Offshore IS Project Risk, Contracts and Team Structure

Completed Research Paper

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Abstract

Offshore information systems (IS) project team structures are often treated as given in extant IS research and there is little insight about what criteria should be used to structure these teams. In this study we sought to understand how IS project risks shape the structure of project teams in offshoring. Drawing on the IS project risk literature, we predicted that social and technical subsystem risks shape the contract provisions that govern offshore relationships. We further posit that IS project risks indirectly influence offshore project team structure (client participation and temporal dispersion) through their effects on contract provisions. The model is tested in a field study of 87 offshore IS projects. We found support for the relationship of social and technical subsystem risk with contract provisions. We also found support for the role of contract provisions as mediating mechanisms between social and technical subsystem risks and offshore IS project team structure.

Keywords: Offshore projects, project teams, contracts, temporal dispersion, client participation
Introduction

The offshoring of software projects is a common consideration when organizations make decisions on how and where to delegate the development of their information systems (IS) (Carmel and Agarwal 2002; Lacity and Willcocks 1998; Ramasubbu et al. 2008). It is well acknowledged that a variety of considerations make offshoring an attractive option for the management of an organization’s IS development, including cost and access to expertise (Dibbern et al. 2008; Kotlarsky and Oshri 2008). Among these, access to expertise has emerged as an important consideration for the successful completion of IS projects (Agerfalk and Fitzgerald 2008; Kotlarsky and Oshri 2008). Offshore software vendor organizations establish their value by developing a core competency in the building of IS. This allows client organizations to leverage this technical expertise, acquire new knowledge, (Ethiraj et al. 2005) and utilize the services of offshore software vendors to build end-to-end systems (Carmel and Agarwal 2002; Rai et al. 2009).

While a large body of research has been accumulated on offshore development, the determinants of IS project teams’ composition remain understudied. Ultimately, it is the individual developers who are responsible for building these systems (Rai et al. 2009) and it is through the integration of the expertise possessed by individual team members that IS project teams are able to produce deliverables for their clients (Robert et al. 2008; Tiwana and McLean 2005). During the project, clients and vendors exchange business and IS knowledge to help facilitate development of a system that best leverages knowledge from both sides. In the context of offshore IS development, knowledge exchange is accomplished by bringing together the disparate domains of knowledge inherent in the client and the vendor. Indeed, the knowledge integration perspectives on how knowledge-based organizations achieve success highlight the central role that teams play in the integration of employee expertise to jointly produce outputs (Grant 1996). With this in mind, we believe that it is very important to consider the structure of offshore IS project teams as team structure has consistently been linked to performance (Tiwana and McLean 2005; Lee and Xia 2010).

In this research, we focus on two aspects of offshore IS project team structure that have been linked to offshore IS project outcomes. The first is team temporal dispersion. Numerous research studies suggest that dispersed teams provide organizations with access to a broader array of expertise that can be leveraged to solve complex problems (e.g., Boh et al. 2007; Sarker and Sarker 2009). Within the offshore and broader software development domain, a particular emphasis has been placed on structuring teams around different time zones as a way of achieving around the clock development so as to shorten the time-to-market for software products and adapting to changing requirements (e.g., Carmel et al. 2010; Jalote and Jain 2006; Sarker and Sarker 2009; Taweel and Brereton 2006; Treinen and Miller-Frost 2006). The second aspect of team structure we examine is client participation in the project team. The broader literature on IS development has consistently shown that greater user participation facilitates project success (see He and King 2008 for a recent meta-analysis). Within the offshore IS development domain, client participation has been found to be important for facilitating IS project success (Rai et al. 2009). For instance, Rai et al. (2009) found that offshore IS project teams with greater client participation exhibited higher client satisfaction with the system and lower levels of project cost overruns than offshore IS project teams with lower client participation. This is attributed to the important role that client members play in bridging the knowledge gap between the client organization context (which includes, standard operating procedures, idiosyncratic business processes, work culture, reporting relationships) and the technical expertise that the offshore IS project team possesses (Patnayakuni et al. 2007). Client members bridge this gap by helping to contextualize knowledge of the client organization environment in a way that offshore vendor project teams typically have difficulty achieving.

Although the importance of these two aspects of team structure in affecting project performance has been acknowledged in the literature, it is also well known that neither of them is without cost. Temporal dispersion has been found to create significant coordination costs in software project teams and can have a negative impact on project performance (e.g., Cummings et al. 2009; Espinosa et al. 2012). Of course, through proper management, it is possible to overcome these coordination costs (Gupta 2009; Sarker and Sarker 2009). However, the point remains that special attention must be paid to managing temporally dispersed offshore IS project teams. Increased client participation in offshore IS projects is also not without cost. There are logistical costs associated with facilitating travel and accommodation for client
representatives. There are also costs associated with lost productivity on the part of client representatives when they divert their attention from their day-to-day duties to focus on supporting the offshore IS project team. In light of these costs and the related trade-offs vis-à-vis performance implications, it is important to understand what factors inform client-side managers’ decisions about how best to structure offshore IS project teams in terms of how many employees to commit to such projects—via client participation—and which different locations to source technical expertise—via temporal dispersion.

Unfortunately, the extant literature offers little guidance to understand how offshore IS project teams come to be structured (i.e., temporal dispersion, client participation). Indeed, there is little theoretical understanding of the factors that inform client-side managers’ decision making about whether to compose their offshore IS project teams of members across different time zones and whether to seek client participation in the functioning of the project team during the development process. Under what circumstances are managers willing to form such team structures given the associated costs? The limited research on this issue constitutes a significant theoretical gap within the IS literature specifically and the management literature more broadly. Much of the prior literature has tended to take team structure as a given and focused on its impact on team processes and subsequent outcomes. This understanding is often reflected in the classic input-process-outcome (IPO) model of teams (Cohen and Bailey 1997; Ilgen et al. 2005). Very little, if any, consideration is given to what shapes the input portion of the IPO model—particularly in terms of team characteristics.

Our objective in this research is to begin to address this theoretical gap by examining how aspects of the offshore IS project itself help to shape the structure of the offshore IS project team. Prior IS project research suggests that IS project risks play a role in shaping managers’ decisions on IS project team composition (Schmidt et al. 2001; Wallace et al. 2004). Wallace et al. (2004) argue that managers’ decisions on how to manage team risk are contingent on the nature of the IS project’s social and technical risks. Therefore, drawing on the IS project risk literature, we argue that a variety of IS project risk factors indirectly shape the specific structures that offshore IS project teams take. One important mediating mechanism through which such team structure can be affected is the contract provisions that govern the client-vendor offshore arrangement (Goo et al. 2009; Gopal et al. 2003). Contract provisions help mitigate certain risks but cannot account for all unforeseeable risks in these inter-organizational arrangements (Banerjee and Duflo 2000; Poppo and Zenger 2002). Consequently, relational mechanisms serve as a useful complement to formal contracts in offshore arrangements (Kirsch, 1997; Goo et al. 2009; Rai et al. 2009). As Rai et al. (2009) argue, such relational mechanisms can be enacted at the team level. Drawing on this extant literature, we develop a model that links IS project risk factors to offshore IS project team structure. The model is tested in a field study of 87 offshore IS projects involving offshore vendors and clients.

**Theoretical Background**

**Risk Factors in Offshore Software Projects**

It is well recognized that there are a variety of project-related factors that pose a significant risk to offshore IS projects and can result in project failure (Schmidt et al. 2001; Wallace et al. 2004). Broadly defined, these IS project risk factors represent conditions in the project environment that pose a threat to successful project completion (Wallace et al. 2004). Prior research has sought to identify the main categories of IS project risk factors as a stepping stone to identifying solutions to mitigate the risks. Schmidt et al. (2001) identified fourteen sets of project risk factors using a Delphi study of IS projects in three different countries. Wallace et al. (2004) refined the categorization into three broad risk factors: social subsystem risk (which includes organizational environment risk and user risk), technical subsystem risk (which includes requirements risk and project complexity risk), and project management risk (which includes planning and control risk and team risk). In this research, we chose to focus on the environmental risks over which IS project managers have little to no control. Consequently, we mainly focus on social subsystem risk and technical subsystem risk (we exclude project management risk, which project managers are more likely to be able to control). This focus enables us to gain insight on how IS project managers structure their teams to meet the challenges of the project environment.
Social subsystem risk reflects threats that emerge from the social context in which an IS project is embedded (Wallace et al. 2004). In offshore IS projects these risks often emerge when the number of different stakeholders involved increases. With more stakeholders comes greater risk of competing needs and interests that can derail the IS project (Baccarini 1996; Xia and Lee 2005). We conceptualize this source of risk as organizational complexity. Such complexity risk can emerge through horizontal differentiation—i.e., the number of different organizational units involved. It describes both the challenges and difficulties associated with coordinating different stakeholder interests of the IS project (Xia and Lee 2005). Strategic importance is another important source of social subsystem risk. It reflects how integral the IS project (and its success) is to the client’s strategic mission and has implications for the level of commitment and resources that will be provided to assure successful project completion (Wallace et al. 2004).

In contrast to social subsystem risk, technical subsystem risk reflects threats that emerge from the technical environment in which a IS project is constructed. Wallace et al. (2004) note that two main sources of such risk are a lack of clarity regarding requirements and the complexity of the technology environment. In our model, we capture these two sources of technical subsystem risk through requirements clarity and technological complexity. Requirements clarity reflects the uncertainty that emerges from inadequate, unclear, or ambiguous specification of requirements (Hoorn et al. 2007; Schmidt et al. 2001; Turner and Cochrane 1993). Technological complexity represents the difficulty created when the IS project must be developed on an unfamiliar technology platform or across multiple, idiosyncratic, technology platforms (Wallace et al. 2004; Xia and Lee 2005).

In offshore IS projects, clients develop contractual agreements with offshore software vendors that will govern the inter-organizational relationship. These contracts outline specific service-level agreements (SLAs)—to align vendor interests with their own and ensure that their quality and service expectations are met (Chen and Bharadwaj 2009; Goo et al. 2009; Gopal and Koka 2010; Gopal et al. 2003). In offshore IS projects, SLAs represent a formal contract between a client firm seeking software services and a vendor firm providing software services (Goo et al. 2009). SLAs are designed ex ante to safeguard against IS project risks and ensure aligned interests in delivering desired software services (Chen and Bharadwaj 2009; Goo et al. 2009). We introduce contracts as a mechanism through which clients may seek to mitigate project risk in offshore IS projects. As we will argue later, these contracts play an important role in shaping IS project managers’ decisions about how to structure the teams that will perform the construction of the software artifact. Next, we briefly discuss contracts and their role in offshore IS projects.

Contracts in Offshore Software Projects

Contracts are a major mechanism through which firms manage risk in IS offshoring arrangements (Banerjee and Duflo 2000, Goo et al. 2009, Gopal et al. 2003). As is the case with most inter-organizational transactions, the need for contractual safeguards increases as exchange risks increase (Poppo and Zenger 2002) and a variety of schemes exist for classifying the provisions that underlie such contracts. Key provisions that have been identified in prior research include roles and responsibilities, monitoring, contingencies, and rewards and sanctions (Chen and Bharadwaj 2009, Goo et al. 2009, Sommer and Loch 2009). Goo et al. (2009) identified three broad classifications of contract provisions: foundation, change, and governance. In light of our focus on offshore IS project teams, we examine the influence of change and enforcement (governance) characteristics, as these have the potential to inform IS project managers’ decisions about how to structure these teams. Though important, foundation characteristics emphasize the establishment of shared values and goals, which are beyond the scope of this research and, hence, are excluded from our model.

Change characteristics of contracts 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). Future demand management provisions are particularly well-suited for such conditions. They force the offshore partners to explicitly develop plans for coping with unforeseeable changes that might occur in project parameters over the course of project development (Goo et al. 2009). Dynamic or unpredictable IS project environments increase the need for such provisions (Anderson and Joglekar 2009, Sommer and Loch 2009). The governance characteristics of contracts focus on ensuring that the client’s needs are met within specified parameters. The enforcement
provisions of contracts are particularly aimed at protecting the interests of client firms. They involve specification of rewards for meeting and/or exceeding project expectations, and penalties for failing to adhere to the terms of the inter-organizational relationship or meet client expectations (Goo et al. 2009). As we will argue next, the presence or absence of such provisions should shape the decisions that project managers make about the structure of offshore IS project teams.

Hypotheses

Organizational Complexity Risk and Contracts

Organizational complexity carries several risks that can derail an offshore IS project. First, as the number of stakeholders that the project must satisfy increases the potential for divergent interests also increases (Jasperson et al. 2002). This can pose a challenge to offshore IS project teams in identifying and reaching agreement on specific project objectives. Multiple interests, agendas, and expectations form significant barriers to prioritizing and reconciling conflicts. As the number of different stakeholders increases, it becomes more difficult to prioritize all interests and tradeoffs inevitably need to be made. Stakeholders who feel that their interests are being sidelined or overlooked may reduce their commitment to the project and refuse to commit resources (Wallace et al. 2004). The risk of failure increases in such situations. Second, with more organizational stakeholders, the number of different subsystems increases—each with its own culture and rhetoric (Xia and Lee 2005). This translates into different work norms, standard operating procedures, work flows and business processes that need to be accommodated in the software. Vendors, who often lack the in-depth business domain knowledge of the client environment (Patnayakuni et al. 2007), find themselves having to contend with learning and understanding multiple subdomains rather than just one or two. Naturally, this heightens the risk for misunderstanding and misalignment in expectations. Higher levels of complexity create coordination challenges among interdependent activities (Becker and Murphy 1992). Research shows that organizational complexity poses challenges for writing contracts needed for effective outsourcing (Dyer 1997).

Client firms can mitigate organizational complexity risk through the use of contract enforcement provisions (Chen and Bharadwaj 2009). As noted earlier, contract enforcement provisions enable clients to monitor project progress against established, mutually agreed targets (Goo et al. 2009; Kirsch 1997). Such provisions safeguard against the client’s interests not being met and help to ensure that the vendor works to prioritize their needs for the project. The risks posed by organizational complexity make such provisions attractive to client firms as it forces vendors to adequately manage competing interests. Client firms also recognize that competing interests among various stakeholders can pose a risk to project success. Future demand management provisions give clients the option of adapting expectations in the event that such tensions hamper project progress (Choudhury and Sabherwal 2003; Goo et al. 2009). Goo et al. (2009) note that such provisions facilitate adaptation to unforeseeable challenges that may arise from the inter-organizational relationship. The uncertainty created by multiple stakeholders makes such contract provisions an attractive mechanism for managing risk.

H1a: Organizational complexity risk will be positively associated with contract enforcement provisions in offshore IS projects.

H1b: Organizational complexity risk will be positively associated with future demand management provisions in offshore IS projects.

Strategic Importance and Contracts

Strategic importance of an IS project to the client firm’s business is often determined by the extent to which it facilitates competitive advantage and differentiation of the client firm, or helps develop new firm capabilities (Fichman et al. 2005). IS projects that contribute directly to enabling client firms to achieved sustained improvements in their competitive position are deemed to be strategically important (Piccoli and Ives 2005; Ross et al. 1996; Wade and Hulland 2004). Examples include enterprise resource planning systems, customer relationship management systems and supply chain management systems (Piccoli and Ives 2005). In contrast, IS projects that contribute to non-strategic firm operations, though important, are not classified as being strategically important. Though necessary and valuable, such IS projects do not directly contribute to client firms’ competitive advantage and, therefore, are not classified as being strategically important (Piccoli and Ives 2005; Ross et al. 1996; Wade and Hulland 2004).
The strategic importance of an offshore IS project can also have an important bearing on the likelihood of project success. Offshore software projects that involve a client’s mission critical systems are more likely to gain the support of stakeholders through resources and attention, compared to less strategically important systems. Strategically important offshore IS projects also leave the client firm vulnerable given its dependence on the vendor firm to develop such a system (Chen and Bharadwaj 2009). Such systems are often idiosyncratic and require significant information sharing between client and vendor. In building strategically important systems, the vendor firm must have access to client firm trade secrets. There is a risk of such secrets being used to meet the vendor’s own ends (e.g., building their own competing software) or sharing such proprietary knowledge with the client’s competitors. Finally, strategically important IS projects need to be adaptable to the client’s business needs. Given the pace of business, client firms often need to adapt their business strategies to maintain their competitive edge in the marketplace. Thus, it is likely that the client’s needs and expectations for the offshore IS project may change as the system is being built. Rigidity can pose a risk to the strategic agility of the client (Sambamurthy et al. 2003) and the success of the project (Overby et al. 2006).

The greater the strategic importance of a given IS project to the client firm’s business, greater the attempts to closely control its development are likely to be (Kirsch 1997). Research has shown that this facilitates greater flexibility in the development process as well as direct control over the quality of the design and development process.

Given the risks of strategically important offshore IS projects, enforcement provisions are more likely to be included in client-vendor contracts. Such provisions will enable the client to assess penalties or terminate the relationship in the event that trade secrets are compromised (Poppo and Zenger 2002). Contract enforcement provisions have been highlighted as a potent remedy for inter-organizational arrangements that involve asset specificity (Chen and Bharadwaj 2009). Strategically important offshore IS projects represent just such a case. Future demand management provisions are also more likely to be included in strategically important offshore IS projects. As noted earlier, mission critical systems need to be able to adapt to the changing business needs of the client (Overby et al. 2006). Consequently, the client needs to have the flexibility to alter project expectations. Goo et al. (2009) note that future demand management provisions enable firms to embed processes for modifying agreements and updating key project objectives when necessary.

H2a: Strategic importance will be positively associated with contract enforcement provisions in offshore IS projects.

H2b: Strategic importance will be positively associated with future demand management provisions in offshore IS projects.

**Requirement Risk, Technological Complexity Risk and Contracts**

Requirement clarity affects the level of risk of a project (Wallace et al. 2004). Inadequately specified requirements can make it difficult for offshore software vendor teams to develop the right functionality for the project. In addition, changing the software code at later stages becomes more costly to implement and carries the potential for introducing errors or increasing structural complexity in the software (Maruping et al. 2009). Ambiguous requirements also increase the potential for scope creep which poses a significant risk for IS projects (Schmidt et al. 2001). In contrast, high requirement clarity provides offshore IS project vendors a clear indication of client expectations for what the system should look like and how it should operate. It also makes it easier for the client to assess how well expectations are being met in terms of software functionality.

Offshore IS projects with clear requirements make it easier for client firms to monitor whether or not expectations for system functionality are being met. As such, it is more likely that contract enforcement provisions will be implemented in offshore IS project arrangements. Requirement clarity makes it possible to set the project targets that form the basis for contract enforcement provisions. Chen and Bharadwaj (2009) suggest that the ability to monitor IS projects for enforcement is predicated on having clear benchmarks against which vendor performance can be evaluated. Requirement clarity is expected to reduce the likelihood of including future demand management provisions in offshoring contracts. When requirements are clearly specified, there is less risk that modifications to functionality will need to be made. In contrast, when requirements are poorly specified or are ambiguous, there is a good chance the expected functions and capabilities will need to be updated as needs become more apparent at later
project stages. Future demand management provisions establish procedures for updating key project assumptions as well as scheduling and costing any future modifications in project parameters (Goo et al. 2009; Johnson et al. 2003).

H3a: Requirement clarity will be positively associated with contract enforcement provisions in offshore IS projects.

H3b: Requirement clarity will be negatively associated with future demand management provisions in offshore IS projects.

Technological complexity poses a threat to IS project success in several ways. First, when the system needs to operate across multiple technology platforms, the potential for project failure increases as such project environments require numerous patches and may encounter incompatibilities (Schmidt et al. 2001). Second, risk of failure increases as the system is required to interact with more external software systems (Wallace et al. 2004). The offshore IS project has to manage a greater diversity of data formats for exporting data to, and importing data from, other software systems; increasing the likelihood of errors in the code (Schmidt et al. 2001). Xia and Lee (2005) also indicate that IS project risk increases as the multiplicity and interdependence of a project’s technology platform, software environments, and data processing requirements increases.

Contract enforcement provisions are more likely to be implemented in offshore IS projects with high technological complexity. Aubert et al. (2004) suggest that technologically complex projects can contain numerous hidden costs that are difficult to anticipate. They argue that monitoring through enforcement provisions is more likely under such circumstances. More broadly, task complexity has been associated with the inclusion of monitoring in inter-organizational arrangements (Aron et al. 2005). Technological complexity also increases the likelihood of including future demand management provisions in offshore IS project contracts. Such contract provisions give the client flexibility in determining how many and which platforms the system should be able to operate on. It also enables the client to change the specific systems the project should be capable of interacting with. The ability to make such changes when necessary is highly desirable for client firms, particularly in technologically complex environments.

H4a: Technological complexity will be positively associated with contract enforcement provisions in offshore IS projects.

H4b: Technological complexity will be positively associated with future demand management provisions in offshore IS projects.

Contract Provisions and Client Participation in Offshore Project Teams

Offshore IS project teams are assembled in the context of the project environment that exists at inception. Consequently, project managers are expected to use elements of the IS project context to inform their decision about how to structure the team. We expect IS project risk factors to play an important role in shaping how offshore IS project teams are structured as project managers need to ensure that their teams are capable of developing the software system in the midst of the existing project environment. We further expect that contract provisions will be one of the mechanisms through which IS project risk factors shape team structure. This set of relationships is discussed in greater detail next.

Social and technical subsystem risks are expected to shape project managers decision to have client participation in the offshore IS project team through its effects on contract enforcement provisions. As discussed earlier, contract enforcement provisions make it easier for clients to evaluate offshore IS project team progress against established performance benchmarks. This reduces the need for close, observational monitoring of offshore IS project team activities (Kirsch et al. 2002). Consequently, it becomes less necessary to have direct client participation in the offshore IS project team. Additionally, the presence of such provisions gives the client firm some form of recourse in the event that proprietary knowledge is appropriated or compromised in any way (Chen and Bharadwaj 2009). Therefore, it is not necessary to have client participation to monitor the offshore project team’s use of proprietary knowledge and trade secrets. In contrast, when contract enforcement provisions are not in place, the client will have an interest in being able to monitor the day-to-day activities of the offshore IS project team to ensure they are working to meet the necessary benchmarks as well as to prevent inappropriate use of client firm knowledge. Based on this logic, we expect social subsystem risk—via organizational complexity and strategic importance—to have a negative indirect effect on client participation on the offshore IS project
team through contract enforcement provisions. Similarly, we expect technical subsystem risk—via requirement clarity and technological complexity—to also have a negative indirect influence on client involvement on the offshore IS project team. In essence, these social and technical subsystem risks increase the likelihood of introducing contract enforcement provisions and these provisions in turn reduce the necessity for close monitoring through client participation on the offshore IS project team.

H5a: Organizational complexity will have a negative indirect effect—through contract enforcement provisions—on client involvement in offshore IS project teams.

H5b: Strategic importance will have a negative indirect effect—through contract enforcement provisions—on client involvement in offshore IS project teams.

H5c: Requirement clarity will have a negative indirect effect—through contract enforcement provisions—on client involvement in offshore IS project teams.

H5d: Technological complexity will have a negative indirect effect—through contract enforcement provisions—on client involvement in offshore IS project teams.

Social and technical subsystem risks are also expected to influence client participation through their influence on future demand management provisions in offshore IS software projects. Future demand management provisions provide the flexibility for changes to be made in offshore IS project expectations due to unforeseen contingencies or to enhance the relationship when the opportunity arises (Chen and Bharadwaj 2009; Goo et al. 2009). The ability to successfully manage such adaptations over time is positively associated with client participation in the project (Rai et al. 2009). Indeed, Rai et al. (2009) billed joint problem-solving through client participation on the team as a core relational mechanism that enriches the client-vendor relationship. Such IS project team structure also facilitates the free flow of information between client and vendor, making it easier to implement any necessary adaptations.

H6a: Organizational complexity will have a positive indirect effect—through future demand management provisions—on client involvement in offshore IS project teams.

H6b: Strategic importance will have a positive indirect effect—through future demand management provisions—on client involvement in offshore IS project teams.

H6c: Requirement clarity will have a negative indirect effect—through future demand management provisions—on client involvement in offshore IS project teams.

H6d: Technological complexity will have a positive indirect effect—through future demand management provisions—on client involvement in offshore IS project teams.

Contract Provisions and Temporal Dispersion in Offshore Project Teams

Social and technical subsystem risks are expected to influence the temporal dispersion of offshore IS project teams through their influence on contract enforcement provisions. Given the emphasis that contract enforcement provisions place on rewarding met or exceeded expectations and penalizing under-performance and failure, project managers have an incentive to assemble temporally dispersed offshore IS project teams. When offshore IS project teams are temporally dispersed, they are able extend the amount of time devoted to completing project requirements (Carmel et al. 2010). In temporally dispersed offshore IS project teams, developers in one time zone complete their assigned tasks, document required next steps, and then engage in a hand-off meeting with developers in the next time zone (Carmel et al. 2010). An additional benefit is that temporally dispersed IS project teams have ready access to expertise at any point in time in a 24-hour cycle. Thus, if needed expertise is not locally available, it can be readily accessed at a location in a different time zone (Kotlarsky and Oshri 2008). This helps the offshore vendor from incurring penalties from failing to meet benchmarks due to lack of expertise (Boh et al. 2007; Oshri et al. 2007). Taken together, these benefits of temporal dispersion make it easier for offshore IS project teams to meet the obligations set forth in contract enforcement provisions in a timely manner. To the degree that social and technical subsystem risks give rise to contract enforcement provisions in offshore IS projects, they should indirectly promote the use of temporally dispersed IS project teams.

H7a: Organizational complexity will have a positive indirect effect—through contract enforcement provisions—on temporal dispersion in offshore IS project teams.
H7b: Strategic importance will have a positive indirect effect—through contract enforcement provisions—on temporal dispersion in offshore IS project teams.

H7c: Requirement clarity will have a positive indirect effect—through contract enforcement provisions—on temporal dispersion in offshore IS project teams.

H7d: Technological complexity will have a positive indirect effect—through contract enforcement provisions—on temporal dispersion in IS software project teams.

Finally, social and technical subsystems are expected to influence the temporal dispersion of offshore IS project teams through their influence on future demand management provisions in offshore IS project arrangements. Future demand management provisions emphasize adaptability in terms of contractual obligations (Chen and Bharadwaj 2009). As a result, offshore IS project teams that operate under such contractual conditions need to be capable of adjusting to changes in project expectations when they arise. Unfortunately, as prior research has consistently suggested, temporally dispersed teams are the least ideal form of IS project team structure under such conditions. Adaptation to change requires significant coordination of inputs from all team members (Maruping et al. 2009). Temporal dispersion has been shown to negatively influence coordination in IS project teams (e.g., Cummings et al. 2009; Espinosa et al. 2012). Thus, project managers are less likely to invoke this form of team structure when future demand management provisions are in place, for fear of the consequences of poor coordination in temporally dispersed IS project teams.

H8a: Organizational complexity will have a negative indirect influence—through future demand management provisions—on temporal dispersion in offshore IS project teams.

H8b: Strategic importance will have a negative indirect influence—through future demand management provisions—on temporal dispersion in offshore IS project teams.

H8c: Requirement clarity will have a positive indirect influence—through future demand management provisions—on temporal dispersion in offshore IS project teams.

H8d: Technological complexity will have a negative indirect influence—through future demand management provisions—on temporal dispersion in offshore IS project teams.

**Methodology**

**Data and Sample**

We tested the proposed models using a web-based survey. The sample consisted of IT project managers engaged in offshored software development projects. A market research company hosted the survey and sent a link via electronic mail to a panel containing 426 managers that fit this description. A total of 127 surveys were received, resulting in a response rate of 29.8%. After eliminating IS projects that were related to updates and maintenance (rather than new systems), missing and unusable data, 87 usable observations were utilized in our analysis, generating an effective response rate of 20.4%.

**Dependent Variables**

Client participation was measured as the proportion of offshore IS project team members who were members of the client firm. This is an extension of Rai et al.’s (2009) binary measure that simply indicated whether or not there was a client representative on the team. Temporal dispersion items are consistent with Espinosa et al. (2012) as the number of time zones spanned by the IS project team. Teams that spanned two or fewer time zones were given a score of 0 and those that spanned more than two time zones were given a score of 1.

**Independent Variables**

Organizational complexity represents risk arising from horizontal differentiation and was measured by multiplicity of contractors and vendors involved and multiplicity of client units (Xia and Lee 2005; Jiang and Klein 2001; Schmidt et al. 2001). The reliability of the two-item scale is .70. Strategic importance measured how critical the system being proposed was to the client’s core mission (Wallace et al. 2004).
Requirements clarity was measured in terms of simplicity of requirements, easy project guidelines and clarity of specifications (Schmidt et al. 2001; Wallace et al. 2004). This is consistent with the notion of uncertainty-based complexity proposed by Williams (1999). The three-item scale has a reliability of .80.

Technological complexity measures reflected challenges created by multiple and rapidly changing software environments and tools (Meyer and Curley, 1991), real-time data processing (Garmus and Herron 2001), multiple and rapidly changing IT infrastructure (Scott and Vessey 2002; Schmidt et al. 2001), and significant interaction with other systems (Meyer and Curley 1991). The five-item scale has a reliability of .82.

Contract enforcement items were adapted from Kirsch et al. (2002) and Goo et al. (2009). The scale included questions about whether the contract included penalties for non-performance, cash bonuses for superior performance etc. The reliability of the three-item scale is .89. Future demand management items were adapted from Grover et al. (1996) and included questions about whether the contract included adjustment of charges to business changes and allowances for the evolution of technology toward market standards. The four-item scale has a reliability of .86.

Control Variables

We measured contract type in terms of the compensation model. Following Gopal et al. (2003) we distinguished between time-and-materials (1), fixed-price (2), and market average cost (3). We also measured project size in terms of the total cost of the project in U.S. dollars.

Analysis and Results

The correlation matrix is shown in Table 1 below. Client participation is correlated with contract enforcement provisions (r = .45, p < .001) and future demand management provisions (r = .54, p < .001). Temporal dispersion is correlated with future demand management provisions (r = -.24, p < .05) but not with contract enforcement provisions (r = .13, p = ns). It is also worth observing that the IS project risk factors are each correlated with the contract provisions. Specifically, organizational complexity (r = .66, p < .001), strategic importance (r = .26, p < .05), requirement clarity (r = .46, p < .001) and technological complexity (r = .58, p < .001) are each correlated with contract enforcement provisions. Organizational complexity (r = .58, p < .001), strategic importance (r = .41, p < .001), requirement clarity (r = .45, p < .001) and technological complexity (r = .52, p < .001) are also each correlated with future demand management provisions.

### Table 1. Descriptive Statistics and Correlations

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<tr>
<td>2. Temporal dispersion</td>
<td>.08</td>
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<tr>
<td>3. Contract enforcement provisions</td>
<td>-.45***</td>
<td>-.13</td>
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<td></td>
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<tr>
<td>4. Future demand management provisions</td>
<td>-.54***</td>
<td>-.24*</td>
<td>.83***</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5. Organizational complexity</td>
<td>-.42***</td>
<td>.16</td>
<td>.66***</td>
<td>.58***</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6. Strategic importance</td>
<td>-.40***</td>
<td>-.09</td>
<td>.26*</td>
<td>.41***</td>
<td>.33**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Requirement clarity</td>
<td>-.35**</td>
<td>-.14</td>
<td>.46***</td>
<td>.45***</td>
<td>.49***</td>
<td>-.20†</td>
<td></td>
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<tr>
<td>8. Technological complexity</td>
<td>-.44***</td>
<td>-.24*</td>
<td>.58***</td>
<td>.52***</td>
<td>.65***</td>
<td>.32**</td>
<td>-.37**</td>
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<td>9. Contract type</td>
<td>.22*</td>
<td>.05</td>
<td>.20†</td>
<td>.09</td>
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<td>.19†</td>
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<td>.03</td>
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<td>10. Project size</td>
<td>-.01</td>
<td>-.04</td>
<td>.16</td>
<td>.14</td>
<td>.13</td>
<td>.16</td>
<td>.12</td>
<td>.15</td>
<td>.17</td>
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<tr>
<td>Mean</td>
<td>.61</td>
<td>.37</td>
<td>4.02</td>
<td>4.59</td>
<td>4.91</td>
<td>6.06</td>
<td>4.99</td>
<td>5.36</td>
<td>1.99</td>
<td>96M</td>
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<tr>
<td>Standard deviation</td>
<td>.23</td>
<td>.49</td>
<td>1.94</td>
<td>1.63</td>
<td>1.66</td>
<td>.81</td>
<td>1.37</td>
<td>1.34</td>
<td>.73</td>
<td>58.4M</td>
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</tbody>
</table>

Notes: n = 87

† p < .10, * p < .05, ** p < .01, *** p < .001.

Given the nature of our dependent variables, we used two different approaches to test the hypotheses. Specifically, we used ordinary least squares (OLS) regression to test the models predicting the contract provisions and client participation. Because temporal dispersion was a binary variable, the underlying
distribution violates the assumption of normality associated with OLS regression. Consequently, we use logistic regression analysis, which is well-suited for binary outcomes. The results of the analyses are shown in Table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Contract Enforcement</th>
<th>Future Demand Management</th>
<th>Client Participation</th>
<th>Temporal Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controls:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract type</td>
<td>.16*</td>
<td>.01</td>
<td>.18*</td>
<td>.20*</td>
</tr>
<tr>
<td>Project size</td>
<td>.03</td>
<td>.02</td>
<td>-15</td>
<td>-.16*</td>
</tr>
<tr>
<td><strong>Predictors:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational complexity</td>
<td>.42***</td>
<td>.28*</td>
<td>.08</td>
<td>.02</td>
</tr>
<tr>
<td>Strategic importance</td>
<td>-.03</td>
<td>.21*</td>
<td>.24*</td>
<td>-.15</td>
</tr>
<tr>
<td>Requirement clarity</td>
<td>.15</td>
<td>.19*</td>
<td>.16</td>
<td>-.89*</td>
</tr>
<tr>
<td>Technological complexity</td>
<td>.24*</td>
<td>.20*</td>
<td>.28*</td>
<td>.23*</td>
</tr>
<tr>
<td><strong>Mediators:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract enforcement</td>
<td>-1.19*</td>
<td>-1.29*</td>
<td>R²</td>
<td>Adj-R²</td>
</tr>
<tr>
<td>Future demand management</td>
<td>.44***</td>
<td>-87*</td>
<td>.51***</td>
<td>.42***</td>
</tr>
<tr>
<td>R²</td>
<td>.47</td>
<td>.41</td>
<td>.35</td>
<td>.35</td>
</tr>
<tr>
<td>Adj-R²</td>
<td>.47</td>
<td>.41</td>
<td>.30</td>
<td>.35</td>
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<td>-2LL</td>
<td>87.624</td>
<td>85.42</td>
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<td></td>
</tr>
</tbody>
</table>

Notes: n = 87, R² for Temporal dispersion is Nagelkerke R²,
† p < .10, * p < .05, ** p < .01, *** p < .001.

As the results in Table 2 show, the model explained 47% of the variance in contract enforcement provisions. H1a, H2a, H3a and H4a predicted that organizational complexity, strategic importance, requirement clarity, and technological complexity respectively would be positively associated with contract enforcement provisions. As the results in Table 2 show, organizational complexity (β = .42, p < .001) and technological complexity (β = .24, p < .05) are both positive and significant in predicting contract enforcement provisions, providing support for H1a and H4a respectively. H2a and H3a are not supported.

The model explained 41% of the variance in future demand management provisions. H1b, H2b, and H4b predicted that organizational complexity, strategic importance, and technological complexity respectively would be positively associated with future demand management provisions in offshore IS project arrangements. H3b predicted that requirement clarity would be negatively associated with future demand management provisions. As the results in Table 2 show, organizational complexity (β = .28, p < .05), strategic importance (β = .21, p < .05), requirement clarity (β = .19, p < .05), and technological complexity (β = .20, p < .05) are each positive and significantly related to future demand management provisions. This provides support for H1b, H2b and H4b, but not H3b.

Finally, the models explained 30% of the variance in client participation and 35% (pseudo-R²) of the variance in temporal dispersion. As the results show, although the sign for contract enforcement was in the expected direction (β = -.16, p = ns), the coefficient is not significant in predicting client participation. However, future demand management provisions is significant in predicting client participation (β = -.44, p < .01). In predicting temporal dispersion, contract enforcement provisions is marginally significant (β = -.62, p < .10). The odds ratio for this coefficient (estimated by exponentiating the coefficient) is 1.851, suggesting that the odds of an offshore IS project team being temporally dispersed increase in the presence of contract enforcement provisions. Future demand management provisions is significant in predicting temporal dispersion (β = -.87, p < .05). The odds ratio for this coefficient is .418, suggesting that the odds of an offshore IS project team being temporally dispersed decrease in the presence of future demand provisions.

H5(a, b, c, d) predicted that organizational complexity, strategic importance, requirement clarity and technological complexity would have a negative indirect effect on client participation through contract
enforcement provisions. To test these hypotheses, we used the multiple mediator approach advocated by Preacher and Hayes (2008). This approach has several advantages that are well-suited for our model. First, the multiple mediator approach is able to estimate indirect effects for each mediator while accounting for covariance between the mediators. Second, this approach relies on bootstrapping and, therefore, does not require large sample sizes (Preacher and Hayes 2008; Shrout and Bolger 2002). Following Preacher and Hayes (2008), we estimated the indirect effects using 1,000 bootstrap samples. The results are shown in Table 3, including the bias corrected confidence intervals for the estimates. As the results in Table 3 show, none of the predictors has an indirect effect on client participation through contract enforcement provisions. Therefore, H5 does not receive support.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Mediator</th>
<th>Indirect effect (s.e.)</th>
<th>C.I. lower bound</th>
<th>C.I. upper bound</th>
<th>Indirect effect (s.e.)</th>
<th>C.I. lower bound</th>
<th>C.I. upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational complexity</td>
<td>CE</td>
<td>-.05 (.08)</td>
<td>-.20</td>
<td>.10</td>
<td>.46 (.27)</td>
<td>.07</td>
<td>1.14</td>
</tr>
<tr>
<td></td>
<td>FDM</td>
<td>.22 (.07)</td>
<td>.10</td>
<td>.39</td>
<td>-.50 (.26)</td>
<td>-.12</td>
<td>-.13</td>
</tr>
<tr>
<td>Strategic importance</td>
<td>CE</td>
<td>.02 (.05)</td>
<td>-.08</td>
<td>.14</td>
<td>.44 (.20)</td>
<td>.04</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>FDM</td>
<td>.23 (.14)</td>
<td>.04</td>
<td>.62</td>
<td>-.46 (.25)</td>
<td>-.98</td>
<td>-.07</td>
</tr>
<tr>
<td>Requirement clarity</td>
<td>CE</td>
<td>-.02 (.06)</td>
<td>-.17</td>
<td>.09</td>
<td>.51 (.22)</td>
<td>.19</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>FDM</td>
<td>.19 (.07)</td>
<td>.09</td>
<td>.37</td>
<td>-.36 (.20)</td>
<td>-.92</td>
<td>-.08</td>
</tr>
<tr>
<td>Technological complexity</td>
<td>CE</td>
<td>-.06 (.07)</td>
<td>-.21</td>
<td>.07</td>
<td>.40 (.29)</td>
<td>.04</td>
<td>1.22</td>
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<tr>
<td></td>
<td>FDM</td>
<td>.22 (.08)</td>
<td>.10</td>
<td>.43</td>
<td>-.57 (.35)</td>
<td>-1.57</td>
<td>-.12</td>
</tr>
</tbody>
</table>

Notes: CE = contract enforcement, FDM = future demand management

H6(a, b, c, d) predicted that organizational complexity, strategic importance, requirement clarity and technological complexity would have a positive indirect effect on client participation through future demand management provisions. As the results in Table 3 show, all four predictors have a positive indirect effect on client participation through future demand management provisions. This provides partial support for H6. H7(a, b, c, d) predicted that organizational complexity, strategic importance, requirement clarity and technological complexity would have a positive indirect effect (through contract enforcement provisions) on temporal dispersion. The results in Table 3 show that all four predictors have a positive indirect effect on temporal dispersion, providing support for H7. Finally, H8(a, b, c, d) predicted that organizational complexity, strategic importance, requirement clarity and technological complexity would have a negative indirect effect (through future demand management provisions) on temporal dispersion. This hypothesis is also partially supported, as all four predictors have a significant negative indirect effect on temporal dispersion (see Table 3).

Discussion

We found strong support for the relationship of social and technical subsystem risk with contract enforcement as well as future demand. This indicates that clients thoughtfully consider these risks in developing contract provisions. We also found that project managers pay close attention to contract provisions when determining how IS project teams should be assembled. Specifically, future demand management provisions inform project managers’ consideration of the level of client participation as well as temporal dispersion. We also found partial support for the role of contract enforcement provisions shaping the level of temporal dispersion of IS project teams. Contract enforcement did not play a role in shaping client participation in offshore IS project teams. One possible explanation of this is that decisions about client participation are mainly informed by domain knowledge needs rather than monitoring and enforcement needs. Indeed, the role of client participants has often been that of knowledge broker between the client firm and the vendor (Rai et al. 2009).

This work contributes to the IS outsourcing and offshoring literature in important ways. First, it adds to this stream of research by examining important antecedents of team composition, which has thus far been treated mostly as a given rather than a design factor to be leveraged. Much of the prior offshore IS project team literature has overlooked the important question of how such teams come to take the form that they do. Yet, as we noted at the outset, such decisions serve as an important precursor to project success.
Second, we contribute to the literature by examining the relationship of social and technical subsystem risks on contract enforcement and future demand. Previous empirical research in the contract provisions has examined project-level data collected from a single firm or a single industry. In contrast, our work examines a broader range of client industries, thus lending it greater generalizability. Finally, we uncover contract provisions as a mediating mechanism that links IS project risk factors to offshore IS project team structure. This sheds light on the operative factors that translate IS project risk factors into offshore IS project team structure decisions.

In terms of practical implications, our results suggest that senior managers have multiple avenues at their disposal for mitigating IS project risk. First, they can have some influence in crafting the content of client-vendor contracts in their partnering relationships. Second, they can address any residual risk by determining whether to dispatch client representatives as members of the IS project team and deciding where (in which time zone) to source their offshore operations. In contrast to contract provisions, decisions about offshore IS project team structure have the added advantage of facilitating knowledge coordination and integration across organizational boundaries.

While this research makes important contributions, its findings should be interpreted with some caution. First, the questionnaire was administered at a single point in time, and therefore causal links cannot be predicted. A longitudinal study can more appropriately test the temporal causality of the lagged effect of client’s knowledge integration on the IS project outcomes. Related to the above, both independent and dependent variables were tested using the same instrument, potentially leading to common method bias. Second, we adapted several of our scales to more appropriately fit our theorizing rather than adopting them as is. This might mean that that our results cannot be compared directly with the results of previous research that utilized these scales. Third, while we have examined key variables of interest here, several other factors that can affect project outcomes were not included. Future work should include certain important control variables, such as firm and partnership characteristics as control variables. Finally, a potential limitation of this study is the use of self-reported survey data to assess the offshored IS project team structure. We chose self-reported measures because of their potential for concept-specific accuracy and because of the unavailability of other objective measures across the entire sample.

References


Appendix. Measurement Scales

Dependent Variables
Client participation: number of client team members / (number of client team members/number of vendor team members)
Temporal dispersion: 0 = project team members located across 2 or fewer time zones; 1 = project team members located across more than 2 time zones

Independent Variables
Organizational complexity:
To what extent does this IS project have...
1. multiple client units
2. multiple contractors and vendors

Strategic importance:
1. Please rate the strategic importance of this IS project to your organization

Requirement clarity:
To what extent does this IS project have...
1. simple requirements
2. an easy set of project guidelines
3. clear specifications

Technological complexity:
To what extent does this IS project have...
1. multiple software environments
2. real-time data processing
3. multiple technology platforms
4. significant interaction with other systems