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Møller Larsen, Marcus

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FAILING TO ESTIMATE THE COSTS OF OFFSHORING:

A STUDY ON PROCESS PERFORMANCE

Marcus M. Larsen
Department of Strategic Management and Globalization
Copenhagen Business School
Kilevej 14, 2nd floor, 2000 Frederiksberg, Denmark
mml.smg@cbs.dk / +45 3815 5628

Abstract: This article investigates cost estimation errors in the context of offshoring. It is argued that an imprecise estimation of the costs related to implementing a firm activity in a foreign location has a negative impact on the process performance of that activity. Performance is deterred as operations are likely to be disrupted by managerial distraction and resource misallocation. It is also argued that this relationship is mitigated by the extent to which firms use modularity to coordinate the activity but worsened by the extent to which ongoing communication is used. The results, based on a hierarchical regression analysis of a unique survey on Danish and Swedish firms, support these arguments.

Keywords: Cost estimation errors, offshoring, modularity, ongoing communication, process performance.

INTRODUCTION

What happens when firms underestimate the costs of offshoring? Offshoring describes the relocation of organizational activities to foreign locations for reasons such as comparative costs benefits, access to new talent, and market proximity (Jensen et al., 2013). However, while the pursuit of offshoring strategies has been a prolific experience for many firms (Dossany and Kenney, 2003), recent research has pinpointed how firms often incur substantial "hidden costs" when implementing activities abroad (Dibbern, Winkler, and Heinzl, 2008; Larsen, Manning and Pedersen, 2013; Stringfellow, Teagarden, and Nie, 2008). For example, firms experience that local labor costs increase beyond expectations and that offshoring operations require substantially more knowledge transfer and control than originally anticipated. Firms are unable to foresee the full consequences of offshoring, and are, as a result, incapable of making precise estimations of the costs of implementing offshoring activities abroad.

The purpose of this article is to investigate the consequences of such hidden costs. Specifically, while prior research has focused on the drivers of offshoring cost estimation errors—emphasizing factors such as complexity (Larsen et al., 2013), interaction distance and intensity (Stringfellow et al., 2008) and contractual incompleteness (Dibbern et al., 2008)—little is known of the consequences. This is an important gap in our understanding of offshoring, as firms need to make important cost estimations of the changes in the organization and the environment so that future resource allocations can be planned and aligned (Durand, 2003; Eisenhardt and Martin, 2000; Makadok and Walker, 2000).

Supported by hierarchical regression analyses of unique survey data reported by Danish and Swedish companies, I argue that firms' inability to effectively estimate the costs of implementing an activity in an offshore location (i.e., cost estimation errors) negatively impacts the process performance of that activity. The operations of the activity are likely to be disrupted by resource misallocation and managerial distraction as a consequence of inaccurate offshoring cost estimations. At the same, I argue that the specific mechanisms employed to coordinate the offshoring activity influence the negative impact on process performance in important ways. Specifically, since cost estimation errors can be seen as a local problem that needs local accommodation, coordination through modularity provides local units with the autonomy to solve the problems caused by cost estimation errors internally and without interference from other units. It will therefore reduce the negative effect on process performance. Conversely, coordination through ongoing communication leaves the offshored unit with less autonomy to accommodate for the challenges caused by cost estimation errors, and therefore exacerbates the negative effects on process performance.

This research contributes to research and practice of offshoring by emphasizing the performance consequences of costs estimation in the offshoring processes (e.g., Lewin and Peeters, 2006; Mol et al. 2005; Massini et al., 2010). This study demonstrates that cost estimation errors eventually reduce the process performance of a given activity. This is an important insight as it provides an explanation for why firms often experience that the initial rational for offshoring is undermined (e.g. Aron and Singh, 2005). Further, by uncovering the opposing moderating effects of modularity and ongoing communication on process performance, respectively, this article suggests that it may not always be relevant to invest in costly decision-making to estimate the costs of offshoring. Rather, depending on the coordinative requirements of the offshoring process, firms may choose to accept cost estimation errors and still uphold performance. In particular, this article suggests that when tasks are modular by design, the performance penalties of inaccurately estimating the costs of offshoring are substantially lower than when tasks require ongoing communication to coordinate work.

The article proceeds as follows: First, the literature on cost estimation and offshoring is discussed. Second, the hypotheses explaining the relationship between cost estimation errors, process performance and different coordination mechanisms are developed. Third, the dataset and methods used to explain process performance are introduced. Finally, the results are presented before the findings are discussed and related more broadly to research on offshoring and the role of cost estimation.

2. THEORY AND HYPOTHESES

2.1 Estimating cost in offshoring

When firms decide to offshore certain activities to foreign locations, a number of important operational decisions must be made. For example, decisions has to be taken on issues such as the contractual ownership and relationship of the offshoring setup (Mudambi and Tallman, 2010), the host location (Graf and Mudambi, 2005), the level of disaggregation or 'fine-slicing' of the overall value chain to identify the specific tasks to be offshored (Contractor et al., 2010), the choice of different coordination mechanisms (Kumar et al., 2009), and the overall coherence and integration of the globally dispersed organizational system (Srikanth and Puranam, 2011).

While such decisions may be motivated by reasons such as lowering labor and production costs (Dossani and Kenney, 2003) and accessing talent and qualified labor (Lewin et al., 2009), an important component of this decision-making relates to the accurate estimation of the costs of relocating activities abroad. Without an accurate estimation of the cost levels of offshoring firm activities, firms will not be able to invest in the required resources to arrange an efficient relocation and subsequent organizational reintegration (cf. Jensen et al., 2013; Mudambi and Venzin, 2010). This argument is supported by research on organizational reconfiguration that has emphasized that firms must successfully account for the additional costs of restructuring organizational activities to ensure that the objectives of the process will eventually be met (e.g., Lavie, 2006; Zollo and Winter, 2002). Lavie (2006: 161), for example, argues that a reconfiguration process entails costs relating to a number of areas—e.g., monitoring, evaluation, termination, learning, unlearning, adaptation, integration, deliberation, and codification—and suggests that "*an intendedly rational choice of reconfiguration mechanism takes into account the associated costs and risks*".

Interestingly, recent research has paid attention to situations where firms are unable to account for the organizational requirements and demands of offshoring. In particular, in contrast to situations where firms effectively foresee and estimate the costs of implementing the activity in an offshore unit, there is evidence that firms experience 'hidden costs' when they relocate activities to foreign locations (Larsen et al., 2013). For example, firms may experience that local labor and resource costs inflate beyond initial estimations. The offshoring implementation may turn out to require additional personnel and training than was originally anticipated and budgeted for to facilitate an effective offshoring operation (Lewin and Peeters, 2006). In a study on offshoring of software projects to India, Dibbern et al. (2008) identified unexpected offshoring costs relating to coordination, control, design, and knowledge transfer. In this article, I refer to the situation in which firms fail to effectively estimate the costs of offshoring as *cost estimation errors* (see also Larsen et al., 2013). Such 'postdecision surprises' (Harrison and March, 1984) therefore suggest the presence of boundedly rational decision makers who at the point of decision making are not able to foresee and estimate the true costs and consequences of implementing the activities abroad (cf. Simon, 1955).

2.2 Offshoring process performance consequences

While extant research has investigated the antecedents of cost estimation errors in offshoring (Dibbern et al., 2008; Larsen et al., 2013; Stringfellow et al., 2008), the focus here is on the their performance consequences. In this respect, different studies have provided different financial and non-financial measures on the consequences of offshoring. On the one hand, research employing financial measures to investigate offshoring performance has looked at aspects such as corporate financial performance (Mol et al., 2005), cost savings (Lewin and Peeters, 2006), export performance (Bertrant, 2011), and sales growth (Murray et al., 1995). On the other hand, research employing non-financial measures to investigate offshoring performance has emphasized aspects such as learning and organizational transformation (Jensen, 2009; Maskell et al., 2007), innovation performance (Nieto and Rodríguez, 2011), market shares (Kotabe and Murray, 1990), and implementation time (Hutzschenreuter et al., 2011).

In this study, I investigate how cost estimation errors affect the process performance of the activity after it has been relocated to a foreign location. Following Srikanth and Puranam (2011: 852), an activity's process performance is defined as "*cost reductions and/or performance improvements that occur in the immediate aftermath of moving the process offshore*", and may relate to factors such as the cost demand, service quality improvements, and satisfaction with the service of a given activity. For example, firms may experience that the relocation of a given activity to a low-cost country will decrease the cost demand of the activity due to preferable labor, production and cost levels (Kedia and Lahiri, 2007; Manning, et al., 2008). Firms may also experience that the operational flexibility and production quality will improve by moving the activity offshore due to superior technologies in the host location (e.g., Lewin and Peeters, 2006). Thus, process performance refers to the isolated performance of a given activity in the host location.

When firms fail to estimate the actual costs of implementing an offshoring activity abroad, a typical response would be to take different measures to best accommodate for these estimation errors. For example, a firm that experiences that the costs relating to knowledge transfer are substantially higher than initially expected may decide to down-scale the offshoring operations. A firm that experiences that the costs of coordinating and controlling a foreign activity exceed expectations may fail to implement an appropriate coordination mechanism. In some cases, firms may also decide to ‘backsource’ or re-nationalize the previously offshored activities due to exceeding levels of reconfiguration costs (Chadee and Raman, 2009).

Under all circumstances, firms suffer substantial opportunity costs as a result of cost estimation errors. For example, rather than allocating appropriate resources to the offshoring operations, the attention of the manager is likely to be directed at adjusting the expectations (Ocasio, 1996). The benefits of using low-cost production may be offset by unexpected additional resources invested in personnel training, facilities, and materials, which may result in economic and cognitive barriers (Lavie, 2006). The failure of accounting for the costs of implementing appropriate global integration mechanisms may lead to additional investments in coordination mechanisms that deteriorate the performance of the activity (Srikanth and Puranam, 2011). Moreover, the offshored activity may require substantially more communication and knowledge transfer between the home and host location due to unexpected cultural differences which makes the organization more inert and less responsive (Kumar et al., 2009).

Thus, I argue that the opportunity costs of cost estimation errors negatively influence the process performance of the activity. The operations of the activity are likely to be disrupted by managerial responses of the cost estimation errors. Rather than allocating resources to the facilitation of the operations of the activity, resources are instead used to accommodate for the cost estimation errors. Indeed, major risks of reconfiguration costs include unsuccessful integration and unsuitable response to technological change (Lavie, 2006). As a consequence, cost estimation errors will likely make the operations of the activity less prioritized, and this will have a negative impact on its process performance. The following hypothesis is therefore formulated:

Hypothesis 1: A higher degree of offshoring implementation cost estimation errors is likely to have a negative effect on the process performance of the activity.

2.3 International coordination

To better understand the contingencies of the aforementioned hypothesis, I focus in the following on the moderating impact of the mechanisms that firms utilize to accommodate for the increased need for coordination when offshoring. Research has emphasized how the process of relocating tasks abroad challenges the coordinative capacity of firms due to the added distance between the home and host locations (Jensen et al., 2013; Kumar et al., 2009; Manning et al., 2015; Srikanth and Puranam, 2011). In contrast to an organization with only domestically located activities which to a larger extent can rely on informal and tacit coordination mechanisms (Allen, 1977; Storper and Venables 2004), offshoring firms need to ensure that the growing numbers of international interdependent activities are coordinated and contribute to joint organizational action (Srikanth and Puranam, 2011). The resulting lack of common grounds to build collegial environments and benefit from rich communication and shared contexts make the act of international coordination more complex and challenging. Thus, to understand the influence of how firms coordinate their offshored activities, the moderating effect of two basic coordination mechanisms is discussed: modularity and ongoing communication.

First, modularity describes structures (products, production systems and organizations) based on minimized and standardized interactions and interdependencies between units (Baldwin and Clark, 2000; Sanchez and Mahoney 1996). By carefully specifying, standardizing and enforcing the interfaces of interdependent organizational activities, modularity intentionally reduces the need for costly coordination as it entails hierarchies with property of near-decomposability that simplifies their behavior (see Simon, 1962). Thus, in the case of offshoring, modularity can be seen as an organizing principle that counters and reduces the increased need for coordination when relocating firm activities abroad (Mithas and Whitaker, 2007).

Second, firms may also employ ongoing communication to coordinate organizational activities that are geographically dispersed as a result of offshoring. Specifically, by relying on coordinative channels of ongoing communications such as voice, emails, and video conferences, actors can "*Create opportunities for extensive communication among interdependent actors so that they achieve reciprocal predictability of action*" (Srikanth and Puranam, 2011: 850). For example, if a firm offshores a knowledge intensive task such as research and development where specifications are not fully specified, relying on ongoing communication with other units may be necessary. Technical problems may hinder the possibilities to standardize and document the interdependencies. Relatedly, new ICT opportunities (e.g., Skype and Cisco's teleconference) have increasingly facilitated 'virtual co-location' through frequent meetings, and consequently undermined the importance of actual co-location. In other words, ongoing communication remains an important mechanism to reduce the adverse consequences caused by the complexities of coordinating work across geography and country borders.

In general terms, a major difference between the two coordination strategies is that modularity seeks to reduce interaction between geographically dispersed units, while ongoing communication relies on rich interaction. Thus, whereas modularity is based on '*a reduced need for coordination'*, ongoing communication relies on '*managing the need for coordination'* (Srikanth and Puranam, 2011). However, while both coordination mechanisms have been highlighted as important in dealing with the complexities of offshoring, I argue that these produce opposing effects on the relationship between cost estimation errors and offshore process performance. In particular, I suggest that cost estimation errors can largely be regarded as a local problem requiring local accommodation and adaptation. Similar to the notions of subsidiary charter and evolution (Birkinshaw and Hood, 1998), the challenges associated with the inaccurate resource allocations and managerial distractions caused by cost estimation errors are likely to reside with the offshored unit instead of the headquarters or other parts of the global organization. Thus, it is predominantly the responsibility of the offshored team to find the necessary resources to accommodate for the challenges posed by the cost estimation errors.

Based on this logic, I first propose that modularity reduces the negative influences of cost estimation errors on offshoring process performance. Since the opportunities for informal face-to-face coordination is undermined when moving an activity abroad, firms benefit from using the coordination principles of modularity which promote structures with pre-specified interdependencies that are not subject to continuous negotiations. Firms are in a position to more easily decouple and disintegrate modular activities (Sanchez and Mahoney, 1996) and subsequently relocate these to foreign locations. By facilitating aspects such as organizational reintegration, knowledge transfer, and effective division of labor between the domestic and foreign activities, the negative impact of cost estimation errors becomes undermined.

Thus, assuming that cost estimation errors can be characterized as a local problem requiring local adaptation, the extent to which the firms use modularity as a coordination mechanism should positively moderate the negative relationship between cost estimation errors and process performance. Firms can to a larger extent "black-box" the problem internally with the offshored unit and hence more easily accommodate for the cost estimation error without inference from other units. Indeed, research on modularity suggests that while there is a risk that the optimality of the solution is more difficult to reach through modular structures, the pace of adaptation (and hence right-tracking the offshored activities) is quicker (Brusoni et al., 2007). Accordingly, offshoring implementations coordinated through modularity should more easily accommodate for the cost estimation errors, and hence experience a positive moderating effect on process performance. This suggests the following hypothesis:

> *Hypothesis 2*: *The degree to which the offshored activities rely on coordination through modularity weakens the negative impact of cost estimation errors on process performance of the activity.*

Second, I argue that ongoing communication increases the negative influences of cost estimation errors. Specifically, by relying on ongoing communication to coordinate the offshored units, more people are engaged in the problem-solving sphere. In contrast to the coordination principles of modularity that promotes structures with pre-specified interdependencies, ongoing communication depends on the ability of organizational members across geographies to solve problems. This may be effective *if* organizational members are aligned on the organizational task to be coordinated. As distance creates problems for communication due to logistical and time-related constraints that inhibit interaction among individuals engaged in pursuing a joint activity (Clark, 1996), it is therefore crucial that different organizational members work toward a common goal.

Cost estimation errors, in contrast, are characterized by inaccurate resource allocation and managerial distraction that require local adaptation. As previously discussed, it is likely that offshored units facing unexpected costs will focus more on addressing these than on the offshored task at hand. Had the activity been isolated from the rest of the global organization, this would not necessarily cause additional problems (cf., the modularity argument). However, since ongoing communication requires personnel from different geographical units to coordinate on an informal basis, there is a larger risk that politics and conflict of interests are induced. The challenge of such international negotiations is a generic problem that is well documented in the literature. For example, the Hudson's Bay Company's headquarters in London faced challenges managing its large Canadian subsidiary (Carlos and Nicholas, 1993). Research on subsidiary autonomy emphasizes the challenges in aligning headquarters and subsidiary goals (Mudambi and Navarra, 2004).

Hence, I propose that cost estimation errors in implementations coordinated by ongoing communication will induce disrupting negotiations between home and host unit rather than achieving 'reciprocal predictability of action'. Thus, it is more likely that the problems of cost estimation errors are strengthened and the offshored task receives less attention. This argumentation leads to the third and final hypothesis:

Hypothesis 3: *The degree to which the offshored activities rely on coordination through ongoing communication strengthens the negative impact of cost estimation errors on process performance of the activity.*

In sum, the foregoing hypotheses form a theoretical model suggesting that cost estimation errors have a negative impact on the process performance of the activity being offshored, but that this is positively moderated by coordination through modularity and negatively moderated by coordination through ongoing communication.

3. RESEARCH METHODOLOGY

3.1 Survey design and sample

The hypotheses are tested on a quantitative dataset based on a survey from the Global Operations Network. The Global Operations Network is a research network of a number of Scandinavian universities that was established in 2009 to study Danish and Swedish industries and companies that have been intensively exposed to globalization. Indeed, Scandinavian firms have a long tradition of offshoring activities to foreign countries (Pyndt and Pedersen, 2007). Their experiences thus serve as a valid empirical foundation to investigate performance consequences of estimation errors in offshoring processes.

The population of the study consists of all Danish firms across industries with more than 50 employees (2,908 companies) and all Swedish manufacturing firms with more than 50 employees (1,549 companies). The survey was conducted among these 4,457 companies in the time period from September 2011 to January 2012, where companies were per postal mail and e-mail invited to participate in an online survey. The invitations were addressed to the CEOs of the companies. However, it was explicitly stated that the survey should be directed to the person with knowledge and responsibility of the firm's offshoring activities. Thus, unless the CEOs responded themselves, the respondents were typically COOs, production managers, and HR managers.

The purpose of the survey was to unravel the organizational consequences of offshoring on issues such as different organizational mechanisms that firms employ to manage their offshoring activities and performance implications. Importantly, in the survey we asked the respondents to report only on the latest offshoring implementation in their respective firms. This means that firms may have additional offshoring implementations to the one described in depth in the survey. However, by asking specifically about the latest implementation in the individual firms alone, the risk of self-selection bias on the implementation level among the respondents (i.e. responding only on the successful/less successful offshoring implementations) is intentionally reduced.

In the survey, the respondents were asked about the characteristics of the offshoring implementations, the coordination of the offshoring activities, the interdependencies between domestic and offshored activities, and the effects of offshoring the activities. In all, 1,086 questionnaires were received (a response rate of 24.4%), out of which 379 companies reported that they had experience with offshoring. The sample used for this study consists of data on 224 specific offshoring implementations reported by 161 Danish companies and 63 Swedish companies across different functions and industries. Although various methods exist to replace missing values (e.g., Royston, 2004), only actual responses are used in this study. The rationale is that respondents giving complete information are likely to be more accurate with any particular data item than respondents giving incomplete information. Of the responses, 62.0% of the implementations are captive offshoring and 37.0% are offshore outsourcing. 62.1% of the implementations are production tasks (e.g. fabrication, assembly, and maintenance), 22.6% are service tasks (e.g. finance, marketing and sales, IT and call centers), and 15.3% are R&D tasks (e.g. product design, product development, and software development) (see Table 1 for a full list of all activities and tasks in the sample). The firms are based in different industries, primarily manufacturing (62.1%), wholesale (9.7%), information and communication technology (7.9%), and other services (7.5%). 26.8% are small (< 150 employees), 29.0% medium (< 500 employees), and 44.2% large (≥ 500 employees). These firms offshore to 43 different countries, where China (18.8%), Poland (12.1%) and India (11.6%) are the most frequently used locations (see Table 2 for a list of the most frequently targeted countries).

**** Table 1 and 2 around here****

3.2 Variable construction

All the variables and underlying questions used to measure the key constructs are summarized in Table 3.

**** Table 3 around here****

The dependent variable is the *process performance* of the activity that is relocated to an offshore location. This variable is similar to previous research that investigates how the implementation has created a positive impact on an activity being relocated to a foreign location (e.g., Scott, 2005; Srikanth and Puranam, 2011). For example, Srikanth and Puranam

(2011) measure process performance by composing an aggregate construct of the following four items: 1) cost savings; 2) service quality improvements; 3) rapid growth; and 4) satisfaction with the service. Inspired by this operationalization, process performance is in this paper measured using the average of five survey items in which respondent are asked to indicate on a 7-point Likert scale (1 = worse; 4 = no changes; 7 = better) the general performance of the activity post implementation. The five items are: 1) flexibility; 2) quality; and 3) productivity 4) profitability; and 5) costs demand. These items produce a single construct with a Cronbach α=0.77. Naturally, firms may have different objectives and intentions of offshoring. For example, while the majority of firms offshore with the purpose of cutting costs (Manning et al., 2008), there is also substantial evidence that firms approach offshoring with the purpose of accessing talent (e.g. Lewin et al., 2009). Hence, I also control for variations in firm strategies (see below). Finally, it should be noted that the performance items in this paper are perceptual measures. While these may be biased, perceptual measures of performance have been widely used in international business and strategic management literature and most studies find high convergent validity with objective measures such as publicly available accounting data (e.g. Powell and Dent-Micallef, 1997; Hart and Banbury, 1994; Dess and Robinson, 1984; Venkatraman and Ramanujam, 1987).

The independent variable is the *cost estimation errors* related to implementing an offshoring activity abroad. The variable follows previous research that investigates hidden costs (Larsen et al., 2013) and firms' forecasting ability (Durand, 2003; Makadok and Walker, 2000), and is measured by asking respondents the following question: "*Has there been a difference between the expected costs of implementation before the offshoring was relocated and the actual costs of implementation after the offshoring activity was relocated?*" The purpose of the variable is to capture the extent to which firms accurately estimate the costs of implementing offshoring activities abroad. If there is a perfect match between the exante expectations of the cost levels and the ex-post realized cost levels, then there are no cost estimation errors. However, if there is a mismatch between the cost expectations and realizations, then there is evidence of imprecise cost estimations during the decision making processes. Hence, I proxy deviations between expected and realized costs as evidence of cost estimation errors (see also Larsen et al., 2013). Operationally, the respondents respond to the question on a 7-point Likert scale ranging from 1 where "*actual cost levels are lower than expectations"* to 7 where "*actual costs levels are higher than expectations*" (the mid-range 4, gives the option that "*actual cost levels meet expectations*"). Thus, the variable captures variations in the extent to which firms can estimate the costs of an organizational reconfiguration by implementing an offshoring activity abroad. The higher the value of the variable, the higher is the degree to which the firm wrongly estimates the cost of implementing an offshoring decision.

The first moderating variable is *modularity* and captures how firms reduce the need for costly coordination across distance through the standardization and minimization of task interdependencies (Baldwin and Clark, 2000; Sanchez and Mahoney, 1996). The variable is measured using the average of five survey items inspired by previous operationalizations of modularity (e.g., Worren et al., 2002). These are the degree to which the offshoring task: 1) is specified with the purpose of easing coordination; 2) is defined through overarching goals and guidelines; 3) has interfaces that are defined through procedures, manuals and blueprints; 4) is integrated with remaining activities at home (inversed item); and 5) is coordinated based on formalization. For each of these items, respondents answer on a 7-point Likert scale (1=nothing; 7=to a large extent). The five items produce a single construct with a Cronbach α=0.72.

The second moderating variable is *ongoing communication* and captures how firms coordinate work through interpersonal communication across organizational and country boundaries. The variable is measured using the average of three survey items inspired by previous operationalizations of ongoing communication (e.g., Srikanth and Puranam, 2011). These are the degree to which the offshoring task is: 1) coordinated based on personnel contact; 2) characterized through a high degree of cooperation with home unit; and 3) has many interdependencies and interaction with home unit. For each of these items, respondents answer on a 7-point Likert scale (1=nothing; 7=to a large extent). The five items produce a single construct with a Cronbach α=0.70.

Finally, a number of variables have been included to control for unobserved heterogeneity and alternative explanations. First, the *governance mode* of the implementation is measured as a dummy (1 = captive offshoring, 0 = offshore outsourcing). Second, the type of offshoring activity is measured as dummy variables. These are *production* and *service* (a third possible type R&D was omitted and therefore serves as the baseline when interpreting the coefficients of production and service). Third, to capture the potential slack resources available, the *size of the offshoring implementation* is measured as the logarithm of the number of employees that are employed at the implementation. Equally, the *size of the offshoring company* is measured as the logarithm of the total number of employees that are employed at the company. Fourth, since process performance is eventually a result of the time since implementation and since local operations evolve over time (e.g. Hood et al., 1994), the *implementation year* of the offshoring implementation is measured as the time in years since the activity was implemented. Equally, I include a dummy variable controlling for whether the firm has *prior offshoring* experience. Fifth, the region where the offshoring implementation is located is controlled for by creating a dummy for each region. Similarly, variables controlling for *the cultural distance,* using the Kogut and Singh Index (Kogut and Singh, 1988), and *geographic distance,* using the logarithm of air miles between home and host location, are included. Sixth, the location of the *Headquarters* is captured by a dummy variable (1 = Denmark; 0 = Sweden). Finally, to capture potential variation in the strategies driving the offshoring decisions, I include the variable *strategy* that asks respondents on a 7-point Likert scale whether firms offshored with the purpose of accessing talent.

3.3 Econometric specifications

The statistical analysis is conducted on the level of the 224 offshoring implementations. A hierarchical regression analysis with successive linear regression (ordinary least squares; OLS) models each adding more explanatory variables is used to measure the dependent variable process performance. OLS models are most suitable for this analysis, as the dependent variable is constructed with continuous values and because a linear relationship between the dependent variable and the explanatory variables is proposed (Greene, 2003). The hierarchical feature refers to the gradual building of separate, but related, models with added explanatory variables. In each step, an F-test for increment is conducted in order to test whether a significant improvement in the explanatory power has been gained. To reduce problems of multicollinearity inherent in moderator models, the key variables have been standardized in the analysis. Moreover, to avoid problems of heteroscedasticity, the analyses are conducted with robust standard errors.

4. RESULTS

4.1 Descriptive statistics

The descriptive data (mean values, standard deviation, minimum and maximum values) and correlation matrix are reported in Table 4 and Table 5. As can be seen, there is considerable variation in the key variables: process performance, cost estimation error, modularity, and ongoing communication. The implementations also vary in terms of size and maturity. A closer inspection of the correlation matrix shows a low correlation between most variables. Hence, the dataset does not seem to involve severe problems of multicollinearity. This conclusion is further supported by the variance inflation factor values (VIF), which in all but two variables (geographical distance and Eastern Europe produce maximum VIF values of 10.56 and 10.24, respectively) are below the critical level of 10 (Hair et al., 1995). When looking at cost estimation error, 12.1% reported that realized costs were lower than expected costs, 60.3% reported that realized costs met expected costs, and 27.6% reported realized costs were higher than expected costs. These cost estimation levels are comparable to levels reported elsewhere using different data sources (e.g., Larsen et al., 2013). All observations are used in the analysis to capture the variation in the relative degree of cost estimation errors. The average company has 5,794 employees on a world basis and the average implementation has 63 employees. The mean maturity of the offshoring implementation is 4.74 years, with a standard deviation of 4.18. Finally, 68% of the respondents have previous offshoring experience (standard deviation=0.47)

*** *Table 4 and 5 about here* ***

4.2 Hypotheses testing

The results of the OLS regression models are reported in Table 6. Model 1 reports results for the control variables only. In this model, 17.8% of the total variance is explained. When including the independent variable (cost estimation errors) in Model 2-8, a clear negative and significant effect on process performance is demonstrated (β=-0.262-0.285, $p<0.01$). This provides support to Hypothesis 1, suggesting that a higher degree of offshoring cost estimation errors negatively impact the process performance of the offshored activity.

*** *Table 6 about here* ***

In order to test Hypothesis 2 and 3, I stepwise add the moderating variables and interaction terms to see the incremental increase in explanatory power on the dependent variable. Model 2, with only the independent and control variables, obtains an R^2 of 0.243. This score is used as a base to test the effect of adding the interaction effect of modularity and ongoing communication. First, the inclusion of modularity in Model 3 produces a positive and significant coefficient (β=0.157, $p<0.05$), which suggests that it has a positive direct effect on the process performance of the offshored activity. Moreover, the R^2 in Model 3 increases significantly to 0.265 compared to Model 2 (F-change=6.01 $p<0.05$), suggesting that the explanatory power of the model with modularity is significantly higher than without modularity. In Model 5, I add ongoing communication to remove any variance caused by the alternative coordination mechanism. In order to investigate the impact of the interaction between cost estimation error and modularity, the results of the full model with all variables are presented in Model 6 (without the interaction term between ongoing communication and cost estimation error) and in Model 8 (with the interaction term between ongoing communication and cost estimation error). In both models, the interaction terms are positive and significant (Model 6: β=0.154, $p<0.05$; Model 8: β=0.127, $p<0.05$), while the moderating variable modularity turns out insignificant (Model 6: β=0.0806, $p>0.10$; Model 8: β=0.0831, $p>0.10$). Moreover, the R^2 shows a significant increase to 0.293 (Model 6: F-change= 6.709, $p<0.01$) and 0.301 (Model 8: F-change=4.452, $p<0.01$) compared to Model 5. Thus, the full model with the modularity interaction terms explains 30.1% of the total variation in the dependent variable cost estimation errors, and is therefore, according to the goodness-of-fit statistics (F-change, R^2, F-test for increment), superior to the other models in explaining process performance. Modularity thus positively moderates the effect of cost estimation errors on process performance (i.e., reduces the negative effect).

In regard to the moderating effect of ongoing communication, it is clear from Model 4 that the moderating variable is positive although insignificant (β=0.0823, $p>0.10$). Further, the R^2 only increases with 0.006 to 0.249. Hence, it does not seem that ongoing communication has a direct effect alone on process performance (F-change= 1.685, $p>0.10$). However, in the full models (Model 7 without the interaction term between modularity and cost estimation error; Model 8 with the interaction term between modularity and cost estimation error), the interaction term is negative and significant (Model 7: β=-0.153, $p<0.05$; Model 8: β=-0.108, $p<0.10$). The R^2 is also significantly increased to 0.286 (F-change=4.656, $p<0.05$) and 0.301 (F-change=4.452, $p<0.01$) compared to Model 5. The full model with ongoing communication as interaction term is therefore also according to the goodness-of-fit statistics (F-value, R^2, F-test for increment) superior to the other models in explaining process performance. Ongoing communication is therefore negatively moderating the effect of cost estimation errors on process performance (i.e., strengthens the negative effect).

*** *Figure 1 and 2 about here* ***

These results are illustrated in Figure 1 and 2, where the two-way interactions between estimation error and modularity (Figure 1a) and ongoing communication (Figure 1b) on process performance are depicted (see Dawson, 2014). First, looking at the impact of modularity in cases with low estimation error, it appears that low modularity obtains slightly higher performance than high modularity. However, as cost estimation errors increase, the performance benefit of high modularity surpasses low modularity. Thus, in cases of high estimation errors, high modularity obtains higher internal performance than low modularity. Moreover, it should be noted that although high modularity has a positive moderating effect, the slope is still negative, but less so than with low modularity. Thus, the moderation of modularity does not increase internal performance per se, but rather reduces the negative impact of cost estimation errors on performance. In contrast, with ongoing communication it is evident that a high degree of ongoing communication is more performance rewarding in cases with low cost estimation errors. Yet, in cases with high cost estimation errors, a high degree of ongoing communication is somewhat comparable to a low degree of ongoing communication. Hence, ongoing communication displays a negative moderating effect on process performance as the cost estimation errors increase.

Among the control variables in the full model, implementation size (β=0.0977, $p<0.10$), production (β=0.339, $p<0.10$), HQ location (β=0.248, $p<0.10$) and strategy (β=0.142, $p<0.01$) come out with significant coefficients, suggesting higher performance. Also, none of the region dummy variables turn out significant in the final model.

To investigate whether cost estimation errors could be an endogenous choice variable that is correlated with unobservables relegated to the error term, a Durbin-Wu-Hausman test has been conducted. Here, the residuals of a reduced models with cost estimation errors as dependent variable turned out insignificant in the full model with process performance as dependent variable, and the F-tests to see whether the residuals were significantly different from zero also turned out insignificant ($F=0.02$, $p>0.10$). This therefore suggests that cost estimation error is not severely suffering from endogeneity.

Further, common method bias where the dependent and the independent variable stem from the same source is a potential problem for cross-sectional studies like the present (Chang et al, 2010). Several measures were taken to investigate whether the present study suffers from common method bias. First, the complexity of the model, particularly with the moderating variables, makes common method biases less of a problem (Harrison et al., 1996). Second, a Harman one-factor test was conducted to see whether the majority of the covariance can be explained by a single factor (Podsakoff and Organ, 1986). Using all the items of the model in the factor analysis, eight factors with an eigenvalue greater than 1 emerged explaining between 20.2% and 6.4% of the total variance. This indicates that the diversity of facets captured by the model constructs makes it unlikely that a single factor explains all the covariance in the constructs. Third, a 'marker variable' – a theoretically unrelated variable to the constructs of interest – as a proxy for common method variance has been investigated (Lindell and Whitney, 2001). A variable indicating whether the offshoring activity can only be conducted by personnel with a higher education was used for this purpose. Only marginal and non-significant correlations between the constructs of interest and the marker variable was found (process performance = 0.02; cost estimation error = 0.02; modularity = -0.06; ongoing communication = 0.10). These tests thus suggest that the results are not severely contaminated by a common method bias.

In sum, the results support the hypotheses that cost estimation errors have a negative effect on the process performance of the offshored activity, but that this relationship is positively moderated by the degree of modularity in the activity and negatively moderated by ongoing communication.

5. DISCUSSION AND CONCLUSION

As firms offshore business activities, they must estimate the costs of relocating organizational tasks to foreign locations (cf., Durand, 2003; Eisenhardt and Martin, 2000; Makadok and Walker, 2000). Often, however, firms experience that factors such as complexity, biases and politics make the implementation of the decisions more costly than expected (Dibbern et al., 2008; Larsen et al., 2013; Stringfellow et al., 2008). Firms experience that hidden or unexpected costs of offshoring undermine the successful implementation.

In this paper, I argue that cost estimation errors have detrimental consequences for the process performance of a given activity that is relocated abroad. I also argue that this relationship is mitigated by the degree of modularity required to coordinate the activity, but worsened by the degree of ongoing communication. Specifically, firms' inability to effectively estimate the costs of implementing an activity in a foreign location will result in opportunity costs that negatively impact the process performance of that activity. Operations are likely to be disrupted by factors such as unexpected additional resources used to train and educate the local labor force and the implementation of inappropriate global integration and communication mechanisms. At the same time, as cost estimation errors can be regarded as a local problem that needs local accommodation, the degree to which the offshoring implementation is coordinated by modularity—i.e., minimizing the interdependency with the home unit—will reduce the negative effect. In contrast, the degree to which the offshoring implementation is coordinated by ongoing communication—i.e., relying on the interdependency with the home unit—will increase the negative effect. Data on 224 offshoring implementations support these arguments.

This study has important implications for research on the costs and performance of offshoring. As companies expand the scale and scope of offshoring, many firms realize that managing an increasingly globally dispersed organization is more difficult and costly than initially expected. Recent offshoring research investigates different factors that may explain variations in offshoring performance, such as the role of corporate strategies (Massini et al., 2010) and learning (Jensen, 2009; Maskell et al., 2007). This research contributes to this literature by demonstrating that the inability to estimate the costs of offshoring due to 'hidden costs' has a negative effect on the process performance of the activity that is being implemented abroad. In this respect, the cost estimation errors are critical to the extent that they lower the process performance of a given activity, and as such can lead to situations in which they undermine the initial rationale for offshoring firm activities abroad (Dibbern et al., 2008; Larsen et al., 2013; Stringfellow et al., 2008). Evidence of offshoring failures and backsourcing lends support to this argument (Chadee and Raman, 2009; Frauenheim, 2003).

Moreover, while previous research has explained 'hidden costs' through measures such as complexity (Larsen et al., 2013) and interaction intensity and distance (Stringfellow et al., 2008), this paper advances this debate by theoretically and empirically pinpointing the detrimental performance consequences of these cost estimation errors and the moderating impact of firms' coordination mechanisms. This is an important theoretical and practical contribution as it offers a performance perspective on the consequences of cost estimation errors. Future research could therefore investigate the nature of different types of offshoring costs, such as knowledge transfer, control and design (cf. Dibbern et al., 2008), and test how these impact performance individually. In addition, as this paper relies dominantly on survey data, future research could more carefully address how the process of offshoring actually develops, the various factors contributing to the success of decision-making, and how this resonates with performance. An in-depth qualitative case study would have obvious advantages in this respect.

At the same time, this research suggests that coordination through modularity positively moderate the effect of cost estimation errors while ongoing communication has a negative effect. These results emphasize the importance of aligning firms' coordination mechanism to the new organizational demands posed by offshoring and internationalization (Srikanth and Puranam, 2011), and more importantly the consequences of relying on inappropriate coordination mechanisms. This is an important contribution as it suggests that modularity may partly replace ineffective cost estimation, while ongoing communication strengthens the consequences of ineffective estimation. Importantly, it is suggested that cost estimation errors should be regarded as a local problem with the offshored unit requiring local adaptation and accommodation. For example, if firms reconfigure modular activities (e.g. Helfat and Eisenhardt, 2004), then the arguments provided here question the extent to which decision making processes, and herein cost estimations, add value to the activity that is being reconfigured. In contrast, if firms offshore activities requiring ongoing communication, such as knowledge intensive activities, then decision making processes should certainly add value to the activity being offshored. These insights are also important for offshoring practice as they provide insights into how firms more efficiently can invest in appropriate coordination mechanisms to align the offshored activities with the domestic organization. Future research could therefore investigate further whether and how modularity and ongoing communication should be regarded as supplementary or perhaps complimentary to decision making processes.

Obviously, the assumption that cost estimation errors are predominantly a local problem can be challenged. For example, one could assume that firms experiencing operational problems in a local context would be in need of additional knowledge transfer and assistance from the headquarters. Further, one could also assume that local knowledge on handling problems related to cost estimation errors should be institutionalized in the global organization, rather than isolated within a local subsidiary. Thus, future research should look more into the contingencies determining the extent to which cost estimation errors should be treated as a problem for the subsidiary (i.e. a local problem) instead of a problem, and a potential source of learning, for the global organization.

Moreover, while this research has investigated the moderating role of two different coordination mechanisms on process performance, it has left out an important discussion on the impact of location. For example, while geographic and cultural distances are controlled for, it can be assumed that environmental uncertainty should have a negative moderating role on the relationship between cost estimation errors and process performance. Previous studies show how foreign market entry mode choices and the effectiveness of these largely depend on the target country's environmental uncertainty (Slangen and van Tulder, 2009). As decision makers make important estimations regarding environmental factors when deciding to engage in offshoring, such as labor and resource cost inflation, exchange rate fluctuation, tax policies, etc., increased perceived environmental uncertainty should make it more difficult for the decision maker to effectively estimate the impact of these environmental factors. Following the logic of this paper, it can be assumed that the ability of firms to effectively coordinate and manage external factors such as the political environment (Oliver and Holzinger, 2008) should have an important influence on the relationship between cost estimation errors and process performance. Accordingly, future research could investigate other factors that moderate performance as a result of cost estimation errors.

Equally, while this study focuses on the immediate performance consequences of inaccurately estimating future costs of offshoring, it is important to recognize that offshored units evolve and develop over time. In this respect, extant research has applied a learning perspective to elucidate the processes of offshoring (e.g. Carmel and Agarwal 2002, Dibbern et al. 2008, Jensen 2009, Manning et al. 2008, Maskell et al. 2007). For instance, Manning et al. (2008) argue that the scope and organizational capabilities of offshoring increase according to the firms' incremental and experiential learning processes. Carmel and Agarwal (2002) propose a chronologically incremental four stage model of offshore IT sourcing based on firms' prior experiences and knowledge. Thus, although I control for time since implementation to reduce the risk of retrospective biases, it is important to acknowledge that operations evolve over time (e.g., Hood et al., 1994) and that original mandates and strategies may change as firms gain more experience (e.g. White and Poynter, 1984; Cantwell and Mudambi, 2005). Future research could therefore investigate the implications of cost estimation errors over time to better understand their long-term consequences on task process performance.

Finally, this research contributes to literature on the role of firms' estimation abilities (Durand, 2003; Makadok and Walker, 2000). Specifically, this paper provides arguments and empirical results that suggest that the failure to effectively estimate costs of implementing an organizational reconfiguration will negatively influence the performance of this decision. Firms' estimation ability is important as it determines future resource allocations to the pace of anticipated changes in the organization and the environment, and, as such, is a significant determinant for performance (Eisenhardt and Martin, 2000). However, in contrast to similar research investigating forecasting in external environments, such as market and industry growth (e.g. Durand, 2003; Makadok and Walker, 2000), this research emphasizes the importance of estimating the costs of organizational change and reconfiguration; an important topic that has only received scant research attention (Lavie, 2006, p. 161). This means that firms' ability to foresee the costs and consequences of organizational change is important to understand performance deviations. Initial cost estimations are likely to set expectations in the implementation process, and, as such, allocate and utilize resources in a most efficient manner. Future research should therefore put more emphasis on understanding the relationship between decision-making processes, the impact of the organizational design, and performance. In particular, research relating to understanding the different factors that ensure more or less effective strategic decision-making (measured by subsequent performance, see Dean and Sharfman, 1996) provide valuable grounds for future research.

This study also has some notable limitations that should be addressed in future research. In particular, due to the nature of the data, cost estimation errors—operationalized as deviations between expected and realized costs of implementing offshoring activities abroad—have been measured as a single item at a single point in time after the offshoring implementation. Although single-item measures have been found equally predictive as multi-item measures if the objective of the measure is singular and concrete (Bergkvist and Rossiter, 2007; Rossiter, 2002), future research should collect data for multiple item measures of cost estimation errors. Also,asking retrospectively about initial expectations may lead to an underestimation of cost estimation errors (however, the results still hold despite this conservative bias of the variable). Moreover, there is a theoretical time lag between cost estimation errors and performance that the data in this study do not capture. For example, the performance of the strategic decision may only materialize after a certain point of implementation maturity (that is not necessarily linear). While the maturity of the project is controlled for, future research could pay more attention to how different time frames resonate with performance. Thus, future research could endeavor to collect multiple data points on expectations and actual costs of implementation before and after the offshoring implementation as well as subsequent performance data. This would have obvious advantages to the design used in this paper.

In conclusion, this paper investigates the relationship between cost estimation errors, coordination mechanisms and offshore process performance, and contributes to an important discussion on the effectiveness of international decision-making. In particular, this paper argues that cost estimation errors create opportunity costs with detrimental process performance consequences, but that this is positively moderated by modularity and negatively moderated by ongoing communication. These insights contribute to scholarly debates on the topic of hidden costs in offshoring (e.g., Dibbern et al., 2008; Larsen et al., 2013; Stringfellow et al., 2008) as well as offshoring practice by highlighting the effects of cost estimation errors and different mechanisms to mitigate their performance deteriorating consequences. While this paper found the context of offshoring to be particularly beneficial for this purpose, especially as the phenomenon points to central added complexities and challenges of managing global enterprises (Kumar et al., 2009, Jensen et al., 2013; Srikanth and Puranam, 2011), the relationship between firms' estimation abilities, organizational design and performance needs to be further explored in other contexts.

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Table 1. Overview of offshored activities

Firm activity	Count
Production	*146 (62.13%)*
Production technology	4
Production improvement	2
Fabrication	93
Assembly	31
Test and quality assurance	1
Maintenance	2
Other	11
Services	*53 (22.55%)*
Finance/accounting	11
Human resources	0
Marketing and Sales	7
Information Technology	9
Call center/customer contact	3
Procurement	4
Logistics	6
Legal services	0
Engineering services	3
Other	9
R&D	*36 (15.32%)*
Core research	0
Product design	5
Product development	7
Software Development	21
Other	3

Table 2. Offshoring locations

Host location	Count	% of total
China	42	18.75%
Poland	27	12.05%
India	26	11.61%
Germany	10	4.46%
Slovakia	8	3.57%
Czech Republic	7	3.13%
Lithuania	7	3.13%
Sweden	6	2.68%
Estonia	6	2.68%
Thailand	6	2.68%
United States	6	2.68%
Great Britain	5	2.23%
Ukraine	5	2.23%
Norway	5	2.23%
Rumania	5	2.23%
Bangladesh	4	1.79%
Hungary	4	1.79%
Belgium	4	1.79%
Spain	3	1.34%
Turkey	3	1.34%
Latvia	3	1.34%
Other (22 locations)	32	14.29%
Sum	*224*	*100.00%*

Table 3. Operationalization of key theoretical constructs.

Dependent variable	**Process performance post offshoring (α = 0.77)** Please indicate on a 7-point Likert scale (1 = worse; 4 = no changes; 7 = better) the general effect of the offshoring activity post implementation regarding: 1) Flexibility 2) Quality 3) Productivity 4) Profitability 5) Costs demand
Independent variable	**Cost estimation errors** "*Has there been a difference between the expected costs of implementation before the offshoring was relocated and the actual costs of implementation after the offshoring activity was relocated?*" (1=actual cost levels lower than expectations; 4=actual cost levels meet expectations; 7=actual costs levels higher than expectations).
Moderating variables	**Modularity (α = 0.72)** For each of these items, please indicate on a 7-point Likert scale (1=nothing; 7=to a large extent) the degree to which the offshoring task is: 1) Specified with the purpose of easing coordination 2) Defined through overarching goals and guidelines 3) Defined through procedures, manuals and blueprints 4) Integrated with remaining activities at home (inversed item) 5) Coordinated based on formalization
	Ongoing communication (α = 0.70) For each of these items, please indicate on a 7-point Likert scale (1=nothing; 7=to a large extent) the degree to which the offshoring task is: 1) Coordinated based on personal contact 2) Defined through a high degree of cooperation with home unit 3) Defined by many interdependencies and interactions with home unit

Table 4. Summary statistics (n=224).

Variable	Mean	Std. dev.	Min.	Max.
Process performance	4.92	0.98	2.00	7.00
Cost est. error	-0.01	1.00	-3.31	2.87
Ongoing comm.	0.00	1.00	-3.61	1.62
Modularity	0.01	0.99	-3.34	3.10
Production	0.63	0.48	0.00	1.00
Service	0.21	0.41	0.00	1.00
Captive	0.63	0.48	0.00	1.00
Impl. year	1.31	0.65	0.69	3.26
Prior experience	0.68	0.47	0.00	1.00
Impl. size	2.83	1.45	0.00	8.52
Comp. size	6.39	1.95	3.40	12.52
HQ location	0.72	0.45	0.00	1.00
China	0.19	0.39	0.00	1.00
India	0.12	0.32	0.00	1.00
Poland	0.12	0.33	0.00	1.00
Asia	0.10	0.30	0.00	1.00
West Europe	0.19	0.39	0.00	1.00
East Europe	0.23	0.42	0.00	1.00
Cultural distance	3.53	1.02	0.77	5.57
Geographic distance	7.66	1.12	5.89	9.30
Strategy	2.91	1.73	1.00	7.00

Table 5. Correlation matrix and descriptive statistics (n=224)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Process performance	1.00																				
2	Cost est. error	-0.29*	1.00																			
3	Ongoing comm.	0.12	0.02	1.00																		
4	Modularity	0.14*	0.06	0.01	1.00																	
5	Production	0.12	-0.07	-0.05	0.09	1.00																
6	Service	-0.11	0.04	-0.01	0.06	-0.69*	1.00															
7	Captive	0.03	0.07	0.02	0.05	0.15*	0.00	1.00														
8	Impl. year	0.08	0.09	-0.03	0.09	-0.03	0.09	0.07	1.00													
9	Prior experience	0.03	-0.04	0.15*	-0.02	0.03	-0.06	0.09	-0.38*	1.00												
10	Impl. size	0.18*	0.00	0.10	0.13*	0.14*	-0.13	0.28*	0.17*	0.06	1.00											
11	Comp. size	-0.07	0.00	-0.05	0.15*	-0.23*	0.26*	0.14*	-0.07	0.18*	0.31*	1.00										
12	HQ location	0.11	-0.09	0.05	-0.17*	-0.31*	0.21*	-0.09	-0.10	-0.01	-0.10	-0.04	1.00									
13	China	0.02	-0.04	0.00	0.00	0.25*	-0.20*	0.11	0.11	0.09	0.19*	-0.06	-0.18*	1.00								
14	India	-0.10	0.05	-0.09	0.07	-0.36*	0.22*	-0.24*	-0.16*	-0.02	-0.06	0.23*	0.07	-0.17*	1.00							
15	Poland	0.09	-0.02	0.03	0.04	0.14*	-0.13	-0.03	0.00	-0.04	0.04	-0.08	-0.07	-0.18*	-0.13*	1.00						
16	Asia	0.01	0.09	0.11	0.05	0.00	-0.10	-0.03	-0.06	0.03	-0.04	-0.05	0.11	-0.16*	-0.12	-0.12	1.00					
17	West Europe	-0.12	0.09	-0.04	0.05	-0.13*	0.28*	0.08	0.09	-0.04	-0.09	-0.01	0.07	-0.23*	-0.17*	-0.18*	-0.16*	1.00				
18	East Europe	0.06	-0.11	0.08	-0.17*	0.04	-0.08	0.03	0.03	-0.03	-0.05	0.02	-0.03	-0.26*	-0.20*	-0.20*	-0.18*	-0.26*	1.00			
19	Cultural distance	0.15*	-0.11	0.01	0.02	0.18*	-0.27*	0.03	-0.03	0.05	0.22*	0.04	0.05	0.27*	-0.10	0.22*	0.12	-0.51*	0.08	1.00		
20	Geographic distance	0.03	0.06	-0.08	0.07	0.00	-0.12	-0.05	-0.11	0.10	0.10	0.05	0.02	0.51*	0.32*	-0.35*	0.34*	-0.46*	-0.40*	0.34*	1.00	
21	Strategy	0.29*	-0.03	0.14*	-0.01	-0.19*	-0.03	0.02	0.12	-0.08	0.12	-0.06	0.22*	0.00	0.04	-0.10	0.09	-0.03	-0.01	0.01	0.13	1.00

* indicate significance levels at 5%.

Table 6. Hierarchical regression models with offshore process performance as DV.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Cost est. error		-0.262***	-0.266***	-0.266***	-0.269***	-0.282***	-0.251***	-0.267***
		[0.0700]	[0.0672]	[0.0710]	[0.0679]	[0.0619]	[0.0642]	[0.0604]
Modularity			0.157*		0.152*	0.0806	0.138†	0.0831
			[0.0742]		[0.0766]	[0.0762]	[0.0721]	[0.0769]
Ongoing comm.				0.0823	0.0734	0.0928	0.081	0.0948
				[0.0704]	[0.0677]	[0.0650]	[0.0627]	[0.0638]
Cost est. error *						0.154*		0.127*
Modularity						[0.0636]		[0.0633]
Cost est. error *							-0.153*	-0.108†
Ongoing comm.							[0.0705]	[0.0654]
Production	0.425*	0.357†	0.267	0.376*	0.286	0.351†	0.286	0.339†
	[0.198]	[0.185]	[0.186]	[0.185]	[0.188]	[0.189]	[0.186]	[0.189]
Service	0.225	0.181	0.097	0.179	0.098	0.197	0.117	0.193
	[0.248]	[0.227]	[0.226]	[0.230]	[0.229]	[0.233]	[0.229]	[0.232]
Captive	-0.0883	-0.0344	-0.0305	-0.031	-0.0275	-0.0834	-0.039	-0.0816
	[0.143]	[0.137]	[0.136]	[0.136]	[0.135]	[0.138]	[0.135]	[0.137]
Impl. year	0.0189	0.0233	0.0197	0.0243	0.0207	0.0186	0.0161	0.0157
	[0.0156]	[0.0151]	[0.0157]	[0.0152]	[0.0158]	[0.0157]	[0.0161]	[0.0160]
Prior experience	0.199	0.181	0.18	0.151	0.153	0.0972	0.106	0.0739
	[0.151]	[0.142]	[0.143]	[0.147]	[0.149]	[0.148]	[0.144]	[0.146]
Impl. size	0.0956†	0.0973†	0.0919†	0.0893†	0.0849†	0.0928†	0.0937†	0.0977†
	[0.0542]	[0.0512]	[0.0519]	[0.0507]	[0.0512]	[0.0510]	[0.0516]	[0.0514]
Comp. size	-0.032	-0.0358	-0.0454	-0.0311	-0.0409	-0.0228	-0.0355	-0.0221
	[0.0370]	[0.0348]	[0.0349]	[0.0354]	[0.0354]	[0.0364]	[0.0345]	[0.0365]
HQ location	0.245	0.187	0.247	0.184	0.242	0.226	0.269	0.248†
	[0.158]	[0.154]	[0.151]	[0.153]	[0.150]	[0.147]	[0.149]	[0.147]
China	-0.259	-0.255	-0.204	-0.302	-0.247	-0.268	-0.234	-0.255
	[0.251]	[0.223]	[0.214]	[0.226]	[0.219]	[0.224]	[0.217]	[0.222]
India	-0.23	-0.153	-0.186	-0.169	-0.199	-0.214	-0.199	-0.212
	[0.314]	[0.273]	[0.262]	[0.275]	[0.264]	[0.261]	[0.263]	[0.261]
Poland	0.324	0.586	0.586	0.584	0.584	0.437	0.579	0.459
	[0.465]	[0.419]	[0.427]	[0.414]	[0.426]	[0.428]	[0.429]	[0.431]
Asia	-0.233	-0.117	-0.139	-0.186	-0.199	-0.219	-0.132	-0.168
	[0.242]	[0.231]	[0.220]	[0.237]	[0.228]	[0.227]	[0.236]	[0.234]
West Europe	-0.098	0.157	0.137	0.173	0.151	-0.0781	0.122	-0.0585
	[0.454]	[0.399]	[0.394]	[0.392]	[0.392]	[0.398]	[0.374]	[0.391]
East Europe	0.168	0.347	0.404	0.334	0.39	0.237	0.394	0.267
	[0.401]	[0.349]	[0.355]	[0.344]	[0.355]	[0.351]	[0.354]	[0.353]
Cultural	0.0412	0.00191	-0.0113	0.00333	-0.00968	-0.00534	-0.0178	-0.0118
distance	[0.0849]	[0.0814]	[0.0824]	[0.0806]	[0.0820]	[0.0811]	[0.0823]	[0.0813]
Geographic	0.109	0.216	0.209	0.241	0.232	0.171	0.224	0.177
distance	[0.171]	[0.156]	[0.160]	[0.154]	[0.161]	[0.160]	[0.160]	[0.160]
Strategy	0.160***	0.149***	0.143***	0.143***	0.138***	0.140***	0.140***	0.142***
	[0.0364]	[0.0362]	[0.0349]	[0.0360]	[0.0349]	[0.0344]	[0.0351]	[0.0347]
Intercept	2.783*	2.062	2.289†	1.896	2.134	2.563*	2.192†	2.528
	[1.411]	[1.279]	[1.314]	[1.251]	[1.299]	[1.302]	[1.295]	[1.295]
N	224	224	224	224	224	224	224	224
F-values	3.31***	4.15***	4.77***	3.96***	4.66***	5.08***	4.85***	4.95***
R^2	0.178	0.243	0.265	0.249	0.27	0.293	0.286	0.301

†, *, ** and *** indicate a significance level of 10%, 5%, 1% and 0.1%, respectively.
Robust standard errors reported in brackets. The main variables standardized.

Figure 1. Two-way interaction on process performance with modularity.

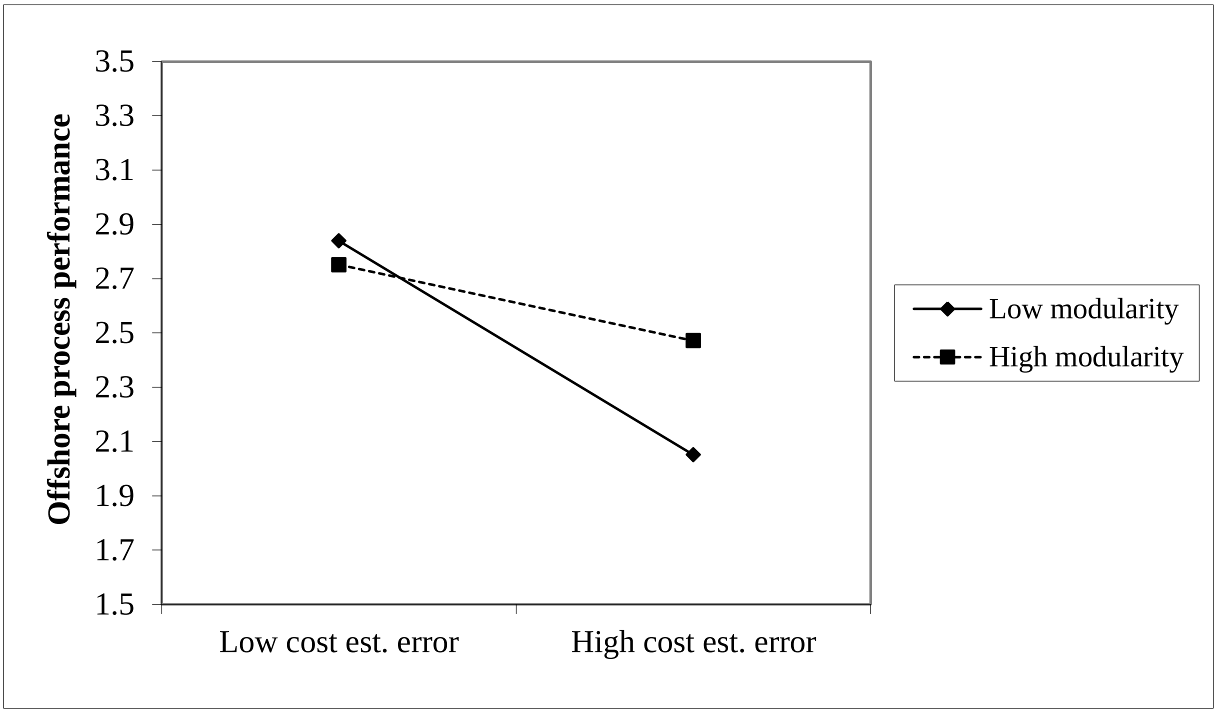

Figure 2. Two-way interaction on process performance with ongoing communication.