8-2011

Integrating distributed work: task design, communication and tacit coordination mechanisms

Kannan SRIKANTH
Singapore Management University, KSRIKANTH@smu.edu.sg

Phanish Puranam

Citation

SRIKANTH, Kannan and Puranam, Phanish. Integrating distributed work: task design, communication and tacit coordination mechanisms. (2011). *Strategic Management Journal*. 32, (8), 849-875.
Available at: https://ink.library.smu.edu.sg/lkcsb_research/4694

Integrating distributed work:

Comparing task design, communication, and tacit coordination mechanisms[1]

Kannan Srikanth
Assistant Professor
Strategy Area, Indian School of Business &
Strategic Organization Design, University of Southern Denmark
Gachibowli, Hyderabad, 500032
INDIA
Phone: +91-40-2318-7165
FAX: +91-40-2318-7032
Kannan_srikanth@isb.edu

Phanish Puranam
Professor
Strategic and International Management
London Business School
Sussex Place, Regent's Park
London NW1 4SA
UK
+44-20-7000-8742
+44-20-7000-8701
ppuranam@london.edu

Key Words: Coordination, Offshoring, Organization Design, Common Ground, virtual organizations, tacit coordination mechanisms.

[1]

ABSTRACT

We investigate coordination strategies in integrating distributed work. In the context of Business Process Offshoring (BPO), we analyze survey data on a 126 offshored processes to understand both the sources of difficulty in integrating distributed work as well as how organizations overcome these difficulties. We find that interdependence between offshored and onshore processes can lower offshored process performance, and investing in coordination mechanisms can ameliorate the performance impact of interdependence. In particular, we outline a distinctive set of coordination mechanisms that rely on tacit coordination – and theoretically articulate and empirically show that tacit coordination mechanisms are distinct from the well known duo of coordination strategies: building communication channels or modularizing processes to minimize the need for communication. We discuss implications for the study of coordination in organizations.

INTRODUCTION

The relatively young phenomenon of Business Process Offshoring (BPO) offers an interesting context in which to re-examine a fairly old, but central problem in the study of organizations- how interdependent activities are coordinated (March and Simon, 1958; Thompson, 1967). In BPO, activities that were performed collocated with their connected activities are moved to different locations, typically to lower wage economies. Since several of the linked processes continue to be performed onsite after the focal process is offshored, managing these interdependencies is essential. Yet the communication constraints posed by geographic distance and differences in time zones make this a non-trivial problem (Armstrong and Cole, 2002; Kraut et al. 2002). The purpose of this paper is to understand the mechanisms that enable offshored business processes to be coordinated with those retained on-shore.

To see why an analysis of coordination mechanisms in the BPO context is not only topical but also has high academic value, it is useful to revisit some basic theoretical generalizations about how coordination takes place in organizations. Successful coordination depends on the creation of reciprocal predictability of action and is necessary whenever actions are interdependent – i.e., when the outcomes of actions taken by A depend in some way on the actions taken by B (Gulati, Lawrence and Puranam, 2005 Heath and Staudenmayer, 2000; Thompson, 1967) [2]. Coordination failures may arise even in the absence of incentive conflict (Camerer and Knez, 1996); indeed incentives meant to foster collaboration may harm rather than help unless coordination problems are accounted for (Kretschmer and Puranam, 2008).

In general more complex forms of interdependence require greater efforts at achieving coordination (Thompson, 1967; Tushman and Nadler, 1978; Van de Ven et al., 1976). This insight has led scholars to propose two generic strategies for coordinating interdependence:

[2] Coordination can be an ambiguous term because it is commonly used both to describe an outcome and as a process -- i.e., a noun and verb. Unless explicitly stated, we use the term "coordination" in its noun form, and denote the process by terms such as "coordinating" or "coordination process."

1. Redesigning tasks to reduce/simplify interdependence and relying on standardized procedures to achieve coordination.

2. Creating opportunities for extensive communication among interdependent actors so that they achieve reciprocal predictability of action.

The well-known dichotomies of coordination by plan vs. feedback (March and Simon, 1958; Thompson, 1967; Tushman and Nadler, 1978), modular vs. integral designs (Baldwin and Clark, 2000; Sanchez and Mahoney, 1996) and loose vs. tight coupling (Orton and Weick, 1990) reflect these twin approaches to coordinating interdependence that have been widely recognized as well as advocated.

However, a new and exciting stream of recent research suggests the possibility of a third approach – in which coordination is achieved in situations of high interdependence in a *tacit* manner - without recourse to explicit ongoing communication, or through restructuring the nature of interdependence. Instead, in this approach, interdependent individuals are able to coordinate their activities largely by relying on common ground – knowledge that is shared and known to be shared - formed by means other than ongoing communication[3]. Clark (1996) explains the need for common ground in order to coordinate as follows:

> In any joint act, participants face a coordination problem: what participatory actions do they expect each other to take? To solve this problem, they need a coordination device – something to tell them which actions are expected. …Everything we do is rooted in information we have about our surroundings, activities, perceptions, emotions, plans and interests. Everything we do jointly with others is also rooted in this information, but only in that part we think they share with us. [pp. 91-92].

In this paper, we refer to Tacit Coordination Mechanisms (TCM) to denote mechanisms that enable the formation and leverage of common ground without the need for direct ongoing communication. While the notion of tacit coordination based on shared

[3] The concept of common ground is similar to the concept of common knowledge in game theory and economics (Aumann and Brandenburger, 1995; Becker and Murphy, 1992; Chwe, 2001). Common knowledge in a group is knowledge that is shared, known to be shared, and known to be known to be shared etc. Other concepts that are closely related include transactive memory (Wegner, 1986), shared mental models and representations (Klimoski and Mohammed, 1994), and focal points (Schelling, 1960). The common thread through these concepts is that they define a form of shared knowledge that enables interacting agents to accurately adjust and align their actions to each others- in other words to coordinate successfully.

knowledge – such as focal points, conventions and precedents – has been well known at least since Schelling's (1960) pioneering work, it is only of late that scholars have begun exploring this form of coordination systematically. In laboratory settings, there are now a substantial number of research studies that have analysed the aids and impediments to tacit coordination (see Camerer, 2003 for an overview). Scholars in the field of organizations (Bechky, 2003; Puranam, Singh and Chaudhuri, 2009; Srikanth, 2007) have begun to examine how mutually-shared knowledge may economize on the need for explicit communication or plan-based coordination mechanisms even in business situations of complex interdependence.

The prospect of coordination with limited communication is of particular interest in the context of distributed work (as in BPO). Geographic distance necessarily places the burden of communication across locations on information and communication technologies, but even the most advanced of these are very poor substitutes for collocated face-to-face communication (Kiesler and Cummings, 2002; Kraut et al., 2002; McLeod, 1996; Olson et al., 2002). The advantages of being able to coordinate interlinked but geographically dispersed processes with limited communication are therefore obvious. Indeed, there is some evidence based on laboratory and case studies that tacit coordination based on some form of common knowledge plays an important role in coordinating geographically distributed activity (Crampton, 2001; Gutwin et al., 2004).

Our goal in this paper is to offer a comparative analysis of all three generic approaches to achieving coordination – redesigning processes to simplify or minimize interdependence (*modularization*), facilitating ongoing (electronic) communication between remotely located actors (*ongoing communication*), and lastly enabling tacit coordination by leveraging/ building a stock of common ground without the need for ongoing explicit communication (*tacit coordination mechanisms* or TCM). We use questionnaire survey data from 126 off-shored software, back-office and contact centre processes to test the impact and the relative

efficacy of the three generic coordination strategies. We are able to show that the three generic coordination approaches are empirically distinguishable. While each helps to manage interdependence across locations, tacit coordination strategies appear to be particularly important in our sample. Our results have important implications for both scholars interested in understanding coordination within and between organizations, as well as practitioners who wish to improve the performance of BPO activities.

The rest of the paper is organized as follows. First we provide a brief description of the offshoring process to familiarize readers with the context for this paper. In the next section we present our research hypotheses followed by a description of our sample and analysis techniques, and then the findings from the analyses. Finally, we present a discussion of these findings that includes conclusions, limitations and directions for future research.

A BRIEF DESCRIPTION OF THE OFFSHORING PROCESS

The sourcing of any process can be discussed along two dimensions – that of owner-ship, (i.e., who implements the process) and geography, (i.e., where the process is implemented). Offshoring involves the geographic distribution of a process, typically to a low-wage location, regardless of whether the process is in-house or implemented by a 3rd party vendor.

Offshoring begins with the client deciding to offshore particular processes (e.g., IT systems maintenance, stock trading or mortgage processing). Then the client selects a vendor for this process as well as the location from which it is to be implemented (such as India, Brazil, and the Philippines). In some cases, the vendor proposes to implement the process from a particular location, rather than the client actively choosing one. These decisions are taken prior to any activity being moved offshore and how these decisions are made is outside the scope of this paper, though an excellent area for future research on governance decisions in a multi-national context.

Once the client firm decides to offshore a particular process and has selected a vendor, the preparations for actually moving the process from the onsite (e.g., USA, UK, Germany) to the offshore location (such as India, China, Brazil) take place. At this stage, a small team of vendor personnel, called the "migration team" or "transition team" visit the onsite location in order to understand the details of the process. Their goal is to understand how the process currently operates onsite – including both details about its internal workings, as well as how this process links to other surrounding processes.

For example, preparing to offshore mortgage processing involves understanding the steps in evaluating a mortgage (which can typically be offshored), as well as how these interact with mortgage origination (which typically has to remain onsite). Significant knowledge transfer to the vendor team occurs at this stage; the vendor team studies how the process operates by observation, or even trying to perform the work themselves under the supervision of client personnel. These knowledge transfer activities are supported by extensive documentation of both the policies and procedures of how the process is supposed to work, as well as how it actually works currently. Often, this may be the first time such a documentation exercise has ever taken place for the process.

A major issue that confronts the vendor team is how it will deal with process inter-dependencies. For example, in one of the mortgage processing projects in our study, prior to being offshored, interdependence between two adjacent steps in a process was coordinated by an employee simply walking over to the cubicle of another employee to have a short discussion, and then coming back to continue work based on the decisions taken in that discussion. Since offshoring precludes this approach, the vendor team has to decide how this link should be managed.

In principle, they could map out all such interactions in full detail, capture them in an interface, such as a form or an EDI system and try to achieve coordination by means of this

interface. Alternately they could decide that this interaction could take place adequately via email/telephone or other such tools. Finally, they might decide to retain this portion of the process onsite, and move offshore only those sections that are well defined and do not require "walking-over" to another section for a discussion. All these decisions are typically made by the vendor team, as the vendor organization invests in process re-engineering and building the IT/communication infrastructure deemed necessary to manage the offshored process.

Once the migration process is completed, the vendor team returns to the offshore location, where it typically forms the core of the team that implements the process from the offshore location. The vendor team now manages knowledge transfer to other offshore personnel. First the process is performed in parallel in both the onsite and offshore locations – often with 50% of the work volume executed at each location. Over the course of some weeks, the offshore volume ramps up, while the onsite volume reduces. During this ramp-up phase, any further "bugs" in performing the process offshore are worked out, as both offshore and onsite personnel learn from experience. Typically, we also found that at this stage, it is rare to perform extensive reengineering of the process to improve its efficiency or effectiveness. Rather, such reengineering is performed only after some months of stable production at maximum volume at the offshore location. Process reengineering at the time of migration is typically restricted to interdependence issues. Figure 1 schematically shows these activities on a time-line. This paper focuses on how process interdependence is managed in offshoring.

INSERT FIGURE 1 HERE

THEORY AND HYPOTHESES

Interdependence between a focal activity and surrounding activities gives rise to the need to coordinate them (Clark and Fujimoto, 1991; Iansiti, 1998; Thompson, 1967; Wheelwright and Clark, 1992). When a process that has high interdependence with its context (or surround-ing activities) is offshored, its performance is therefore likely to depend critically upon the ability

of the onsite and offshore locations to coordinate their actions for the continued production of the service. It follows that the greater the extent of interdependence between the onsite and offshore locations, the more likely is coordination failure and lowered process performance, unless coordination mechanisms are implemented to fully account for such interdependence.[4] Put differently, in the absence of coordination mechanisms, inter-dependence is likely to detract from the performance of offshored processes through coordination losses. We develop theoretical arguments below as to how different coordination strategies can mitigate the adverse consequences of interdependence between onshore and offshore activities in BPO.

Strategies to manage interdependence: Ultimately, all *consciously* coordinated action requires sufficient common ground – knowledge that is shared and known to be shared – to enable reciprocal predictability of action (Schelling, 1960).[5] Exactly how much common ground is necessary is something that varies by situation.

***Modularization*:** Ongoing communication is typically the most intuitive and potent mechanism for dynamically updating and maintaining sufficient common ground necessary for coordination. Traditional arguments that emphasize ongoing communication, such as feedback (March and Simon, 1958) or mutual adjustment (Thompson, 1967) implicitly invoke this dynamic updating of common ground to achieve coordination. However, in the context of offshoring, physical distance, information channel bandwidth constraints and time zone differences can severely limit the possibility of relying solely on ongoing communication to attain coordination (Kiesler and Cummings, 2002; Kraut et al., 2002; Olson et al, 2002).

[4] Here by process performance, we follow industry usage and consider the cost reductions/and or performance improvements that occur in the immediate aftermath of moving the process offshore. We do not consider potential long term performance consequences- such as the possibility of modular re-configuration of processes.

[5] Actions between agents may also be coordinated unconsciously as when each adapts individually to an environment that happens to include the other. Organisms co-evolving in ecology display such a property.

A common approach to minimizing the need for ongoing communication is what we might think of as "one-time" communication with the intention of designing interfaces and embedding these into common ground. Interfaces can be conceptualized quite generally in terms of a description of how elements of a system interact with each other. In organizations, the elements are organizational sub-units (such as project teams) and interfaces include standard operating procedures, design rules, plans and schedules that specify what each element must do so that their joint actions are coordinated (Galbraith, 1973, 1977; Tushman and Nadler, 1978).

Once interfaces are designed, they have two important effects: a) they economize on the need for ongoing communication – rather than communicate, two interdependent individuals may coordinate their actions simply by adhering to an operating procedure that specifies what each must do individually so that their joint actions are coordinated b) they economize on the amount of knowledge held in common ground- to achieve coordinated actions, it is sufficient that knowledge of the interface is in common ground.

An example of an organizational interface is an Electronic Data Interchange (EDI) protocol that banks may use in order to exchange information with each other to process checks or pay bills. Individual banks need not know how other partner banks use and process this data, because to interact successfully, both banks need to know only the EDI format. Here the common ground necessary for coordinated outcomes is restricted to the interface.

This approach to coordination based on the creation of interfaces is referred to as the *modularity strategy* in the current paper. The essence of the modularity strategy is to decompose a system of activities into sub-systems (also known as modules or components), such that activities within a module are highly interdependent with each other, but there are few dependencies between activities that are part of different modules (Baldwin and Clark,

---

The functioning of the price system in an efficient market is another instance. The emergence of routines

2000; Langlois, 2002; Sanchez and Mahoney, 1996; Simon, 1962; Ulrich and Eppinger, 1999). The cross-module dependencies are primarily managed through interfaces that limit the need for ongoing communication.

A rational decision to create such organizational interfaces would balance these ongoing economies against the costs of their creation. This decision would include the cost of understanding the system in order to discover points at which sub-systems may be de-coupled or minimally coupled (Simon, 1962), as well as possible opportunity costs arising from the fact that some interdependence is probably ignored when an interface is designed – organizational architects are unlikely to infallibly discover perfect loci for decoupling (Ethiraj and Levinthal, 2004). The research literature on product and technological modularity has explicitly pointed to these opportunity costs arising from the conscious downplaying of interdependence: lowered performance is traded-off against advantages such as parallelism, lower communication needs, as well as the option value of modular reconfiguration (Baldwin and Clark, 2000; Ulrich and Eppinger, 1999). Despite the existence of this trade-off, we believe the pressures to modularize to the extent possible are immense in BPO, because the costs of coordinating high levels of interdependence across geographies is prohibitive and could significantly detract from the savings from wage arbitrage. [6]

To illustrate, consider the mortgage processing example from our sample again, in which origination and evaluation agents coordinated their actions through ad hoc face-to-face communication when both activities were done onshore. In this instance, the vendor teams studied the mortgage origination and evaluation steps to develop a standardized form as the interface between the agents. In order to make good loan evaluation decisions, apart from objective information, such as name, current income etc., the form also captured subjective information, such as the origination agent's impression of the trustworthiness of the applicant,

---

as a byproduct of individual adaptation by interdependent agents is a common organizational instance.

their likelihood of maintaining a steady source of income, and their ability to make payments in a timely fashion. In this case, the point at which the mortgage process could be broken into two was already given (origination vs. evaluation) but the vendor team still had to invest considerable efforts to create the standardized form (and train the users of the form) that attempted to capture the informal verbal discussion that previously occurred.[7] While the new form was not a perfect substitute for direct communication, it did economize on the need for it.

As the above example suggests, the modularity strategy is not implementable without costs. Modularity typically implies upfront investment in generating significant and detailed knowledge about the process and its surrounding activities and understanding the nature of interdependence between them- what we may think of "architectural knowledge" (Henderson and Clark, 1990; von Hippel, 1990). Only with such knowledge can the tasks be divided into appropriate modules and the interfaces specified to minimize the need for ongoing communication. We therefore expect that investment in modularising business processes may be useful in mitigating the negative performance consequences of interdependence between the offshored process and those retained onshore. We formalize this reasoning as follows:

> ***Hypothesis 1***: *Investment in modularizing offshored processes weakens the negative impact of interdependence between offshored and onshore processes on process performance post offshoring.*

***Ongoing communication*:** Distance, differences in time zones, and the generally low media richness of ICT based communication all limit the extent to which ongoing communication can help build common ground across locations. Nonetheless channels of communication may serve an important additional and independent role in enabling coordination of the residual inter-dependence that cannot be fully managed through modular interfaces.

---

[6] For instance, some estimates suggest that the gross cost savings from wage arbitrage are reduced by as much as 15 to 25 percent due to indirect costs of coordination and managing in a distributed environment (Farrell, 2003)

[7] Training in the use of the new standard form was critical- for instance offshore and onshore employees need to have a uniform procedure for coding "income stability" as low vs. medium.

For instance, when circumstances change, a modular interface may become less useful. Even under stable conditions, extensive specification may not be viable. In the mortgage processing example above, the firm may need to change the information it typically gathers in the origination phase due to changed economic conditions or changes in regulation. It may need to capture different types of information depending on property type, customer type and geographic location, and may change these criteria over time with learning. While creating a special form for each of these contingencies may be theoretically feasible, in practice it is likely to be very expensive to make ongoing changes, especially, if the firm relies on capital intensive interfaces such as EDI. This may force the firm to design a more generic interface and rely on some degree of ongoing communication to transmit additional information as required. Therefore, when the offshore evaluation agents do not understand the comments of the origination agent or may desire some additional contextual information, they may obtain it by calling/emailing the origination agent.

The above considerations suggest that in offshoring situations, despite efforts to partition activities into modules with limited interdependence across locations, there will typically remain some residual interdependence that needs to be coordinated for successful service delivery. Thus, the second generic coordination strategy -- ongoing communication -- should have an independent effect on minimizing the adverse consequences of inter-dependence between the offshored process and other processes linked to it that remain onsite.

When interdependence cuts across onsite and offshore locations, whatever communication occurs must necessarily occur by means of electronic channels. In the offshoring context, investments in electronic communication infrastructure include special applications for remote collaboration (e.g., software like ShrEdit or large high resolution editable objects such as LiveBoard), provision of high bandwidth tools (such as video-conferencing, Net meeting) and high capacity lines that make these tools operational, as well

as training personnel in remote collaboration techniques (such as active listening, role playing) (Kiesler and Cummings, 2002; Olson et al, 2002). Similar to our hypothesis on the use of the modularity strategy, we suggest that investment in facilitating ongoing communication through investments in such electronic communication channels is likely to mitigate the negative performance effects of process interdependence across locations.

> ***Hypothesis 2***: *Investment in facilitating ongoing* ***electronic*** *communication between the onsite and offshore locations weakens the negative impact of interdependence between offshored and onshore processes on post offshoring process performance.*

Coordination strategies involving Ongoing Communication and Modularity are well known and well established in the literature. They are often referenced as the dichotomy between "feedback vs. plan" or "communication vs. program." To give the canonical citation:

> To the extent that contingencies arise, not anticipated in the schedule, coordination requires communication to give notice of deviations from planned or predicted conditions, or to give instructions for changes in activity to adjust to these deviations. We may label coordination based on pre-established schedules coordination by plan, and coordination that involves transmission of new information, coordination by feedback (March and Simon, 1958: 182).

Put simply, Ongoing Communication constantly updates common ground; Modularity involves working with a minimal, constant level of common ground. In this paper we are also attempting to describe a third approach to coordination, relying on what may be termed Tacit Coordination Mechanisms (TCM). TCM create sufficient common ground without the need for direct communication during the course of work on the project (hence the prefix "tacit"), and they also do not rely on pre-planned interfaces.

***Tacit coordination*:** Tacit Coordination Mechanisms (TCM's) achieve sufficient common ground to coordinate in two broad ways: (a) by leveraging pre-existing common ground that may not be specific to the task at hand – much as focal points can be useful without having to be of direct relevance to the coordination problem at hand (Schelling, 1960); and (b) by building common ground through enhancing observability across locations of context, actions

and outcomes -- rather than direct communication (Clark, 1996; Crampton, 2001; Gutwin et al., 2004). Leveraging shared experiences or working to common standard procedures is an instance of the former; using technologies that enable observation of the work progress and context across sites is an instance of the latter.

Staffing distributed teams with employees who worked together before (in order to utilize their shared interpersonal experiences) is an important TCM to ensure that employees across locations know about each other's idiosyncratic work practices. Arranging to staff teams in this way is not trivial, because of the need to take into account career paths, project requirements, and vendor's incentives to keep (employee) capacity utilization as high as possible. Thus, explicitly following a policy of staffing distributed teams with those who had worked together before represents an important "investment." Further, drawing on pre-project shared training programmes is another way in which existing common ground can be leveraged. The confidence that others sitting half way around the world will interpret and approach a problem armed with the same background knowledge can play an important role in coordinating action in offshore service delivery.

Research on virtual teams has generated the interesting insight that even in collocated situations coordination may be achieved not primarily through face-to-face communication, but simply by virtue of sharing the same physical location. This is because sharing space enables individuals to be "aware" of the context that influences each other's actions (Kraut et al., 2002; Olson et al., 2002). Such findings highlight the point that the functional value of communication is the creation of common ground, but it is not the only means to create common ground (Clark, 1996). For example, when two people are interactively working on the same program, it is much more useful for them to have a view of the each other's screen to see what they are manipulating than to see each other's faces (Fussel et al., 2000; Karsenty, 1999) – though the latter was traditionally emphasized in the media richness literature.

Gutwin et al. (2004) discuss how visibility of work by other contributors in code repositories and CVS logs generates shared awareness that helps achieve coordination in open source software projects. TCM's that help build such awareness across locations should thus be another important means to achieving coordination across locations in distributed service delivery.

The TCM strategy differs from ongoing communication because no direct communication between interacting individuals is involved while the project is being implemented. It also differs from modularity-based strategy in a critical way: modularity and TCM leverage different types of knowledge to achieve coordination. Modularity-based approaches require only the interface to be in common ground; TCM help to put knowledge of the inner workings of the modules/locations into common ground, or enhance awareness of context and actions across locations as the project unfolds. Modularity-based strategies would not leverage either kind of knowledge.

Returning to our mortgage processing example, if the origination agent has made some comments regarding a specific loan application, a new agent might not understand the comments and may call the originating agent to discuss. This would be an example of the communication strategy. However, another employee, who has had prior working relationships with this originating agent may be able to interpret those same comments with no difficulty and without any need for further communication, because she can interpret them in the context of her prior knowledge regarding how this origination agent approaches her task and completes the application. In contrast , a new employee in the evaluation unit, though she may have considerable experience with another firm, may still need some help understanding the precise meaning of the information provided in the loan application along with the originator's comments. An employee with more experience in this firm, on the other hand, would be able to process the application based on her knowledge of the firm's procedures and practices regarding how comments are created and used in evaluation. If the two employees can access

a shared repository that captures the originators subjective assessments, or makes visible to the evaluator some of the information that is being used by the originator, this would be an example of a tacit coordination mechanism that builds visibility of context across locations.

In sum, the requisite common ground may be achieved across locations in offshored settings by TCM such as reliance on pre-project familiarity among team members, shared knowledge of each others work procedures (this is not the same as shared knowledge of the work procedures used to ***link*** the actions of the two teams- which would be an example of a modularity based approach), and enabling visibility of information across locations. Thus analogous to investments in enabling ongoing communication, as formulated in hypotheses 2, we expect that investments in the creation of common ground by tacit means also have a similar ameliorating effect on the negative process performance consequences of inter-dependence. We therefore predict:

> ***Hypothesis 3:*** *Investment in Tacit Coordination Mechanisms weakens the negative impact of interdependence between offshored and onshore processes on post offshoring process performance.*

Figure 2 is a schematic representation of the three coordination strategies. Figure 3 schematically shows the three hypotheses we intend to test in this paper.[8]

INSERT FIGURE 2 and FIGURE 3 HERE

[8] Please note that in this work, we are not proposing or testing any 'main effects' of coordination mechanisms, since there is no theoretical basis for doing so. This is because each of these coordination mechanisms is expensive to deploy and thus is likely to have net positive performance consequences only when the benefits exceed the costs. Our approach here closely adheres to work in organization design or media richness theory. Contingency theory suggests that centralization or decentralization (or a mechanistic or an organic structure) does not automatically lead to better performance, but depends on the level of uncertainty (Burns and Stalker, 1961; Tushman and Nadler, 1978). In media richness theory, the choice between poor and rich media is made based on the level of ambiguity or equivocality. High richness does not always lead to high performance (Daft and Lengel, 1984, 1986). Similar to these studies, since we are proposing a contingency argument involving the effect of the use of coordination mechanisms on the main effect of level of interdependence, we do not propose any "main effects" for the coordination mechanisms themselves.

The next section discusses the empirical methods used to test these hypotheses, and the one after discusses the findings from this study.

METHODOLOGY

Sample and survey design

Sampling frame and sample: To test the hypotheses, we collected survey data from managers of offshored processes from a number of client and vendor organizations. The target population was managers who had primary responsibility for the ongoing delivery of a service from an offshore location for an IT, back office or call centre process.

Offshore services can be divided into two broad categories – content development and service provisioning. Content development involves generation of content to pre-defined specifications on a one-time basis such as in market research or software development. The service provider is free to choose any method to create the output as long as it adheres to pre-specified agreements regarding the outcome. Service provisioning, on the other hand, involves ongoing delivery of service from a remote location and therefore implies the specification of not only the outputs but also the process by which the output is generated. Interdependence across locations and the need for ongoing coordination is much higher for such process specifications. Therefore, in this paper we focused on service provisioning as the population of interest. Processes involving service provisioning include maintaining IT systems from offshore locations, contact centres that provide services such as handling inbound enquiries, making telesales calls, and performing back office operations such as: accounting, check clearing, and funds transfer.

The sampling frame was the set of firms that provided or received offshore service delivery from India, identified though public announcements between 2000 and 2005. Since India accounts for 65% of global offshore IT industry and 46% of the global BPO industry (NASSCOM-McKinsey Report, 2005), restricting the sample to firms with an Indian

connection should not adversely affect generalizability. By searching for public announcements of off-shoring of services during the specified time period we identified 44 firms, of which 17 firms agreed to participate in this research[9]. We received completed surveys for multiple processes from each firm, for a total of 126 offshored processes[10], thus allowing us to control for firm specific factors in the analyses. We received information about 42 IT, 54 back office and 30 call centre processes.

Survey instrument design: There are two distinctive features of the survey we wish to highlight. First, given the novelty of the setting as a context to study coordination mechanisms, we needed to engage in a significant item construction effort. Second, we adopted a two-part design with the aim of having data on dependent and independent variables provided by two distinct individuals to avoid common method bias, which is a common hazard in survey research.

The two-part survey instrument was designed using items from prior research studies where available, and on the basis of interviews conducted in a related qualitative study (Srikanth and Puranam, 2009) where prior items were not available. The interviews were especially useful in classifying the types of effort involved in migrating processes from their original location to the offshore location (such as knowledge capture, modularization and building ongoing communication channels).

The survey was piloted with several managers to remove ambiguities and examine the face-validity of our measures. The managers who provided feedback on the survey items were different from the survey respondents. We used the insights from the pilot-study to reword some questions as well as add appropriate comments next to some items using the comment

[9] The Kolmogrov-Smirnov non-parametric tests for differences in size (measured as number of employees or sales revenue) between the responders and non-responders did not reveal significant differences.

[10] Data limitations reduced the effective number of observations for some analyses.

feature in MS Word as additional help for respondents to interpret the questions. These comments were also piloted with managers before the surveys were sent to respondents. Finally, in order to reduce response bias, we used multi-item scales for most constructs and used multiple response formats.

The surveys were emailed in advance to a senior manager in each firm that indicated willingness to participate in this study. The senior managers typically appointed a person within the firm to be responsible for coordinating the collection of responses from within their firms. These coordinators identified suitable processes from within their firms to include in the study and requested the managers who were responsible for migration and steady-state management to complete the questionnaires. In many instances these coordinators themselves were respondents – they completed the survey first with the involvement of the researchers to interpret and clarify questions, which helped them answer any queries from other managers in their firm.

For each offshored process, the questionnaire requested information on the characteristics of the business process before offshoring, the effort spent on migrating the process, and performance of the process in steady state. Since many of the measures are subjective, to avoid common method bias, two different individuals who had knowledge about the process completed each part of the questionnaire. Part A of the questionnaire requested information on process characteristics before offshoring and on the steps taken to migrate the process from its original location to the offshore location. Part B requested informa-tion on the steady-state performance of the process. For 15 processes, the same person completed both parts of the questionnaire, because it was not possible to find a second respondent. However, even for these single respondent surveys, the two parts were completed at different times after an effort was made to identify another suitable respondent, and none was found. Our results are robust to dropping these observations from analyses.

Measures

Each respondent first answered some general questions about the offshored process such as process size, its geographic location pre- and post offshoring, the length of time spent in preparing the process for offshoring and the time this process had been operating in steady state at the offshore location. The respondents then answered detailed questions about the nature of the process pre-offshoring, the steps taken to migrate the process and its performance post-offshoring. Where possible, we also measured constructs using objective information. All processes in our sample were transitioned from the client to the offshore location by the vendor, and vendor managers were involved in understanding the nature of the process prior to offshoring and the measures implemented to move it successfully to the offshore location. Thus, respondents had sufficient knowledge to answer questions about both the pre-offshoring state of the process as well as the investments made to offshore the process.

We measured the reliability of the constructs used in the analyses by calculating Cronbach alpha's and performing confirmatory factor analysis. Nunnally and Bernstein (1994) suggest that alphas higher than 0.7 are acceptable in most cases. Therefore, in this research we use an alpha of 0.7 as the cut-off value to accept a scale. All confirmatory factor analyses reported here were performed using AMOS v6.0. We used the Comparative Fit Index (CFI) proposed by Bentler (1990) to assess fit in the confirmatory factor analysis. Models with CFI closer to 1.0 than 0 are considered to have good fit (Bentler, 1990).

Dependent Variable

Steady state Performance of the process post-offshoring: The dependent variable is the steady-state performance of the process post transition to the offshore location. We measured performance along the following four categories: (1) cost savings; (2) service quality improvements; (3) rapid growth; and (4) overall satis-faction with the service. We focused specifically on these categories since our interviews as well as prior research studies of

offshoring (Scott, 2005; Srikanth et al., 2006) suggested that these capture the motives for offshoring for a large majority of the firms. Performance was measured on each of the above categories on a 9-point scale, where -4 was "Complete Failure"; the mid-point 0 was "Meets Expectations" and +4 "Exceeds Expectations." These four items produced a single scale with Cronbach's alpha = 0.72. In a confirmatory factor analysis, all items loaded on a single factor with a CFI of 0.97.

Independent Variables

Investment in modularization: Five survey items were used to measure the extent of investment in modularizing the process during transition. These items were created based on our fieldwork in the offshoring setting as well as adapting items from prior literature to the offshoring setting (Gulati et al., 2005; Sobrero and Roberts, 2001). The items captured the effort spent in reengineering the process, simplifying linkages between processes, creating well specified interfaces and portioning the process such that cross-location interdependencies are minimized. The scale had a good fit with Cronbach alpha = 0.88. Confirmatory factor analysis resulted in a CFI 0.92 indicating a very good fit.

Investment in ongoing communication: Four items were used to measure the extent of investment in ongoing communication between the onsite and offshore locations. The items, created based on our fieldwork in the offshoring setting as well as from prior studies on virtual teams (Kraut et al., 2002; Weisband, 2002), captured the effort spent in creating or adapting an IT network to enable distributed teams to communicate, training in remote collaboration, and access to communication tools. The Cronbach alpha for this scale was 0.75 indicating a satisfactory fit, while confirmatory factor analysis indicated a very good fit with a CFI of 0.98.

Investment in tacit coordination mechanisms (TCM): Six survey items captured the extent of investment in TCM during transition and afterward. Since the survey-based measurement of

TCM is novel to this study, the items used to measure this construct are explained in detail below. Prior studies as well as our field research suggested that common ground is built by the following tacit mechanisms:

a. Enabling mutual knowledge of respective decision making procedures- through shared work related training and/or cultural sensitivity training (Srikanth, 2007);

b. the ability to make actions transparent across locations - by investment in technology tools (Bechky, 2003; Gutwin et al, 2004);

c. enabling mutual knowledge of individuals idiosyncrasies - typically by leveraging shared work experience (Crampton, 2001; Hollingshead, 1998); and

d. the knowledge to easily interpret communications across locations by using a shared vocabulary (Clark, 1996)

Since initial travel at the beginning of the project is often used as a compensating mechanism when requisite common ground for coordination is not already present (Armstrong and Cole, 2002; Carlson and Zmud, 1999), we also measured the level of such compensatory travel using the item "Encouraging and facilitating travel by personnel from the one location to visit the other location."[11]

The Cronbach alpha measure for reliability of this construct is satisfactory ($\alpha = 0.81$). Confirmatory factor analysis indicated a single factor with a CFI of 0.87.

Pre-transition Process Interdependence: Process interdependence was captured using two items that measured the intensity of interactions between focal process with other processes, and the magnitude of cascading effects of process changes across its linked processes- prior to transition. These items were adapted from prior literature to make them applicable to the offshoring setting (Gatignon, et al. 2002; Zander and Kogut, 1995).[12] Since these two items capture different dimensions of interdependence, we created a composite measure by adding

[11] We checked to understand if our effects for this variable are primarily driven by the pre-project travel related item. Our results are robust to eliminating this item from the TCM measure.

[12] To the extent we had to adapt these items to make them appropriate to our context, prior reliability scores for these items cannot be validly inferred to apply to our versions, and are indicative at best.

the scores on each item. In the data, the correlation between these two items is 0.4, showing that these do capture different aspects of interdependence. Robustness checks using the average of these two items and the effect of each individual item show similar results to those reported here.

INSERT TABLE 1 HERE

Discriminant validity among the coordination mechanisms

One of the contributions of this paper is to establish a measure for TCM and show that it is a distinct coordination mechanism, different from modularization and ongoing communi-cation. For this purpose we carried out further analyses to establish discriminant validity between these constructs. In confirmatory factor analysis, all three constructs were entered as endogenous variables and their respective items as observed variables. The three factor model allowing co-variation between the constructs has vastly superior goodness of fit over the single factor model. The CFI's were respectively 0.89 for the multi-construct model, compared to 0.54 for the single construct model. In the multi-construct model, the co-variances between each pair of constructs were also significantly different from 1.0, again showing discriminant validity. The multi-construct model had significantly better fit on all measures than any of the single-construct models since the former accounts for both the distinct constructs as well as the correlations between them.

To ensure discriminant validity between ongoing communication and TCM, we carried out a procedure similar to the one above, where only ongoing communication and TCM were the endogenous constructs. Again, the two-factor solution had superior goodness of fit with a CFI of 0.85 over a single factor solution with CFI of 0.7. The covariance between the two factors of 0.7 is significantly different from 1.0, establishing discriminant validity.

Control Variables

Size of the process: Size was measured as the log of number of full time equivalent employees that were employed in the process.

Maturity of process offshore: Maturity of the process offshored was measured as the time since steady state operations were achieved in the offshore location for this process.

Migration Time: The time taken to migrate the process is likely to affect the nature of operations offshore and any efforts taken to mitigate post offshoring coordination difficulties.

Process Type: The data consist of IT, back office and contact centre processes. The effects of the process types are controlled for using dummy variables.

Process Knowledge Stickiness: While process interdependence is the characteristic of interest in this paper, process stickiness is another characteristic that could significantly affect process performance. Knowledge stickiness impedes the transfer of knowledge necessary for implementing the process from one set of personnel to another set of personnel (Birkinshaw et al., 2002; Szulanski, 1996; von Hippel, 1994; 1998; Zander & Kogut, 1995) – in this case from onsite personnel to offshore personnel. It is therefore important to control for the effects of knowledge stickiness, since low performance of the offshored process could result from the inability to transfer the knowledge required to implement the process rather than the inability to coordinate between the onsite and offshore locations.

To measure knowledge stickiness we used seven items from the literature that capture tacitness, codifiability, causal ambiguity, and social complexity of process knowledge (Szulanski, 1996, Zander and Kogut, 1995). The Cronbach alpha for this scale was 0.82 indicating satisfactory fit. Confirmatory factor analysis indicated excellent fit with a CFI of 0.96.

Knowledge Transfer efforts: Prior literature has suggested a number of mechanisms that are useful in transferring sticky knowledge (Hansen, 1999; Szulanski, 1996; Zander and Kogut, 1995). We used two items capturing the dimensions of close observation and process

mapping and documentation. The items have very low correlation of 0.23 and have poor fit in confirmatory factor analyses. This is mainly because different firms and different process types emphasize different means of transferring knowledge: some rely on close observation and not much documentation and vice versa, others rely on study and examination type methods. Results for this control variable must therefore be interpreted with requisite caution.

Analysis techniques

The hypotheses predict that the effects of interdependence will be positively moderated by the investments in the three generic coordination mechanisms. We test these hypotheses using OLS regression models. Since the data contain multiple processes from each firm, we control for the resulting non-independence of observations by clustering the standard errors for each firm. We also examined the presence of firm effects by analysing both fixed effects and random effects models. In both cases, model results suggested that the null hypothesis that all the firm effects are not different from zero could not be rejected. In the fixed effects estimation, the F-test for firm fixed effects suggests that the null hypothesis that firm fixed effects are no different from zero cannot be rejected ($F(15,87) = 0.97$; p-val =0.49). Further, the Hausman test suggests that the null hypothesis that the random effects estimates and fixed effects estimates are identical cannot be rejected (χ^2 (13) = 3.26, p-val =0.99). The Breusch and Pagan Lagrangian multiplier test for random effects cannot reject the null hypothesis that all effects are not different from zero (χ^2 (1) = 1.66, p-val =0.19). This drove our choice for using OLS models to test our hypotheses. To harmonize the different scales and make interpretation easier, we use standardized items in the analyses.

FINDINGS

Summary Statistics

Table 2 reports summary statistics and Table 3 the pair-wise correlations between the variables used in the analysis. Inspecting the descriptive statistics, we see that there is considerable variation in the important independent variables – the investments in modularity, ongoing communication and TCM. The processes also vary widely in other characteristics such as size, maturity and migration effort. Inspecting Table 3, the low correlations between most of the independent variables suggests that collinearity is not a significant concern for analyses. However, we note the (expected) high correlation between the interaction terms, which could thus make it harder to assess their statistical significance when tested jointly.

INSERT TABLE 2 AND TABLE 3 HERE

Hypotheses Testing

The modularization process occurs (if it does) during process transition and migration. In contrast, communication and TCM play a role in coordinating across locations only after any modularization efforts. We thus first test hypothesis 1- the effect of modularization and interdependence on process performance (Table 4), and then the effects of ongoing communication and TCM (hypotheses 2 and 3) conditional on investment in modularization (Table 5).

Table 4 reports OLS models in which the dependent variable is post-offshoring performance. Model 1 is the baseline that reports the effect of all control variables. We find that of the control variables, only the time taken for migration and type of process adds any explanatory power to the models. Processes that take longer to migrate have poorer performance: since more complex and difficult processes are likely to take longer to migrate, it is possible that they also have poorer performance. While contact centre processes typically have similar performance to back office processes, IT processes in general seem to have poorer performance than both.

Preceding the tests of our hypotheses, we add the main effects for interdependence followed by coordination mechanisms. Inspecting model 2 in Table 4, we find that pre-transition interdependence of the process with other processes remaining onshore has a strong negative relationship with post-transition process performance. This direct relationship validates our fundamental premise that it is more difficult to coordinate processes with high interdependence across locations. In the same model, process knowledge stickiness has no significant relationship to post-offshoring performance. Also, inspecting model 3 in Table 4 we find that efforts at modularization have no main effect on process performance.

The first hypothesis suggests that as process interdependence increases, increasing investments in modularization leads to higher performance post offshoring. Model 4 in Table 4 shows that the interaction term between investments in modularity and process inter-dependence is positive and statistically significant providing support for the first hypothesis.

INSERT TABLE 4 HERE

The second and third hypotheses predict that investments in ongoing communication and TCM across locations positively moderate the impact of pre-transition process inter-dependence on post offshoring performance. Model 1 in Table 5 adds the main effects of communication and TCM, in addition to modularity. In model 2, Table 5 we find that the interaction term between communication and interdependence is positive and statistically significant as expected from the second hypothesis. In model 3, Table 5 we find a positive and statistically significant coefficient of the interaction term between TCM and interdependence, providing support for the third hypothesis.

One of the main aims of this paper is to empirically measure TCM and show that it is of value in coordinating process across locations. Note that in Table 5 we have the most conservative econometric specifications. In these results, we control for other interventions that may affect process performance, such as investments in modularity and ongoing

communication, as well as knowledge transfer efforts, while testing for the interaction effect of TCM and process interdependence on performance. Finally, as an additional specification, we tested the interaction effect of both communication and TCM together by specifying both interaction effects in the same model. Model 4 in Table 5 shows that coefficients for both the interaction terms are positive, but they are not statistically significant. As noted earlier, since the correlation between the two interaction terms is high at 0.7, we suspect that this makes it more difficult to detect their independent effects. A joint test of just the two interaction terms shows however that they are significantly different from zero ($F(2,15) = 3.96$; p-val = 0.04). Table 5A reports these results after controlling for the interaction with modularity as well. We note that the results are qualitatively unchanged.

INSERT TABLE 5 and TABLE 5A HERE

The above results suggest that investments in modularization, TCM and ongoing communication have the hypothesized positive moderation effects on the relationship between interdependence and process performance. We present robustness checks for these results in the next section. Figure 4 shows these interaction effects graphically.

INSERT FIGURE 4 HERE

Additional analyses and robustness checks

Apart from the above measures of investments in the coordination mechanisms, the respondents were also requested to provide data on the percentage of transition effort that was spent in modularization, ongoing communication, TCM. These form alternative measures for the investments in the coordination mechanisms, and we tested the hypotheses with these effort measures rather than with the "item" based measures as reported above. Table 6 and 7 replicate the models in Table 4 and 5 with these new measures. The strength of these measures is that they enable us to explore the impact of the relative levels of investments in these coordination mechanisms as opposed to the absolute levels of investment. This allows

for inferences about the relative importance of each mechanism in enabling coordination. The results from the two kinds of measurement are therefore not directly comparable, but can help generate some additional insight over what we learn from the item measures.

From Model 4 in Table 6 we see that the interaction term for the effort spent in modularization, though positive is not statistically significant, unlike the results reported above. This result suggests that changing the level of relative investment in modularization (as opposed to ongoing communication and TCM) in our sample may not be critical in managing the adverse consequences of interdependence- though the absolute level may be. In Model 2 in Table 7 we see that the interaction term for ongoing communication is statistically significant but negative. This result suggests that proportionally increasing investment in ongoing communication at the expense of the other mechanisms may harm performance. From model 3 in Table 7, we see that the interaction term for TCM is positive and significant, which indicates that proportionally spending more on TCM is associated positively with performance. From model 4 in Table 7, we see that when the interaction terms for both ongoing communication and TCM are present in the model, the interaction term for communication is negative and not significant, while for TCM is positive and significant. However, a joint test of these two interaction terms is highly significant ($F(2, 15) = 11.9$; p – val =0.0008). These results suggest that increasing effort in TCM at the expense of modularization and ongoing communication may be beneficial to manage interdependence, while increasing effort in ongoing communication at the expense of TCM may not be.

INSERT TABLE 6 AND TABLE 7 HERE

Though not formally hypothesized, the theory section suggests that the problem of knowledge transfer is distinct from the problem of ongoing coordination in BPO. The theory also suggests that transition activities needed to achieve ongoing coordination are likely to be distinct from those that mitigate the impact of process stickiness. Based on prior theory, we

expect that "knowledge extraction" procedures that either reduce stickiness (such as documentation) or help in transferring sticky knowledge (such as direct observation and working closely with current process experts) would positively moderate the impact of knowledge stickiness on post-offshoring performance (Birkinshaw et al., 2002; Hansen, 1999; Szulanski, 1996; Zander and Kogut, 1995). We also expect that the three coordination mechanisms discussed above would not impact the performance of sticky processes. We examine these ideas through our results in Tables 8 and 9. While model 2 in Table 8 suggests that stickiness does not have a direct impact on post offshoring performance, model 4 in Table 8 shows the positive and statistically significant coefficient for the interaction term between stickiness and knowledge extraction. The measure of knowledge extraction efforts has low reliability, so these results must be treated as indicative at best. The models in Table 9 show that none of the coordination mechanisms, modularity, communication or common ground has any impact on stickiness, since none of the interaction terms are statistically significant. These results strongly suggest that the problem of knowledge transfer and that of ongoing coordination are quite distinct and require different solutions.

INSERT TBALE 8 AND TABLE 9 HERE

To test the robustness of our findings we tried to reproduce the above results reported in the hypothesis testing section for alternative measures of interdependence, using only the first item, only the second item and the average of the two items respectively. Specifically, the test with only the second item in the measure of interdependence is an important one because it is more representative of the type of coordination issues that frequently occurs in BPO, and is untainted by concerns that it actually captures volume of communication rather than interdependence. In all specifications, investments in TCM and modularization positively moderate the impact of process interdependence on performance. The evidence for the moderating effect of ongoing communication is less robust. We also tested our results for

alternative measures of TCM, in which the two travel-related items (items 3 and 4) are removed to rule out conflating pre-project travel to build common ground from in-project travel to discuss coordination problems. Our results are robust to all these different specifications. Finally, to identify whether a few observations are influencing our results (i.e., outliers), we constructed bootstrapped estimates of our coefficients and standard errors. The bias in our coefficients for all variables are less than $1/10^{th}$ the bootstrapped standard errors, increasing confidence in the robustness of our results.

DISCUSSION AND CONCLUSIONS

The primary purpose of this study was to examine in a field setting (the offshoring of business processes) the performance consequences of investment in three coordination strategies: modularization, ongoing communication, and tacit coordination mechanisms (TCM), as a function of the interdependence between the offshored process and remaining onsite processes.

Our results indicate that modularization, ongoing communication and TCM are conceptually as well as empirically distinct coordination mechanisms. Further, each of them can be shown to mitigate the adverse performance consequences of interdependence between onsite and offshore locations in the context of offshoring. We also find that these coordination mechanisms are not useful to overcome knowledge stickiness, just as knowledge extraction methods (which can deal with stickiness) are not useful to manage interdependence. This finding reinforces the distinction between knowledge transfer and coordination problems. Finally, it appears that at least in our sample, the tendency is towards an over-investment in ongoing communication channels at the expense of TCM's. We discuss the implications of these findings for theory and practice, and conclude with an overview of the limitations of this research, as well as thoughts on how future research might improve on it.

Implications for theory and practice

The primary theoretical contribution of our study is to articulate the notion of Tacit Coordination Mechanisms (TCM) as representing a distinct strategy for coordinating interdependent actions- without recourse to explicit ongoing communication, or through restructuring the nature of interdependence. Like all coordination strategies, TCM's also enable coordinated action by relying on common ground between interdependent actors so that they achieve reciprocal predictability of action. However, rather than minimizing the absolute level of common ground required (through modularization) or creating and constantly updating common ground (through ongoing communication), TCM's work by: (i) leveraging pre-existing common ground; and (ii) building common ground through enhancing observability across actors of contexts, actions and outcomes.

While there has been some prior evidence based on laboratory and case studies that tacit coordination based on some form of mutual knowledge plays an important role in coordinating geographically distributed activity (Crampton, 2001; Gutwin et al, 2004), our study is perhaps the first to show the workings of TCM's in a field setting. The empirical setting of our study, Business Process Offshoring, is one in which TCM's are highly pertinent. Given geographic distance and the resulting constraints on real time face to face communication, it is reasonable to expect TCM's to play an important role in such settings, and we find that they do. Moreover, we provide a first, if perhaps imperfect, attempt at empirically measuring TCM's in a manner that distinguishes them from other coordination strategies.

Viewed as an alternative to the traditional coordination strategies based on modularization or ongoing communication, TCM's may shed valuable new lights both on the internal organization and external boundaries of firms. A direct implication of how TCM's work is that shared knowledge and collocation may be powerful alternatives to formal organizational design mechanisms, such as rules and procedures (of which modularization is an instance), or

communication channels (of which electronic mediated communication is an instance). This insight suggests a useful approach to analyzing the link between formal and informal organization from a coordination (rather than an incentive based) perspective.

In our sample, all the relationships studied involved offshore outsourcing. However, a promising line of future research might examine the use of TCM's within as opposed to between firms. Much of the argumentation in the "knowledge based view of the firm" (Conner and Prahalad, 1996; Grant 1996; Kogut and Zander, 1992) rests on the coordination advantages of intra-firm relative to inter-firm relationships. It appears to us that offshoring provides an excellent context within which to study the coordination of interdependent work in both intra-firm (e.g., captive units) and inter-firm (i.e., vendors as in this study) settings. In particular, we would expect to see qualitative differences in the use of TCM's between firms and within firms, if the ability to create and maintain common ground is aided by common ownership and authority. In other words, in distributed work settings, firm boundaries may matter for coordination because of a differential ability to leverage pre-existing common ground through TCM's.

Our results have several implications for practitioners as well. It is interesting to compare our results with conventional wisdom, which suggests that standardized and well documented processes are easier to offshore since knowledge transfer is easier for such processes (Szulanski, 1996; Warner and Brown, 2005). Our results, however, suggest that interdependence between offshored processes and those processes that remain onsite is a significant barrier to process performance post-offshoring, a barrier that is as important as or more important than knowledge stickiness, but one to which limited attention is paid. Even highly standardized processes may face coordination problems unless the links between the process and other processes are also standardized or ongoing coordination is facilitated through other means.

Thus, managers should recognize that knowledge stickiness and interdependence are two distinct problems in offshoring and require distinct solutions. While issues pertaining to stickiness receive a lot of attention, issues pertinent to interdependence and the need for ongoing coordination receive short shrift, or worse are conflated with knowledge transfer issues in the practitioner literature (Davison, 2004; Warner and Brown, 2005). Our results clearly show that these are distinct problems, with different antecedents *and* solutions. We do caution that our results do not prove causation, but are strongly indicative of the performance benefits of investing in solving the interdependence issues. We also note that three coordination mechanisms are associated with short-term performance of the offshored process in our study and further research is required to understand their long-term impact.

Further, there may be value in a wider recognition that ongoing communication using Information and Communication Technologies is not the only means to achieve coordination across locations. Our results suggest that investments in costly technologies such as video-conferencing may not necessarily be the most efficient means of achieving remote coordination. Managers (as appears to have been the case in our sample) may over-invest in communication while under-investing in TCM. We suggest that managers must give attention to tasks such as standardizing process linkages and ensuring transparency in decision-making processes and actions across sites. Ultimately, successful coordination requires the creation of sufficient common ground, and direct communication is but one way to do this – tacit coordination mechanisms are another (and in this context, perhaps cheaper) alternative.

Limitations and conclusions

This study is subject to a number of limitations. First, the majority of our data comes from vendor companies. While vendors should have accurate knowledge of the state of the process prior to offshoring since they observe it in action at its original location during migration, it is likely that their perceptions are biased toward exaggerating how dysfunctional the processes

were prior to them taking it over. Vendors may also be more likely to overstate the current performance of the process. We try to correct for this bias by introducing a dummy variable in our analysis that takes into account whether a client or vendor completed the survey. This dummy is not significant, suggesting that a bias may not exist in our data; however it does not substitute for having responses from both parties to the transaction for every transaction.

This paper's conceptualization of interdependence is also still rather traditional and builds directly on Thompson's (1967) work. However, we see opportunities for better dimensionalization of the interdependence construct- for instance in terms of the nature of knowledge requirements imposed by particular patterns of interdependence. Our measure of interdependence has low inter-item correlation, which arguably occurs because these items capture different facets of inter-dependence. While our results are qualitatively similar for each item, the reliability of our measure of interdependence is unknown. Dimensionalizing interdependence and developing robust measures is of great importance to move the study of coordination in organizations forward.

Further work could also examine if the generic coordination strategies we analyze are each more appropriate under different situations. In particular, a promising line of research might examine when these strategies act as substitutes vs. complements. For example, from this study it is unclear how much of the investment in modularization, and especially in ongoing communication and TCM occurred during transition rather than after, when coordination difficulties were experienced. From these data we cannot conclude much about the foresight that went into the choices of coordination strategies. Longitudinal data collected at each state of the movement of a process, such as pre-transition, migration, post-transition, and steady state would help alleviate these problems.

Our measure of performance could have been designed more narrowly to capture coordination performance rather than project performance as a whole. While the two

measures should be strongly correlated, a narrower measure may have improved the power of our tests. It would also be interesting to examine if the coordination strategies have different performance effects over the long and short term. Our performance measures are best characterized as short-term performance, and the effects of the use of coordination strategies that involve changing the character of interdependence by process transformation efforts may be different for long-term performance.

Offsetting these limitations, we believe our study also has certain unique strengths. Importantly, we are able to utilize data from different respondents for the dependent and independent variables to avoid the common method bias which often plagues survey research. To our knowledge, the current study also offers the first attempt to theoretically articulate TCM as an alternative coordination strategy in organizations and at developing a survey based measure of the TCM construct. However, we also recognize opportunities for improvement of our measures. For instance, future research could develop multi-item scales for the different types of TCM, and understand if each is more suitable under different conditions; and could develop more reliable measures of knowledge extraction efforts that help to combat stickiness.

We also acknowledge that our analysis stops short of leading to conclusions about causation. Our analysis shows that it is unlikely that stable unobserved features of vendor firms could be spuriously inducing our observed results (we found no evidence for significant vendor fixed effects). We cannot however rule out the possibility that other unobserved features of the projects, such as the culture of the teams involved or technological properties of the processes may have influenced both the choice of coordination strategies as well as post-offshoring performance outcomes. The investments in modularity, ongoing communication and TCM may be endogenous to the model.

While acknowledging these limitations to reaching conclusions regarding causation, we do, however, have a fair degree of confidence about the basic validity of our results for two reasons. First, we believe we have accounted for plausible alternate explanations through several important control variables such as process size and maturity, time to transition, process knowledge stickiness, and knowledge transfer efforts. We believe these variables could be correlated with important features of projects that we cannot directly observe, such as culture, technological properties etc. Second, our hypotheses are primarily around interaction effects rather than main effects - unobserved variables would also have to generate the same interaction pattern in order to generate our observed results. It seems difficult to suggest a plausible alternative explanation that accounts coherently for all the results we found. Perhaps, most importantly, our fieldwork in the IT services offshoring setting also suggests the basic validity of these propositions and results. In sum, we believe this study takes a first important step towards articulating and measuring the distinctive role of Tacit Coordination Mechanisms in coordinating interdependent activity in a field setting in which such mechanisms are of great importance- Business Process Offshoring.

ACKNOWLEDGEMENTS

Puranam acknowledges funding from the European Research Council under Grant # 241132 for "*The Foundations of Organization Design*" project. Srikanth acknowledges funding from the Leverhulme Trust Digital Transformations Programme at London Business School and from AIM Research (UK) under ESRC grant RES-331-25-0025. We also thank Markus Becker, Gerry George, Reddi Kotha, Thorbjørn Knudsen and Mari Sako for comments on previous versions.

References

Armstrong DJ, Cole P. 2002. Managing distances and differences in geographically distributed work groups. In *Distributed Work*, P Hinds, S Kiesler (Eds.). Cambridge, MA: MIT Press; 167-186

Aumann RJ, Brandenburger A. 1995. Epistemic condition for Nash equilibrium. *Econometrica* 64: 1161-1180.

Baldwin C, Clark K. 2000. *Design Rules: The Power of Modularity*. Cambridge, MA: Harvard Business School Press.

Bechky B. 2003. Sharing meaning across occupational communities: the transformation of understanding on a production floor. *Organization Science* 14(3): 312-330.

Becker GS, Murphy KM. 1990 The division of labor, coordination costs, and knowledge. *Quarterly Journal of Economics* 107(4): 1137-1160.

Bentler PM. 1990. Comparative fit indexes in structural models. *Psychological Bulletin 107:* 238–246.

Birkinshaw J, Nobel R, Riddersdale J. 2002. Knowledge as a contingency variable: Do the characteristics of knowledge predict organization structure. *Organization Science* 13 (3): 274-289.

Burns T, Stalker G. 1961. *The Management of Innovation*. London, U.K: Tavistock.

Camerer C. 2003. *Behavioural Game Theory*. Princeton, NJ: Princeton University Press.

Camerer C, Knez M. 1996. Coordination, organizational boundaries and fads in business practices. *Industrial and Corporate Change* 5(1): 89-112.

Carlson JR, Zmud RW. 1999. Channel expansion theory and the experiential nature of media Rrchness perceptions. *Academy of Management Journal* 42(2): 153-170.

Chwe, M. S-Y. 2001. *Rational Ritual: Culture, Coordination, and Common Knowledge*. Princeton, NJ: Princeton University Press.

Clark H. 1996. *Using Language*. Cambridge, U.K.: Cambridge University Press.

Clark KB, Fujimoto T. 1991. *Product Development Performance: Strategy, Organization, and Management in the World Auto Industry*. Boston, MA: Harvard Business School Press.

Conner K, Prahalad CK. 1996. A resource based theory of the firm: Knowledge vs. opportunism. *Organization Science* 7(5): 477-501.

Crampton C. 2001. The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science 12*(3): 346-371.

Daft RL, Lengel RH. 1984. Information richness: A new approach to manage information processing and organization design. In BM Staw, LL Cummings (eds). *Research on Organizational Behavior*. Greenwich, CT: JAI Press.

Daft RL, Lengel RH. 1986. Organizational information requirements, media richness & structural design. *Management Science* 32(5): 554-571.

Davison D. 2004. Top 10 risks of offshore outsourcing. *Meta Group CIO* 02/16/2004.

Ethiraj S, Levinthal D. 2004. Modularity and innovation in complex systems. *Management Science* 50(2): 159-163.

Farrell D. 2003. Offshoring: Is it a win-win game. *McKinsey Global Institute Report.*

Fussel S, Kraut RE, Siegel J. 2000. Coordination of communication: Effects of shared visual context on collaborative work. In Proceedings of the *ACM 2000 Conference on Computer Supported Cooperative Work*. New York: ACM Press.

Galbraith JR. 1973. *Designing Complex Organizations.* Boston, MA: Addison-Wesley.

Galbraith JR. 1977. *Organization Design.* Boston, MA: Addison-Wesley.

Gatignon H, Tushman M, Smith W, Anderson P. 2002. A structural approach to assessing innovation: Construct development of innovation locus, type, and characteristics. *Management Science* 48 (9):1103-1122.

Grant RM. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal* 17 (Winter Special Issue): 109-122.

Gulati R, Lawrence P, Puranam P. 2005. Adaptation in vertical relationships: Beyond incentive conflict. *Strategic Management Journal* 26(5): 415-440.

Gutwin C, Penner R, Schneider K. 2004. Group Awareness in Distributed Software Development. *Proceedings of the International Conference on Computer-Supported Cooperative Work* (CSCW'04): 72-81.

Hansen M. 1999. The search-transfer problem: The role of weak ties in sharing knowledge across organization sub-units *Administrative Science Quarterly* 44(1): 82-111.

Heath C, Staudenmayer N. 2000. Coordination Neglect: How Lay theories of organizing complicate coordination in organizations. In RI Sutton, BM Staw (eds.). *Research in Organization Behaviour* 22. Greenwich, CT: JAI Press; 153-193.

Henderson RM, Clark KB. 1990. Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly* 35(1):9-30.

Hollingshead AB. 1998. Communication, Learning and retrieval in transactive memory systems. *Journal of Experimental Social Psychology* 34:423-442.

Iansiti M. 1998. *Technology Integration.* Boston, MA: Harvard Business School Press.

Karsenty L. 1999. Cooperative work and shared visual context: An empirical study of comprehension problems in side-by-side and remote help dialogues. *Human-Computer Interaction* 14:283-315.

Kiesler S, Cummings J. 2002. What do we know about proximity and distance in work groups? A legacy of Research. In P Hinds and S Kiesler (Eds.). *Distributed Work*. Cambridge MIT Press.

Klimoski R, Mohammed S. 1994. Team mental model: Construct or metaphor?. *Journal of Management* 20*:* 403-437.

Kogut B, Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* 3: 383-397.

Kraut RE, Fussell S, Brennan S, Siegel J. 2002. Understanding effects of proximity on collaboration: Implications for technologies to support remote collaborative work. In P Hinds, S Kiesler (Eds.). *Distributed Work*. Cambridge MIT Press.

Kretschmer T, Puranam P. 2008. Integration through incentives in differentiated organizations. *Organization Science* 19:860-875.

Langlois R. 2002. Modularity in technology and organization. *Journal of Economic Behavior and Organization* 49:19-37.

March JG, Simon HA. 1958. *Organizations*. New York, NY: Wiley Press.

McLeod P. 1996. New Communication technologies for group decision making: toward an integrative framework. In R Hirokawa, MS Poole (eds.). *Communication in Group Decision Making*, 2nd Edition.

NASSCOM-McKinsey Report. 2005. Extending India's leadership of the global IT and BPO industries.http://www.mckinsey.com/locations/india/mckinseyonindia/pdf/NASSCOM_McKinsey_Report_2005.pdf

Nunnally JC, Bernstein ICH. 1994. *Psychometric Theory* 3rd Ed. New York: McGraw-Hill.

Olson JS, Teasley S, Covi L, Olson G. 2002. The (currently) unique advantages of collocated work pp 113-136. In P Hinds, S Kiesler (Eds.). *Distributed Work*. Cambridge MIT Press.

Orton JD, Weick KE. 1990. Loosely coupled systems: A reconceptualization. *Academy of Management Review* 15(2): 203-223.

Puranam P, Singh H, Chaudhuri S. 2009. Integrating acquired capabilities: When structural integration is (un)necessary. *Organization Science* 20 (2): 313-328.

Sanchez R, Mahoney J. 1996. Modularity, flexibility and knowledge management in product and organization design. *Strategic Management Journal* 17 (Winter): 63-76.

Schelling TC. 1960. *The Strategy of Conflict*. Cambridge, MA: Harvard University Press.

Scott J. 2005. Offshoring in the financial services industry: Risks and rewards. *PriceWaterhouseCoopers and Economist Intelligence Unit report on global financial services.*

Simon HA. 1962. *The Sciences of the Artificial*. Cambridge, MA: MIT Press.

Sobrero R, Roberts J. 2001. The trade-off between efficiency and learning in inter-organizational relationships for product development. *Management Science* 47(4):493-511.

Srikanth K. 2007. *Coordination in Distributed Organizations*. Doctoral Dissertation, London Business School.

Srikanth K, Gupta S, Puranam P. 2006. Demystifying alternative sourcing. *Asian Management Review* July-September.

Srikanth K, Puranam P. 2009. Firm as a coordination system. *London Business School Working Paper*, Dec 2009.

Szulanski G. 1996. Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management Journal* 17:27-43.

Thompson JD. 1967. *Organizations in Action.* New York, NY: McGraw Hill.

Tushman M, Nadler D. 1978. Information processing as an integrating concept in organization design. *Academy of Management Review* 3:613-624.

Ulrich K, Eppinger S. 1999. *Product Design and Development.* New York, NY: McGraw Hill.

Van de ven A, Delbecq A, Koenig R. 1976. Determinants of coordination modes within organizations. *American Sociological Review* 41:183-197.

Von Hippel E. 1990. Task partitioning: An innovation process variable. *Research Policy* 19: 407-118.

Von Hippel E. 1994. Sticky information and the locus of problem solving: Implications for innovation. *Management Science* 40(4): 429-440.

Von Hippel E. 1998. Economics of product development by users: The impact of sticky local information. *Management Science* 44(5): 629-644.

Warner AJ, Brown N. 2005. Increase the success of your knowledge transfer effort, *CIO* 8/15/2005.

Wegner, DM. 1986. Transactive memory: A contemporary analysis of the group mind. In B Mullen, GR Goethals (Eds.). *Theories of Group Behavior.* New York, NY: Springer-Verlag; 185-208

Weisband S. 2002. Maintaining awareness in distributed team collaborations: Implications for leadership and performance. In P Hinds, S Kiesler (Eds.). *Distributed Work.* Cambridge MIT Press; 311-334

Wheelwright H, Clark KB. 1992. *Revolutionizing Product Development: Quantum Leaps in Speed, Efficiency and Quality.* New York: Free Press.

Zander U, Kogut B. 1995. Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test. *Organization Science* 6 (1):76-92.

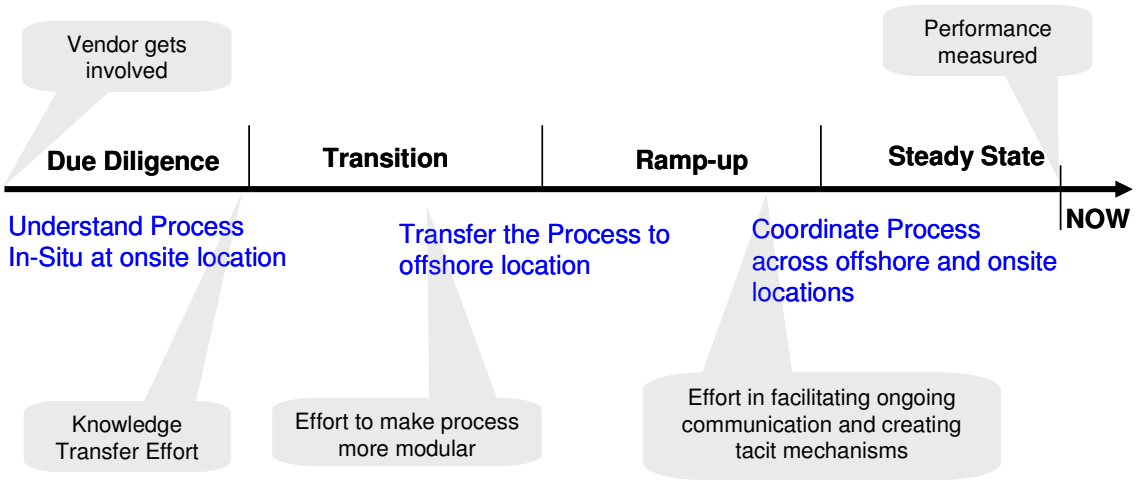


Figure 1 – The offshoring process

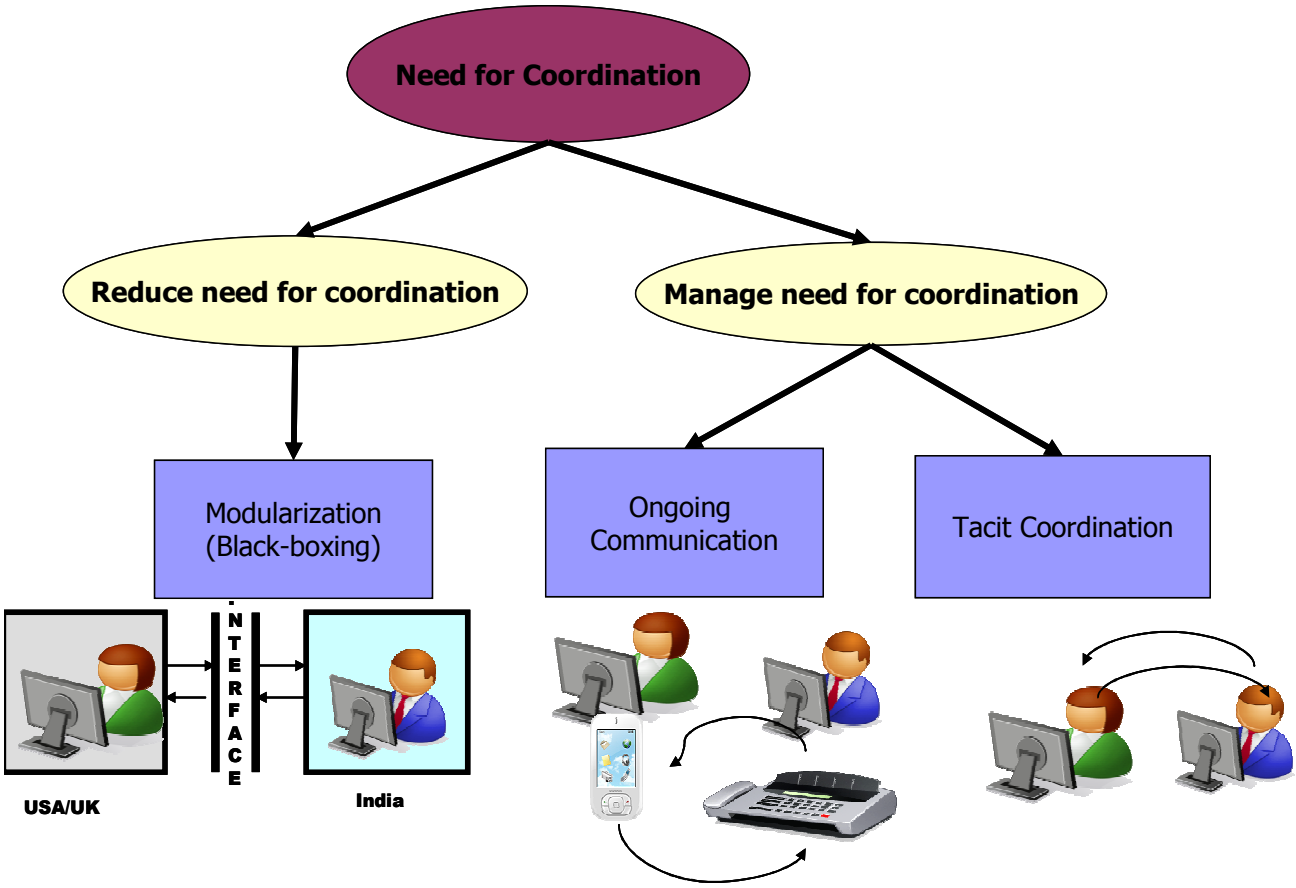


Figure 2: Schematic representation of alternative coordination strategies

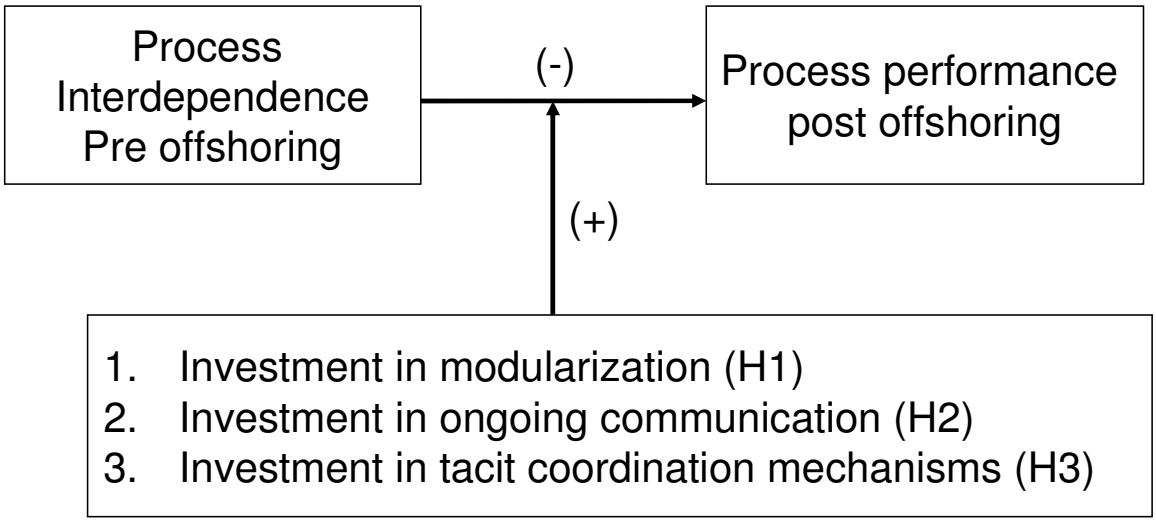


Figure 3: Graphical representation of hypotheses

Table 1: Key Constructs

Performance	
Please indicate the extent to which the offshoring initiative for this project has met/exceeded expectations on (-4: complete failure; 0: Meets expectations; 4: Exceeds expectations): (1) Cost savings; (2) Service quality improvements; (3) Rapid growth; (4) Satisfaction with service;	
Pre-Transition Inter-Process Interdependence	
The following questions measure the nature of interactions between the offshored process and linked activities/departments in the client firm **before** this offshoring initiative was undertaken (-3: Strongly disagree; 0: Neither disagree nor agree; +3: Strongly agree) 1. Personnel executing this process were in constant touch with personnel executing other linked activities 2. Changes to this process led to substantial changes in other linked onsite processes	
Investment in Tacit Coordination Mechanisms	
Please tell us how much effort was spent on the following activities during and after transition (until now) to facilitate smooth interactions between the offshored location and onsite location (-4: Little or no effort; -2: Some effort; 0: Moderate Effort; +2: Significant effort; +4: Intensive focused effort): (1) Helping personnel in each location to understand the decision making procedures used by personnel in the other location (2) Investment in technologies that enable personnel in one location to observe the work –in-progress in the other location (3) Encouraging personnel from one location to relocate and work from the other location for some time (4) Encouraging and facilitating travel by personnel from the one location to visit the other location (5) Investment in cultural training for employees in each location to better interact with employees in the other location (6) Encouraging and facilitating personnel in the offshore location to learn and adopt the vocabulary used by personnel in the onsite location	
Investment in Ongoing Communication	
Please tell us how much effort was spent on the following activities during and after transition (until now) to facilitate smooth interactions between the offshored location and onsite location (-4: Little or no effort; -2: Some effort; 0: Moderate Effort; +2: Significant effort; +4: Intensive focused effort): (1)Developing/adapting a IT communication network; (2) Training personnel in remote collaboration; (3) Providing electronic tools that could be used to collaborate remotely (e.g., Net Meeting, Messenger, etc); (4) Encouraging and facilitating personnel from one location to contact the other location whenever they feel the need (e.g., telephone calls, Instant Messenger etc.)	
Investment in Modularization	
Please tell us how much resources were spent on the following activities during transition to enable offshoring: (-4: Little or no effort; -2: Some effort; 0: Moderate Effort; +2: Significant effort; +4: Intensive focused effort): (1) Simplifying linkages between the offshored process and linked activities retained onsite (process was modularized); (2) Adapting the offshored process to be executed remotely so that need for interactions between the offshored process and linked activities retained onsite is minimized; (3) Creating standard operating procedures (rules, policies, etc) such that interactions between the offshored process and linked activities retained onsite are structured; (4) Partitioning the offshored process into portions with low and high interaction components (process chunking); (5) Reengineering the offshored process such that any coordination between the offshored process and linked activities retained onsite is fully structured	

Table 2: Descriptive statistics

Variable	N	Mean	Std. Dev.	Minimum	Maximum
Dependent variable					
Process Performance post offshoring	122	2.40	0.79	0.00	3.75
Independent Variables					
Process Interdependence	126	1.45	2.44	-6.00	6.00
Investment in TCM	125	0.28	1.65	-4.00	4.00
Investment in Ongoing Communication	125	0.78	1.73	-3.49	4.00
Investment in Modularization	125	0.90	1.69	-4.00	4.00
Control Variables					
Process Stickiness	126	0.22	1.26	-2.28	2.89
Knowledge Transfer Effort	125	2.29	1.53	-4	4
Log(Size)	123	3.91	1.26	1.39	7.38
Process Maturity	126	15.38	13.13	0.00	63.00
Duration of Migration	126	10.14	7.46	1.50	42.00

Table 3: Pair-wise correlations among variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Process Performance	**1**	1.00														
Process Interdependence	**2**	-0.10	1.00													
Investment in Modularization	**3**	0.02	0.09	1.00												
.. Ongoing Communication	**4**	0.05	0.03	0.42*	1.00											
..TCM	**5**	0.06	0.15	0.27*	0.62*	1.00										
Interdependence * Modularity	**6**	0.12	-0.01	-0.07	-0.05	-0.04	1.00									
Interdependence * Communication	**7**	0.12	0.06	-0.06	-0.14	-0.09	0.66*	1.00								
Interdependence * TCM	**8**	0.18*	-0.08	-0.04	-0.09	-0.03	0.54*	0.69*	1.00							
Process Stickiness	**9**	-0.19*	-0.04	0.15	-0.08	-0.19*	-0.20*	-0.18*	-0.17	1.00						
Knowledge Transfer effort	**10**	0.10	0.13	0.32*	0.21*	0.27*	-0.19*	-0.18*	-0.16	0.13	1.00					
Process Size	**11**	0.09	-0.14	0.01	0.11	0.01	0.01	-0.06	-0.01	-0.15	-0.09	1.00				
Process Maturity	**12**	0.02	0.16	0.00	-0.06	0.06	0.06	0.03	0.03	-0.04	0.00	-0.05	1.00			
Duration of Migration	**13**	-0.31*	-0.19*	0.00	0.04	0.00	0.04	0.01	0.05	0.13	-0.13	0.17	0.12	1.00		
IT Process	**14**	-0.32*	0.09	0.01	-0.02	0.02	0.01	-0.02	-0.06	0.32*	-0.11	-0.18*	0.09	0.17	1.00	
Call Centre Process	**15**	0.11	-0.06	-0.02	0.00	0.06	0.05	0.03	0.09	-0.28*	-0.03	0.39*	0.10	-0.08	-0.39*	1.00

Legend: * $p<0.05$

Table 4: Effect of pre-transition process interdependence and modularization on post offshoring performance
OLS Models with standard errors adjusted for multiple responses per firm

Variables	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Process Interdependence * Modularization efforts				0.01*
				(0.005)
Process Interdependence		-0.014**	-0.01**	-0.01***
		(0.005)	(0.005)	(0.004)
Modularization			0.00	0.001
			(0.01)	(0.008)
Process Stickiness	-0.006	-0.006	-0.007	-0.004
	(0.01)	(0.01)	(0.01)	(0.01)
Knowledge Transfer Effort	0.005	0.006	0.006	0.01*
	(0.01)	(0.01)	(0.006)	(0.006)
Process Size in FTE	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Process Maturity	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Duration of Migration	-0.003***	-0.003***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
IT Process	-0.05***	-0.05***	-0.04**	-0.05**
	(0.02)	(0.02)	(0.02)	(0.02)
Contact Centre Process	-0.02	-0.02	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Intercept	0.83***	0.84***	0.84***	0.84***
	(0.03)	(0.03)	(0.03)	(0.03)
N	116	116	116	116
F	8.76***	10.43***	10.56***	16.96***
R2	19.54	21.71	21.72	23.37

Legend: *** p<0.01 ** p<0.05 * p<0.1

Table 5: Effect of pre-transition process interdependence, communication and TCM on post offshoring performance

OLS Models with standard errors adjusted for multiple responses per firm

Variables	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Process Interdependence * Ongoing Communication		0.01**		0.002 †
		(0.005)		(0.01)
Process Interdependence * TCM			0.02**	0.02 †
			(0.01)	(0.01)
Ongoing Communication	-0.00	-0.001	-0.002	-0.002
	(0.01)	(0.01)	(0.01)	(0.01)
TCM	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Process interdependence	-0.015**	-0.016***	-0.013**	-0.014**
	(0.005)	(0.004)	(0.005)	(0.005)
Process Stickiness	-0.005	-0.001	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Modularization	0.00	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Knowledge Transfer Effort	0.005	0.01	0.01*	0.01*
	(0.005)	(0.005)	(0.005)	(0.005)
Process Size in FTE	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Process Maturity	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Duration of Migration	-0.004***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
IT Process	-0.05**	-0.05**	-0.05**	-0.05**
	(0.02)	(0.02)	(0.02)	(0.02)
Contact Center Process	-0.02	-0.02	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Intercept	0.84***	0.83***	0.83***	0.83***
	(0.04)	(0.04)	(0.03)	(0.03)
N	116	116	116	116
F	11.07***	13.75***	33.45***	28.73***
R2	22.13	24.23	26.00	26.02

Legend: *** p<0.01 ** p<0.05 * p<0.1

† Two interaction terms jointly significant; F(2, 15) = 3.96, p-val =0.04; (correlation between two interaction terms = 0.70)

Table 5A: Effect of process interdependence, ongoing communication and TCM on post offshoring performance (after controlling for the interaction effect of modularization on process interdependence)

OLS Models with standard errors adjusted for multiple responses per firm

Variables	MODEL 1	MODEL 2	MODEL 3	Model 4
Process Interdependence * Ongoing Communication		0.01**		-0.00†
		(0.004)		(0.005)
Process Interdependence * TCM			0.02*	0.02†
			(0.01)	(0.01)
Process Interdependence * Modularization	0.01*	0.005	0.003	0.00†
	(0.005)	(0.005)	(0.006)	(0.00)
Ongoing Communication	-0.00	-0.002	-0.002	-0.002
	(0.01)	(0.01)	(0.01)	(0.01)
TCM	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Modularization	0.00	-0.00	-0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Process Interdependence	-0.015**	-0.016***	-0.013**	-0.014**
	(0.005)	(0.004)	(0.005)	(0.004)
Process Stickiness	-0.005	-0.001	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.00)
Knowledge Transfer Effort	0.005	0.01	0.01*	0.01*
	(0.005)	(0.005)	(0.005)	(0.005)
Process Size in FTE	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Process Maturity	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Duration of Migration	-0.004***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
IT Process	-0.05**	-0.05**	-0.05**	-0.05**
	(0.02)	(0.02)	(0.02)	(0.02)
Contact Center Process	-0.02	-0.02	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Intercept	0.84***	0.83***	0.83***	0.83***
	(0.04)	(0.04)	(0.03)	(0.03)
N	116	116	116	116
F	16.83***	25.22***	49.00***	299.17***
R2	23.86	24.47	26.12	26.12

Legend: *** p<0.01 ** p<0.05 * p<0.1

† Three interaction terms jointly significant; F(3,15) = 2.94, p-val =0.06;

Table 6: Effect of percentage of transition effort spent on modularization and knowledge extraction on post offshoring performance.
OLS Models with standard errors adjusted for multiple responses per firm

Variables	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Process Interdependence * Modularization				-0.00
				(0.00)
Process Interdependence		-0.012**	-0.01**	-0.01**
		(0.005)	(0.005)	(0.005)
Modularization			-0.00	-0.00
			(0.007)	(0.01)
Process Stickiness	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Knowledge Transfer Effort	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Process Size in FTE	0.01	0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Process Maturity	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Duration of Migration	-0.003**	-0.003**	-0.004**	-0.004**
	(0.001)	(0.001)	(0.001)	(0.001)
IT Process	-0.05**	-0.05**	-0.05**	-0.05**
	(0.02)	(0.02)	(0.02)	(0.02)
Contact Centre Process	-0.02	-0.02	-0.03	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)
Intercept	0.84***	0.84***	0.85***	0.85***
	(0.03)	(0.03)	(0.04)	(0.04)
N	101	101	101	101
F	10.92***	14.01***	15.46***	15.39***
R2	23.96	25.41	25.43	25.44

Legend: *** p<0.01 ** p<0.05 * p<0.1

Table 7: Effect of percentage of transition effort spent on ongoing communication and TCM on post off-shoring performance
OLS Models with standard errors adjusted for multiple responses/ firm

Variables	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Process Interdependence * Ongoing Communication		-0.02**		-0.01 †
		(0.006)		(0.01)
Process Interdependence * TCM			0.02***	0.01*
			(0.004)	(0.006)
Ongoing Communication	-0.01	-0.01	-0.01	-0.01
	(0.02)	(0.01)	(0.03)	(0.03)
TCM	0.00	-0.00	-0.00	-0.01
	(0.02)	(0.00)	(0.02)	(0.02)
Process Interdependence	-0.01**	-0.01	-0.01**	-0.01
	(0.005)	(0.005)	(0.005)	(0.01)
Process Stickiness	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Modularization	-0.01	-0.02	-0.01	-0.01
	(0.01)	(0.03)	(0.03)	(0.03)
Knowledge Transfer Effort	0.00	-0.01	0.00	-0.00
	(0.01)	(0.02)	(0.03)	(0.03)
Process Size in FTE	0.00	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Process Maturity	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Duration of Migration	-0.004**	-0.004**	-0.003**	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
IT Process	-0.06**	-0.06***	-0.05**	-0.06***
	(0.02)	(0.02)	(0.02)	(0.02)
Contact Center Process	-0.04	-0.05*	-0.03	-0.04
	(0.02)	(0.02)	(0.02)	(0.03)
Intercept	0.86***	0.85***	0.84***	0.84***
	(0.04)	(0.04)	(0.04)	(0.04)
N	101	100	101	101
F	19.26***	20.18***	9.1***	11.3
R2	25.94	28.29	28.3	29.4

Legend: *** p<0.01 ** p<0.05 * p<0.1

†: two interaction terms jointly significant F(2, 15)=11.9; prob =0.0008;

Table 8: Effect of process knowledge stickiness and knowledge transfer efforts on post offshoring performance
OLS Models with standard errors adjusted for multiple responses per firm

Variables	MODEL 1	MODEL 2	MODEL 3	MODEL 4
Process Stickiness * Knowledge Transfer				0.01***
				(0.004)
Knowledge Transfer Effort			0.006	0.01**
			(0.006)	(0.005)
Process Stickiness		-0.006	-0.007	-0.007
		(0.01)	(0.01)	(0.01)
Process Interdependence	-0.013**	-0.014**	-0.01**	-0.01**
	(0.004)	(0.005)	(0.005)	(0.004)
Modularization	0.002	0.003	0.001	0.001
	(0.006)	(0.006)	(0.01)	(0.007)
Process Size in FTE	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Process Maturity	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Duration of Migration	-0.003***	-0.003***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
IT Process	-0.05***	-0.05***	-0.04**	-0.04**
	(0.02)	(0.02)	(0.02)	(0.02)
Contact Centre Process	-0.02	-0.02	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Intercept	0.83***	0.83***	0.84***	0.83***
	(0.03)	(0.03)	(0.03)	(0.04)
N	116	116	116	116
F	8.05***	10.26***	10.56***	23.18***
R2	20.96	21.31	21.72	24.85

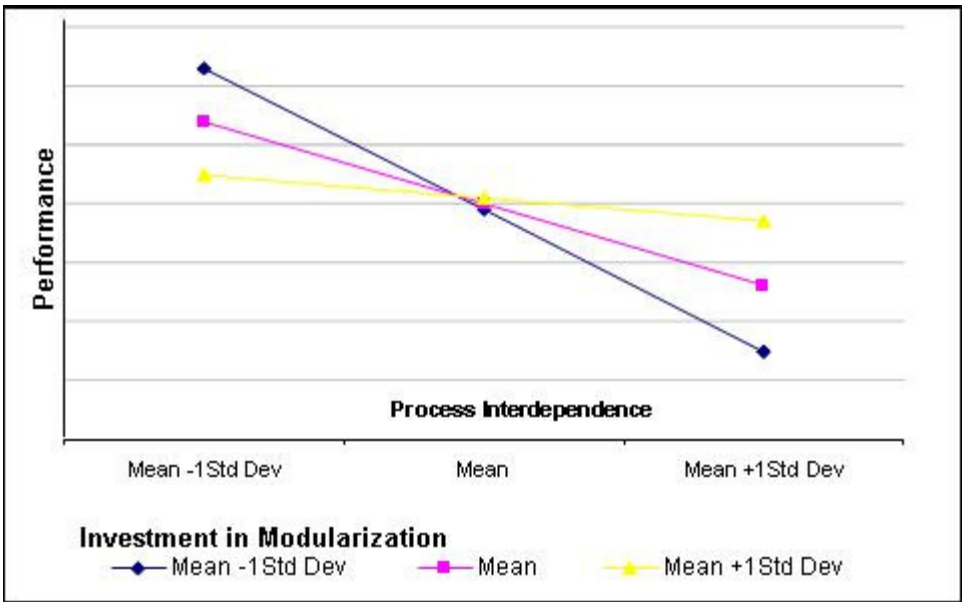
Legend: *** p<0.01 ** p<0.05 * p<0.1

Table 9: Effect of process stickiness and coordination mechanisms on post offshoring performance
OLS Models with standard errors adjusted for multiple responses per firm

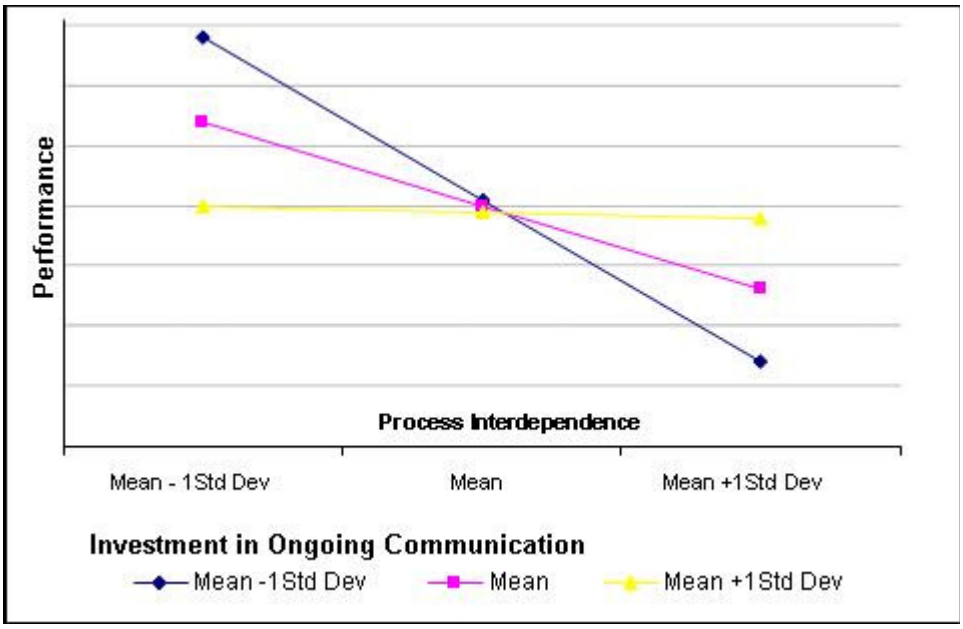
Variables	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
Process Stickiness * modularization		0.00 (0.01)				
Process Stickiness* Ongoing communication				-0.005 (0.01)		-0.001 (0.01)
Process Stickiness* TCM					0.01 (0.01)	-0.01 (0.01)
Modularization	0.001 (0.01)	0.001 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Ongoing Communication			-0.003 (0.01)	-0.003 (0.01)	-0.003 (0.01)	-0.003 (0.01)
TCM			0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Knowledge Transfer Effort	0.006 (0.006)	0.006 (0.005)	0.005 (0.005)	0.005 (0.005)	0.003 (0.005)	0.003 (0.005)
Process Stickiness	-0.007 (0.01)	-0.007 (0.01)	-0.005 (0.01)	-0.005 (0.01)	-0.004 (0.01)	-0.004 (0.01)
Process Interdependence	-0.01** (0.005)	-0.01** (0.005)	-0.01** (0.005)	-0.02*** (0.005)	-0.02*** (0.005)	-0.02*** (0.005)
Process Size in FTE	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Process Maturity	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Duration of Migration	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
IT Process	-0.04** (0.02)	-0.04** (0.02)	-0.05** (0.02)	-0.05** (0.02)	-0.05** (0.02)	-0.05** (0.02)
Contact Centre Process	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Intercept	0.84*** (0.03)	0.84*** (0.03)	0.84*** (0.03)	0.84*** (0.03)	0.84*** (0.03)	0.84*** (0.03)
N	116	116	116	116	116	116
F	10.56***	9.62***	11.07***	26.29***	10.22***	12.47***
R2	21.72	21.72	22.13	22.41	22.72	22.73

Legend: *** p<0.01 ** p<0.05 * p<0.1

Modularization



Ongoing Communication



Tacit Coordination Mechanisms (TCM)

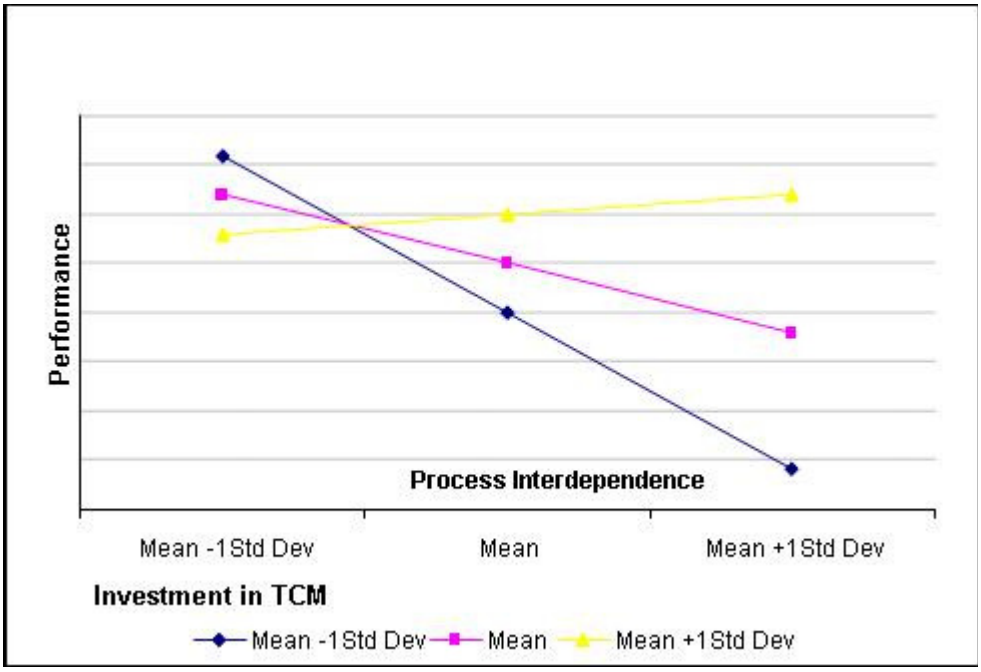


Figure 4: Interaction Effect of Modularization, Ongoing Communication and TCM with process interdependence [13]

[13] All the graphs are drawn to the same scale