochial vs. Professional	.12*	.03	.05	.04	.02	-.10	-.03	-.02
Open vs. Closed System	.08	.05	.05	.05	.01	-.03	-.04	-.03
Service Level Agreements								
Foundation Characteristics		-.16*		-.14*	-.07		.17*	
Change Characteristics		-.17**		-.13*	-.13*		.21***	
Team Processes								
Team Transition Processes (TP)			-.20**	-.17*	-.12*			.17*
Work Practice Differences								
Process- vs. Results-Orientation (PO)	.15*	.14*	.15*	.14*	.13*	-.17*	-.16*	-.13*
Employee- vs. Job-Orientation (EO)	.16*	.08	.10	.08	.05	-.15*	-.12*	-.11*
Loose vs. Tight Control Orientation (CO)	.20**	.14*	.17*	.14*	.12*	-.21***	-.15*	-.14*
Interactions								
PO x TP					-.20**			
EO x TP					-.24***			
CO x TP					-.23***			

Notes:
* p < .05; ** p < .01; *** p < .001.

Table III. SLAs provisions (I.V) predicting transition processes (Mediator) (n = 279)

	Team Transition	
	Model 1	Model 2
R2	.25	.29
ΔR2		.04
Control Variables		
Project complexity	-.20**	-.15*
Requirements uncertainty	-.15*	-.13*
Project size	-.13*	-.12*
Firm history	.08	.05
Parochial vs. Professional	.13*	.08

Open vs. Closed System	.12*	.10
Service Level Agreements (I.V to M)		
Foundation Characteristics		.20**
Change Characteristics		.16*

Notes:
* p < .05; ** p < .01; *** p < .001.

Appendix: List of Scales

Outcomes

Maintenance costs (obtained from project archives)

Calculated as expenses incurred by the client after the completion of the development phase to fix bugs and address quality problems relative to the total project costs.

Actual project costs

Calculated as a composite of (1) billed man-hours, (2) negotiated billed expenditures on specialized software, training, conferences, project team visits, and (3) additional expenses not included in negotiated billed expenses.

Client satisfaction (Nidumolu, 1995)

Measured on a 7-point Likert scale (1 = "not at all satisfied" to 7= "very satisfied")

1. Ease of use of software.
2. Ability to customize outputs to various user needs.
3. Range of outputs that can be generated.
4. Overall responsiveness of software to users.

Predictors

SLA foundational characteristics (obtained from project archives)

Service level objectives

1. A statement of [client name]'s management and organizational expectations at the end of the contract.
2. A statement of expectations and capabilities of [vendor name].
3. A statement of [client name] business objectives from the service.

Process ownership

1. Statement of process ownership roles and responsibilities.
2. Inventory of processes required to manage the agreements between [client name] and [vendor name].
3. Inventory of processes directly affected by the services included in the agreements.

Service level content

1. A statement of the key business measurements required by [client name].
2. Established service-level/quality targets.
3. A general description of service requirements, major categories of services, and specific service elements.

SLA change characteristics (obtained from project archives)

Future demand management

1. Processes for scheduling, costing, and modifying agreements with new demand.
2. Processes used to obtain end-user feedback on [vendor name]'s delivery of services that are provisioned to meet new demand.
3. Processes that the [client name] and [vendor name] will use to prioritize changes and modify the volume, type, or level of service to match evolving user requirements.

Anticipated change

1. Relevant technology, business, and industry drivers for change.
2. Roles, responsibilities, and decision-making procedures of [client name] and [vendor name] for each category of change.
3. Clear definitions of the key categories of change.

Transition processes (Mathieu and Schulze, 2006)
Measured on a 7-point Likert scale (1 = "strongly disagree" to 7= "strongly agree")
1. Members of my team discuss how we plan to achieve our objectives.
2. Members of my team discuss alternative plans for achieving objectives.
3. Members of my team discuss our project team's objectives.

Organizational work practices (Hofstede et al., 1990)
Measured on a 100-point scale (e.g., 0 = process-oriented; 100 = result-oriented)—the score for each practice is the average of the response to each of the three items.
Process-oriented vs. result-oriented
1. Comfortable in unfamiliar situations.
2. Each day brings new challenges.
3. People put in maximal effort.

Employee-oriented vs. job-oriented
1. Important decisions made by individuals.
2. Organization is only interested in work people do.
3. Little concern for personal problems of employees.

Loose control vs. tight control
1. Everybody is cost-conscious.
2. Meetings times kept punctually.
3. Always speak seriously of organization and job.

Open system vs. closed system
1. Only very special people fit in the organization.
2. Organization and people are closed and secretive.
3. New employees need more than a year to feel at home.

Parochial vs. professional
1. People's private life is their own business.
2. Job competence is only criterion in hiring people.
3. Think three years ahead or more.

Control variables
Project complexity (obtained from project archives)
Computed as the number of function points in software code (adjusted for system requirements and programming language). The higher the number of function points, the greater the project complexity (Albrecth and Gaffney, 1983).

Requirements uncertainty (obtained from project archives)
Measured as the number of formal written changes to project requirements after initial contract was agreed. More changes indicate greater requirements uncertainty.

Project size (obtained from project archives)
Measured as the number of lines of software code in final deliverable.

Firm history (obtained from vendor firm archives)
Measured as the number of previous projects the vendor firm has completed for a specific client firm.