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PROJECT MANAGERS' SKILLS AND PROJECT SUCCESS IN IT OUTSOURCING

Les compétences des chefs de projet et le succès d'un projet de sous-traitance informatique

Completed Research Paper

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Abstract

What skills do project managers (PMs) need, and how do these skills impact project success in IT outsourcing? In this study, we seek to identify what factors impact IT project outcomes, such as costs and client satisfaction, given the project characteristics and PM's hard and soft skills. We examine data collected from a field study conducted at a major IT service provider in India. Our results suggest that while hard skills such as technical or domain expertise may be essential in a PM, soft skills, such as tacit knowledge of organizational culture and clients, are more important for project success. The results are robust to different specifications.

Keywords: IT outsourcing, IS Project Management, IS/IT Governance, IT/IS professionals

Résumé

L'article porte sur l'importance des compétences techniques et des qualités humaines des chefs de projet, pour le succès de leur mission dans le domaine de la sous-traitance informatique. L'étude repose sur l'analyse de données collectées lors d'une étude de terrain menée auprès l'un des principaux fournisseurs de services informatiques en Inde. Les résultats montrent que les qualités humaines telles que la connaissance de la culture d'entreprise et celle de ses clients ont autant d'importance que les compétences techniques pour le succès du projet. Nos résultats peuvent aider les directeurs informatique à mieux former les chefs de projet.

Introduction

Information Technology (IT) outsourcing is a growing industry. More and more firms are outsourcing their IT assets to external vendors. Typically, the IT outsourcing activities are formalized as different projects, which may involve building a new software application, or maintaining an existing software application. From both the vendors' and the clients' perspectives, the assignment of the right person to lead a project is very important. For the client, having the right person in charge helps ensure better project outcomes in terms of higher software quality, lower risk of project failure, and more peace of mind. For the vendor, better project management reduces the risk of project failure and translates to favorable project outcomes like lower costs and higher client satisfaction.

Selecting the right person to lead a software project is a challenging task. For larger vendors – who have access to a myriad pool of talent and a vast divergence in projects – this is especially important and especially difficult to do well. This selection predicament is compounded in the case of IT outsourcing projects. An inadequate approach to project resource assignment can have severe consequences. A common characteristic of failed projects is the lack of effective project management (for example, see Applegate et al. 1996). Poor project management can not only impact a firm strategically, economically, or culturally; but may also jeopardize client relationships, result in project cost overruns and tarnish the project team's spirit. Over the long term, the goal for an organization is to build capabilities that lead to an improved cost structure, and thus the resource allocation can be viewed as a strategic tool (Venkatraman and Prescott, 1990).

The need for selecting a suitable project manager (PM) is well recognized, and the extant literature has prescribed various skills that a PM needs. However, there is relatively little knowledge about how different PM skills affect project outcomes. Our goal is to understand which PM skills are most valuable for project success, in the context of IT outsourcing. Our study brings together two strands of research: literature related to software project management and IT personnel skills.

Lee et al. (1995) suggest that IT professionals need to have multi-dimensional skills; i.e., IT professionals should be well versed in not only the technology and application domains but also in interpersonal and management skills. Kirsch (2000) has highlighted that successful project management requires both hard and soft skills. Hard skills comprise technological skills, domain expertise, experience – including overall IT experience as well as project management experience, and project management skills such as planning, monitoring, risk management and scheduling. Soft skills are intangible, and are primarily concerned with managing and working with people and fostering inter- and intra- organizational "relationships." Such skills include but are not limited to organizational knowledge, tacit knowledge in handling people within the organizational structure, leadership and management skills, and customer handling skills (Becker, 1975; Lee et al., 1995; Kirsch, 2000). Thite (1999) has emphasized that both technical and transformational leadership skills are required of IT managers. Similarly, prior research (e.g., Byrd and Turner, 2001) implies that both hard and soft skills are necessary in IT professionals to achieve higher performance. However, to the best of our knowledge, there has been no study that measures the direct impact of the PM's skills, especially soft skills, on project success.

While IT professionals' skills have been explored with respect to project performance (e.g., Martin et al., 2004), we provide a unique perspective of these in the specific context of IT project management. We especially focus on the skills that a PM brings to the project as the PM is critical to project success. We conceptualize the PM's hard skills as task familiarity, and we draw upon the literature on Practical Intelligence (Joseph, et al. 2008; Wagner and

Sternberg 1985) to conceptualize the PM's soft skills. We then develop a theoretical model that links a PM's task familiarity and soft skills to project performance.[1]

We evaluate our theoretical model using detailed archival longitudinal data and the critical incidents methodology. A key advantage of our longitudinal data is that we can observe multiple projects for each PM, and can thus isolate the effects of the PM's skills from the project characteristics. Our data were collected from a leading IT outsourcing vendor, and include project and personnel level archival data from 530 projects completed over a four year time period. We use archival data to measure PM hard skills. In addition, following the approach of Joseph, et al. (2008) and Wagner and Sternberg (1985), we employ the critical incidents methodology to assess the soft skills of the 209 PMs who led those projects. Our data and research setting allow us to study the differing impact of hard and soft skills on various project outcomes.

We find that after controlling for project characteristics and team attributes, both the PM's hard skills and soft skills have a significant favorable impact on project performance including cost performance and client satisfaction. This is an especially important finding in the case of IT outsourcing projects, where both project costs and client satisfaction can be important determinants of vendor profits and market share. We also find that the PM's hard skills can improve project performance, but the impact is less compared to that of the PM's soft skills.

Our research contributes to the existing software project management literature in the following ways. First, we measure different kinds of PM skills in our analysis. In particular, we draw upon aspects of task familiarity to measure the PM's hard skills and we adapt and develop a soft skills measure for PMs. Second, we relate measures of PM skills to project performance. Our results provide unique empirical evidence of the importance of soft skills in a PM using a rich dataset and rigorous methods, thereby establishing the critical role of soft skills in this context. While previously the literature has discussed what skills a PM needs, these studies have been prescriptive in nature. To the best of our knowledge, there has been no research that quantifies how different kinds of PM skills impact software project performance outcomes. Finally, while prior articles have stated that both hard and soft skills in a PM are desirable, our study highlights a tension between these different dimensions of PM's skills set, that is, we are able to explore in detail which of the skills are more valuable for different project outcomes.

This paper is organized as follows. In the next section, we present our hypotheses. The methodological section describes both our qualitative and quantitative data sets and our empirical strategy. This is followed by our analysis and results. Finally, we discuss the results and conclude with managerial implications from this study and suggestions for further research.

Relevant Literature and Hypotheses

IT projects, especially in the outsourcing world, are complex (Kirsch, 1996; Weinberg, 1998) and require multifaceted management skills. A PM has to manifest not only project management related skills (Kirsch, 2000), but also technical and domain expertise as required by the project (Thite, 1999). Project management activities include but are not limited to defining project scope and requirements gathering, managing resources and relevant training issues within a project, advising about technical architecture, identifying specific and general project management practices and escalation procedures, estimating project schedule and budget, ascertaining and managing risks within a project, preparing risk mitigation plans, ensuring adherence to organizational quality frameworks, effectively managing change control, and reporting project status to various stake holders (Duncan, 1996; Martin et al., 2004).

Software development or maintenance requires coordination within the project team (Kraut and Streeter, 1995). In the case of IT outsourcing, PMs also interface with the client (Hirscheim et al., 2002; Lacity and Willcocks, 2001). More often than not, IT project teams are distributed geographically (onsite and offshore), making coordination issues a greater challenge (Espinosa et al., 2007). PMs are thus expected to (i) provide technical and domain leadership, (ii) manage geographically and organizationally distributed teams, (iii) interact with the clients, and (iv) coordinate with all of the stake holders across inter- and intra-organizational boundaries. Hence, consistent with the literature, we would expect that a PM needs a judicious mix of hard and soft skills for effective project management.

[1] Table 1 summarizes the extant literature on IT personnel skills.

It is well known that IT projects have multi-dimensional outcomes. Project performance is often assessed in financial terms, which can be measured in two ways, project margins or profits, and costs (Deephouse et al., 1995). While project profits may depend on a number of factors beyond the PMs' control, PMs can, however, influence project costs (Nidumolu and Knotts, 1998), and thus project cost performance is a good indicator of project success in this context. Furthermore, especially in IT outsourcing, projects are evaluated by clients; clients are considered crucial stakeholders in defining and assessing project success. As Ethiraj et al. (2004) observe, maintaining client relationships is a key to success in the vendor market for IT outsourcing. Many vendors view client satisfaction as an important project outcome measure, as it can lead to further assignments with the same client.[2] Since achieving different project outcomes may require different kinds of skills we examine the impact of PM hard and soft skills on these two dimensions of project success.

PMs are likely the most senior people within a project. They are often perceived as sounding boards for technical and architectural decisions made for projects. In addition, as more strategic functions are IT enabled and outsourced, PMs are also expected to demonstrate a deep knowledge of the business objectives of the IT system being provided (Bloom, 1996). We conceptualize PM hard skills in terms of *task familiarity*, that is, we assess the hard skills needed by the project relative to what the PM brings on board. As an example, a PM who is an expert in object oriented technology may not be able to successfully lead a project in say, mainframe technology. Similarly, domain experience may also be equally necessary in the PM. Prior literature has shown that task familiarity helps in improving performance (e.g., Campbell, 1988; Goodman and Leyden, 1991). Prior exposure to the project characteristics such as technology, domain, or methodology would make the current task more familiar to the PM, and hence improve performance (for example, see Boehm, 1981; Brooks, 1995; Curtis et al., 1988; Banker and Slaughter 2000). Task familiarity is especially important in the case of software projects (Espinosa, et al. 2007). As Kirsch (2000) and Thite (1999) suggest, PMs should be able to take on the leadership role with respect to not only managing the project but also leading the technological initiatives. PMs should be able to advise team members as well as the clients on the various technology options available. They should understand the business needs of the application software being built or maintained, and realize its interdependence on other application software. Such familiarity should lead to lower coding and testing errors, improving efficiency and thus having positive impact on performance outcomes such as project costs, budget and schedule. A high task familiarity on part of the PM would make the client also feel more comfortable, knowing that the project is in good hands. Thus, the more relevant hard skills a PM brings to the project, the greater would be the probability of project success. This suggests that:

H1A*: A higher level of PM hard skills is associated with higher project performance, given project and team characteristics.*

Although a PM's greater task familiarity should promote better project performance along all dimensions, we would expect that this task familiarity would be especially beneficial for project cost performance. A software project's cost performance reflects the technical efficiency of the team in converting inputs and resources such as experience, time, tools, and methodologies into software code (e.g., Banker et al., 1991). The PM's task familiarity should help the team to be more efficient, since a more familiar PM would be able to identify the appropriate technical tasks that must be completed, estimate how long the tasks will take to complete, determine the sequence of the tasks and effectively monitor task completion. Thus, we expect that:

H1B*: PM hard skills will have a greater impact on project cost performance than on client satisfaction, given project and team characteristics.*

While hard skills are essential in PMs, soft skills are especially important for PMs because of the nature of the PM's role not only within the project team – requiring intangible management skills – but also in the organizational and client relationship structure. Lee et al. (1995) follow extant literature to argue that interpersonal and management skills are critical for IT professionals, the more so because of the boundary spanning role that these professionals must assume. In the outsourcing world, the PMs have to interact with many stakeholders. They have to not only manage internal project teams, their peers and superiors, but also interact with clients, using skills that are essentially non-technical in nature, and which may not be easily imitable. These include but are not limited to organizational knowledge, tacit knowledge in handling people within the organizational structure, leadership and management skills, and customer handling skills (Becker, 1975; Lee et al., 1995; Kirsch, 2000). Within project teams, as individuals progress from technical roles to more managerial roles, these skills come into play, and help in

[2] As marketing wisdom proclaims, it takes considerably lower costs to retain an existing client than to engage a new client. The same holds true for IT outsourcing industry.

effective project management. Wagner and Sternberg (1985) focus on skills that are tacit, and gained through experience rather than being taught in a classroom. They classify these skills as related to managing self, others, and career. They find that differences in these skills between a novice and an expert are consequential for career performance in professional and managerial career pursuits. Further, for many IT vendors, the PMs are rated on their performance on the project; hence we assume that there exists an alignment between project outcomes and PMs' project performance. Because these goals are aligned, we argue that soft skills are correlated with PM's performance, and hence also with positive project outcomes. Thus, we hypothesize that,

H2A: *A higher level of PM soft skills is associated with higher project performance, given project and team characteristics.*

Soft skills help a PM coordinate more effectively with various stakeholders within the project team and thus help with the project's finances. However, a PM's soft skills should be even more advantageous in facilitating client satisfaction. A PM can use soft skills to build an effective relationship with a client (Joseph, et al. 2008). A good relationship should help the PM to cope with and manage client expectations more effectively, resulting in a happier client. Therefore,

H2B: *PM soft skills will have a greater impact on client satisfaction than on project cost performance, given project and team characteristics.*

We have argued that a PM's hard skills will benefit project cost performance more than client satisfaction, while a PM's soft skills will benefit client satisfaction more than project cost performance. A further question is whether the PM's hard and soft skills will equally impact each of these project performance dimensions. That is, will the PM's hard skills or soft skills have a greater impact on project cost performance? Will the PM's hard skills or soft skills have more influence on client satisfaction? To evaluate these questions we draw upon human capital theory (Becker 1975). Human capital theory distinguishes between general and specific human capital. General human capital comprises technological skills, domain expertise, experience – including overall IT experience as well as project management experience, and project management skills such as planning, monitoring, risk management and coordination. An individual can use general human capital to increase productivity in many firms. Specific human capital utilizes skills that are intangible, and may be specific to a particular firm or environment (Becker, 1975; Lee et al., 1995; Kirsch, 2000). We can thus broadly conceptualize general human capital as hard skills and specific human capital as soft skills. Slaughter, et al. (2007) show that IT managerial jobs require higher levels of firm-specific human capital compared to other IT jobs such as programming. Thus, as per the human capital theory, PMs with higher levels of firm-specific capital are expected to be more productive and hence more valuable compared to PMs with lower levels of firm-specific capital, given the nature of their job. As stated earlier, this notion is consistent with that of practical intelligence, where individuals need to tailor their skills to the environment (Sternberg and Hedlund, 2002). The core competency of a PM when dealing within the technical project environment would be general and hence more influenced by the PM's hard skills, whereas the core competency of the PM dealing with external stakeholders would not be general, but highly tailored to the environment, and hence firm-specific and more influenced by the PM's soft skills. It follows that a) hard skills or general human capital will be more beneficial for project cost performance outcomes than will soft skills and that b) soft skills or firm-specific human capital will be more beneficial for client satisfaction outcomes than will hard skills. Therefore:

H3: *The PM's hard skills will have a greater impact on project cost performance than soft skills. However, the PM's soft skills will have a greater impact on client satisfaction than hard skills.*

Methodology

To empirically validate our hypotheses, we conducted a field study with a leading IT outsourcing vendor in India. The vendor has expertise in software development and maintenance of complex IT business systems and provides IT services for multiple domains such as banking and finance, retail, telecommunications, etc. The vendor deploys stringent quality processes and has been assessed at CMM level 5. The organizational policies with respect to project management are thus perceived to be flexible yet measurable. We collected data from the vendor on 530 IT outsourcing projects executed between 2002 and 2006 which involve 209 project managers. The data include both archival and critical incidents data. We first describe the data and then define measures of key variables as well as the controls used in our analysis.

The archival data for the IT projects include financial data, resource allocation data, project characteristics, and personnel data. As Espinosa et al. (2007) note, archival data are objective and impervious to response bias or response rates, making them ideal for performance studies. The financial data include project costs, profits and operating margins in USD.[3] The project resource allocation data are detailed, and specify which employee was allocated to which project, in what capacity, and for what duration. The data on project characteristics include project type (development or maintenance), contracting type (fixed price or time and materials), project technology (whether low level or high level, including the Caper Jones language level indicator), client id, project duration, and project domain. The personnel data include PM and team members' performance ratings as well as details on their total work experience. The data also contain client feedback reports for these projects, which are on a scale of 1 (very dissatisfied) to 7 (very satisfied). Following the approach of Wagner and Sternberg (1985) and Joseph, et al. (2008), we use the critical incident methodology to collect data on PM soft skills. The measurement of the variables in our analysis is described below.

Project Outcomes

We consider two dimensions of project outcomes: (i) financial outcomes, that is, project costs, and (ii) client satisfaction. Cost performance is a key variable related to project success because an increase in costs is akin to a decrease in performance. To aid in interpretation of the results, we follow Espinosa et al. (2007), and compute our cost performance variable as -1*log(Cost). In the preceding discussion, we similarly elucidated that client satisfaction is an important dimension of project performance (e.g., Kekre et al., 1995; Aladwani, 2000). In a typical development project, clients are asked for feedback at the end of project lifecycle or at an end of an important project phase. For maintenance projects, these feedbacks are solicited to gauge the health of the project so that appropriate action can be taken with regard to project renewal.

All of these outcome measures are closely related to efficient project management, and hence appropriate in the context of the current study.

Measuring PM's skills

We measure a PM's skill set across the two basic dimensions distinguished in the literature: hard skills and soft skills (Kirsch, 2000). As stated earlier, we conceptualize hard skills as task familiarity. Although the CMM maturity level of the vendor may moderate the impact of such PM skills (Kemerer, 1987), in our sample, the projects had been assessed at the same CMM level. Furthermore, Kirsch (2000) suggests that the processes designed to aid project management in mature organizations can complement the PM's experience and skill level.

We assess the PM's average prior experience in project technology, domain and methodology in number of years, and use that as a measure of hard skills or PM's task familiarity (Krishnan, 1998). Discussions with industry experts reveal that domain expertise is crucial when interacting between the client and the design team. As Lee et al. (1995) point out, the focus of IT activities is the effective application of IT to meet business needs. When the client outsources, a PM with an in-depth business functional knowledge necessary for the project is an important asset to the team. IT systems are often seen as strategic assets (Ethiraj et al., 2004), and hence clients need their IT systems to align to their organizational structure and processes to maximize the value of these systems. Domain or functional knowledge is essential not only from the vendor's perspective but is also prized by clients. In addition to domain expertise and project management skills, a PM has to manifest technological expertise appropriate to the project requirements. One of the PM's activities is to make the technology accessible to the client, and also to examine what business needs and functional requirements from the IT system can or can not be handled by the technology being employed by the project. Further, the literature has suggested that maintenance and development projects may require different frameworks and management styles (Swanson and Beath, 1990, Gopal et al., 2003); therefore we include methodology experience in our hard skills measure.

While the importance of practical intelligence and soft skills in IT professionals is well established, such skills are not easily assessed. Following Wagner and Sternberg (1985) and Joseph, et al. (2008), we measure these skills using

[3] 70% of the projects executed in our sample had the base currency as USD. When projects were delivered in countries other than USA, the currency was specified. The other currencies included CAD (Canadian dollar), EURO, GBP (Great Britain pound), or AUD (Australian dollar). We converted these to USD using the historical exchange rates at the time of project transaction. These historical rates are available from US Federal Reserve Board's website (http://www.federalreserve.gov/releases/h10/Hist/, retrieved 07/01/2007).

the critical incident methodology, along the seven dimensions defined by Wagner and Sternberg: managing tasks, self, career, peers, subordinates, superiors, and clients. For PMs, managing tasks relates to soft skills that they utilize while performing project management related activities, such as costing and project planning. In managing careers, PMs display acumen in managing short and long term career growth goals. In managing self, PMs manifest self-regulation strategies of applying self-motivation and self-organizational aspects of individual performance with the objective of improving one's productivity, for example, prioritizing project activities. Finally, because management is an interactive activity, an important soft skill dimension for PMs is managing others. PMs have to manage not only their team members, but also collaborate with their peers and their superiors. This skill is further demonstrated when interacting with external entities like clients, especially in the outsourcing scenario. Joseph et al. (2008) include superiors, subordinates (permanent or contract), peers, users, clients and vendors in their definition of "others." We find, however, that for IT vendors, "others" include superiors, subordinates, peers, and clients.

Critical incident collection: The critical incidents were gathered from an expert panel at the research site along each dimension of practical intelligence mentioned above. These experts had executed at least five projects as project managers; they were not included in the PMs in our sample. We had a total of 32 questions in our incident bank. We created eight separate instruments, where we randomized the question for each dimension from our incident bank. We then randomly administered one of the eight instruments to the PMs corresponding to the projects. Each PM in the sample was thus asked to respond to seven critical incidents (corresponding to the dimensions mentioned above). An example of the critical incident in the client dimension is: "You are the onsite PM for a project which is being transitioned from another vendor. Unfortunately, the knowledge transfer necessary for the transition is not happening, and the other vendor has support from client middle management. What would you do to ensure that you take on the project smoothly?" PM responses were captured in a detailed essay type format.

Critical Incident Evaluation: We received complete responses from 209 PMs.[4] At the time of incident collection, we had asked the expert panel for a sample good, average, and bad response. Detailed evaluation instructions were prepared using the expert panel's response guidelines. The detailed responses – seven in all from each respondent – were evaluated by a panel of four experts with requisite credentials. Each evaluator had considerable experience in IT as well as project management, in addition to having worked in or been exposed to outsourcing projects; the evaluators also had graduate degrees. Each response was evaluated on a scale of 1-7, so that each respondent could score a minimum of 7 and a maximum of 49 points. We computed inter rater reliability measures for each of the respondents in each dimension, and found that these were over 0.96, suggesting substantial agreement among evaluators. Note that by following Wagner and Sternberg's conceptualization of practical intelligence, we can empirically measure a PM's ability to manage the project as well as that of managing others (including clients). We conducted a factor analysis of the evaluations, using a varimax rotation (Harman, 1967). A single factor emerged from this analysis; suggesting that the PM's abilities in these separate dimensions are correlated. We use the factor loadings from this analysis as a measure of PM soft skills.

Project controls

We measure project control variables as follows:

Project complexity is assessed in terms of the factors contributing to higher coordinative complexity: project size, schedule pressure, and team size. Prior literature suggests that project size, measured in function points (FP), is indicative of project complexity (Kemerer, 1987 and 1993; Shenhar, 2001). Schedule pressure is also a measure of scheduling complexity, as greater pressure to finish a large project in a short time period requires more coordination effort. Further, as team size increases, coordination and other issues arise, requiring more complex management skills (e.g., Kraut and Streeter, 1995; Nidumolu, 1995; Koushik and Mookerjee, 1995). Geographical dispersion of the team also increases coordination complexity (e.g., Espinosa et al., 2007). The data allow us to directly measure project size in terms of both software functionality (e.g., Boehm, 1983; Gopal, 2003) and team size. We used the baseline measure spreadsheets provided by the vendor to compute project size in terms of function points and computed team size based on the number of individuals who worked on the project. To measure schedule pressure, we use project's FP count and team size, and normalize it by the project duration in months. Geographical

[4] Not all 300 PMs in our original data set responded to the questionnaire. We conducted statistical tests to check for any non-response bias. T-tests of means for experience and performance ratings for the PMs in our sample and the larger population of PMs at the research site indicated no significant differences, suggesting that there was no selection bias in the response to our survey.

dispersion is measured as the ratio of onsite versus total effort in a project, and calculated directly from the allocation data for each project.

Project familiarity is measured with two constructs: team and client familiarity. The literature suggests that prior familiarity between team members enhances coordination and hence impacts project performance (for example, Crowston and Kammerer 1998; Curtis et al. 1988; Faraj and Sproull 2000; Espinosa et al., 2007). We developed a team familiarity measure following Espinosa et al. (2007). For this, we assigned a count variable for each team member. We then examined the allocation data, and increased the count variable by one if a team member had worked with another prior to the current project. We did this for each team member, summed it up at the project level, and normalized it by the number of team dyads.[5] Interviews at the research site confirmed that clients are indeed the most crucial external entities that a PM has to deal with. A PM's prior experience with the same client may thus ameliorate project outcomes, especially client satistfaction, for the better (Ethiraj, et al., 2004; Duncan, 1996). Hence we include PM's prior client experience to control for client familiarity. We also include a dummy to indicate whether the client was familiar to the vendor before the current project execution, because a familiar client would need less hand holding; the vendor may have a rapport with the client which can also ease communication, understanding, and problems with the client.

Other controls: We control for other PM, team, and project characteristics in our analysis. For the PM, we control for PM's prior performance rating; we averaged historical performance ratings data for each PM at the start of the project. Joseph et al. (2008) find that soft skills are also correlated with the work experience of the IT professional. Thus we control for the PM's IT and project management experience (at the start of the project). We also control for PM learning as indicated by the number of prior projects completed by the PM before the start of the current project.

Project team characteristics, such as average IT experience within the team and average hard skills at the team level, also impact project outcomes. At the project level, we control for organizational learning, as proxied by prior projects completed within the client organization. Factors such as project contracting types may also impact project outcomes (Gopal et al., 2003). For example, fixed price contracts are usually very closely monitored, and hence a tighter control over budget may be exercised, leading to lower project costs. Similarly, time and materials contracts are usually maintenance or repeat contracts with an existing client, with whom the vendor may already have established a rapport, and hence may lead to favorable satisfaction. Finally, we controlled for project type (whether maintenance or development) and project technology (whether third or fourth generation language). Variables such as project cost and function points were transformed using logs. Further, prior to analysis, we standardized each variable in the analysis to facilitate interpretation of coefficients (Aiken and West, 1991).

Analysis and Results

We develop the following model to test our hypotheses for project *i* and PM *j*:

$$\begin{aligned}
CostPerformance_i = {} & \alpha_0 + \alpha_1.\log(FP)_i + \alpha_2.SchedulePressure_i + \alpha_3.AvgTeamExp_i + \alpha_4.TeamSize_i \\
& + \alpha_5.TeamFamiliarity + \alpha_6.TeamHardSkills_i + \alpha_7.OnsiteRatio_i + \alpha_8.PriorProjectOrg_i \\
& + \alpha_9.ContractType_i + \alpha_{10}.ProjectType_i + \alpha_{11}.ProjectTechnology_i + \alpha_{12}.PMRating_{ij} \\
& + \alpha_{13}.ITWorkEx_{ij} + \alpha_{14}.PMWorkEx_{ij} + \alpha_{15}.PriorProjectPM_{ij} + \alpha_{16}.SoftSkills_j \\
& + \alpha_{17}.ClientExp_{ij} + \alpha_{18}.HardSkills_{ij} + \varepsilon_{1i} \\
ClientSatisfaction_i = {} & \beta_0 + \beta_1.\log(FP)_i + \beta_2.SchedulePressure_i + \beta_3.TeamSize_i + \beta_4.TeamFamiliarity \\
& + \beta_5.TeamHardSkills_i + \beta_6.OnsiteRatio_i + \beta_7.PriorProjectOrg_i + \beta_8.dVendorClient_i \\
& + \beta_9.ContractType_i + \beta_{10}.ProjectType_i + \beta_{11}.ProjectTechnology_i + \beta_{12}.PMRating_{ij} \\
& + \beta_{13}.ITWorkEx_{ij} + \beta_{14}.PMWorkEx_{ij} + \beta_{15}.PriorProjectPM_{ij} + \beta_{16}.SoftSkills_j \\
& + \beta_{17}.ClientExp_{ij} + \beta_{18}.HardSkills_{ij} + \varepsilon_{2i}
\end{aligned}$$

[5] For example, let a team contain members A, B, and C. Suppose A and B have worked together 3 times in the past, and A& C have worked twice in the past, the familiarity variable for the current project is 5. Normalizing it by the possible number of team dyads, we obtain a normalized team familiarity measure as 5/3.

We assume that the error terms in the two equations are correlated, and estimate the model using the Seemingly Unrelated Regression (SUR) technique.[6] The results are provided in Table 2. We inspected the model for multicollinearity by conducting regression diagnostics; we computed condition indices (Belsley et al., 1970) and variation inflation factors (Marquardt, 1970). These collinearity statistics are also reported in Table 2. Further, we tested for heteroskedasticity using White's test (White, 1980), and for autocorrelation using the Durbin-Watson test (Greene, 2002). These tests did not reveal any problems.

We first estimated a baseline model, without adding any of the PM skills variables; and then sequentially added the PM skills variables: soft skills, client experience, and hard skills.[7] We find that this increased the explanatory power of the model significantly, especially for the client satisfaction equation (Performance: ΔR^2 =0.0195, $F_{\Delta R^2}$ = 5.432, p < 0.005; client satisfaction: ΔR^2 =0.150, $F_{\Delta R^2}$ = 34.099, p < 0.0001). This suggests that PM's skills are important predictors of project outcomes like performance and client satisfaction.

Results

We first discuss the coefficient estimates of project complexity and familiarity and the control variables, and then the impact of PM skills.

We find that the effects of the complexity, familiarity and control variables are largely as expected. Project size significantly decreases cost performance (α_1 = -1.301, p < 0.01); however, we find that project size is associated with an increase in satisfaction (β_1 = 0.192, p < 0.05). This perhaps is indicative of the fact that although executing more complex projects decreases project performance with respect to budget constraints, the final delivery resulted in higher client satisfaction.[8] As expected, schedule pressure negatively and significantly impacts both project cost performance and client satisfaction (α_2 = -0.270, p < 0.10; β_2 = -0.255, p < 0.01). When there is higher schedule pressure, that is, when a complex project has to be executed in a shorter duration of time, project costs tend to increase. In addition, there is a higher likelihood of quality setbacks and schedule slippage, perhaps leading to decreased client satisfaction. Team level attributes have varied impacts on project outcomes. Team familiarity and team hard skills are associated with an increase in both cost performance and client satisfaction (α_5= 0.406, p < 0.01; β_4 = 0.107, p < 0.05; α_6= 0.678, p < 0.01; β_5 = 0.072, p < 0.05). Likewise, average team experience increases project cost performance (α_3 = 0.475, p < 0.01). Team size is associated with a decrease in cost performance but an increase in client satisfaction (α_4 = -0.297, p < 0.05; β_3 = - 0.112, p < 0.05). At the project level, we find that the onsite ratio is associated with a decrease in project cost performance, but an increase in client satisfaction (α_7= -0.536, p < 0.01; β_6 = 0.082, p < 0.05). This has implications for optimal onsite ratios for IT outsourcing projects; maintaining higher onsite ratios would lead to higher client satisfaction but also to greater project costs. Organizational learning can also help increase cost performance (α_8= 0.262, p < 0.01). We find that older technology projects are associated with poorer project outcomes (α_{11} = -0.949, p < 0.01; β_{11} = -0.224, p < 0.01). One explanation could be the difficulty in finding people who are willing to develop expertise in older technologies, leading to poor performance in these project types.[9]

Maintenance projects were significantly associated with better cost performance and client satisfaction (α_{10} = 0.482, p < 0.01; β_{10} = 0.167, p < 0.05), suggesting that the long term relationship with the client, as is the case with most maintenance projects, is beneficial for both the client and the vendor, in terms of project costs. It reduces uncertainty

[6] We use a dummy variable to indicate vendor's client experience and use it in the client satisfaction equation. This strategy renders the parameters in the two equations different; hence the SUR model is identified, and provides more efficient estimates than estimating these models separately.

[7] The results of the baseline model are available from the authors upon request.

[8] This result led us to examine whether project costs could be an explanatory factor in client satisfaction. We estimated a simultaneous equation model to control for the endogeneity in the resultant model. However, we found that although better project cost performance positively relates to client satisfaction, the effect is not significant. Hence we do not report it in the current study. The results are available by request from the authors.

[9] Talks with the developers at site revealed that even when the base system is a mainframe, many of the clients were developing or in the process of developing internet or open system enabled applications; hence there was a high attrition from the projects using older technologies, leading to larger development or knowledge transfer costs.

and also builds up trust. In addition, we find that client familiarity at the firm level is significantly correlated with higher satisfaction ($\beta_8 = 0.636$, $p < 0.01$).

Surprisingly, we find that the project manager's ratings are insignificantly associated with project cost performance and client satisfaction ($\alpha_{12} = -0.252$, $p > 0.10$; $\beta_{12} = -0.023$, $p > 0.10$).[10] We also find that the PM's total IT or project management experience did not significantly impact project cost performance but did help with client satisfaction ($\beta_{13} = 0.202$, $p < 0.01$; $\beta_{14} = 0.180$, $p < 0.01$).

The skills variables in our model included measures for PM hard and soft skills as well as a variable for client familiarity, which was computed at the PM level. We find that PM's skills, especially soft skills, significantly improve project outcomes.

Hypothesis 1A predicted that PM hard skills, or task familiarity, would improve project outcomes, that is, increase cost performance as well as client satisfaction. We find that these skills do help in improving cost performance, but they do not have any significant impact on client satisfaction ($\alpha_{18} = 0.391$, $p < 0.01$; $\beta_{18} = 0.064$, $p > 0.10$). Thus, hypothesis 1A is partially supported. We also find support for hypothesis 1B, positing that hard skills have a greater impact on cost performance as compared to that on client satisfaction ($\chi^2 = 5.922$, $p = 0.015$).

Hypothesis 2A predicted that PM soft skills would also improve project outcomes. We find support for this hypothesis ($\alpha_{16} = 0.408$, $p < 0.01$; $\beta_{16} = 0.706$, $p < 0.01$). Soft skills significantly and positively impact both cost performance and client satisfaction. Furthermore, we find that hypothesis 2B is supported as PM soft skills improve client satisfaction more than cost performance ($\chi^2 = 4.459$, $p = 0.035$).

Hypothesis 3 predicted that a PM's hard skills would have a greater impact on cost performance than her soft skills. Surprisingly, a one tailed test failed to support this hypothesis ($\chi^2 = 0.56$, $p = 0.455$). However, as per Kraut and Streeter (1995), IT projects are often plagued by lack of coordination, and this is especially true for IT outsourcing projects, where project teams have to synchronize with stakeholders across firms and geographical locations. Soft skills would ease coordination, and also enable PMs to find and enable expertise within the project. Thus, soft skills appear to be as helpful as hard skills in achieving good cost performance. Hypothesis 3 also predicted that PM soft skills would impact client satisfaction more than hard skills; this hypothesis is supported ($\chi^2 = 22.438$, $p < 0.0001$). We thus find that PM soft skills impact both financial and stakeholder outcomes more than hard skills. Intuitively, hard skills are both more observable and readily if not perfectly substitutable. Hence, if a PM lacks, say technical or domain expertise, it may be compensated by appropriate team allocation. On the other hand, a PM needs soft skills in managing the team as well as the client, and these skills are tacit in nature and hence may not be as easily substituted. This suggests that soft skills rather than hard skills may be more valuable for a PM.

Discussion and conclusion

How do PM skills affect IT outsourcing projects? We provide a rigorous empirical answer to this question in the current study. While prior research has predicted that project manager's skills should impact IT project performance, our study is one of the first to provide unequivocal evidence that a project manager's skills, especially soft skills, do indeed improve project cost performance and client satisfaction. In fact, from our data, we can quantify the precise benefits of the PM's skills for project performance. Using the estimated regression coefficients from our analysis, we determined the marginal impact on project cost and client satisfaction for a one unit increase in PM soft skills, *ceteris paribus*.[11] We find that all else being equal an increase of one unit in PM soft skills enhances project cost performance by approximately $96,000 and increases client satisfaction by 0.706 (on a scale of 1 to 7).

The most significant contributions of the current study are thus. We first develop a rigorous measure for assessing a PM's soft skills. We then relate this measure to project outcomes. Our findings, though not counter intuitive, provide support that both a PM's hard (technical, general) and soft (non-technical, tacit) skills enhance project outcomes. Although the PM's hard skills impact only project cost performance, we find that PM soft skills significantly

[10] A discussion with the vendor revealed that factors other than PM's performance may influence ratings, and hence they may not be reliable indicators of project performance.

[11] In multiple regression, an estimated coefficient represents the relationship between ΔX and ΔY, all else equal, i.e., the change in Y due to a one unit change in X, with all other values at their means. Thus, if one wishes to determine how Y (project cost or client satisfaction) will change if X (PM soft skills) changes, all else equal, then one can increment the PM soft skills by 1 and multiply by the estimated coefficient on soft skills to determine the marginal impact on Y (project cost or client satisfaction).

improve both cost performance and client satisfaction. We further show that their impact is much stronger compared to that of PM hard skills.

Our findings have important implications for senior managers, as they advise and groom potential candidates for PM positions. We find that IT or project management experience may not be indicative of an individual's true potential as a PM, in that the experience may not always be commensurate with increased soft skills. Hence it may be necessary for senior management to provide tailored training to PMs to develop such skills.

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Table 1: Extant literature on IT skills

Reference	Type	Synopsis
Wagner and Sternberg (1985)	Experiment	The article quantifies practical intelligence and tacit knowledge as measured through experimental data. The results indicate that differences in this measure are correlated to performance in managers.
Kraut and Streeter (1995)	Survey based conceptual article	This article identifies coordination as one of the key issues in software development. Factors such as project complexity and uncertainty can aggravate coordination. The article prescribes complex management skills (on part of the project manager) to ameliorate coordination problems
Lee et al. (1995)	Survey based research article	This article looks at computing trends and what knowledge and skills do IS professionals need. The results suggest that IS professionals need technology, business operations, management and interpersonal skills to be effective.
Bloom (1996)	Conceptual (article)	This article advocates that project managers should have deep knowledge of the project's business objectives and effective communication skills. They must also possess adequate technical competence, above-average political and people management skills.
Duncan (1996)	Conceptual (book)	This PMI book advises that project managers should be able to not only address project management activities such as scope, time, cost, and quality management; but should be effective communicators, should be able to manage diverse teams and do adequate risk management for the project.
Krishnan (1998)	Archival data based research	The article studies the impact of product team's capability and domain and language experience on product development and support costs and its quality. In particular, it helps quantify the 'hard skills' in software development teams.
Weinberg (1998)	Conceptual (book)	This book explores human issues in computer programming. It looks at the problems that plague software development and advises on courses of

Table 1: Extant literature on IT skills		
Reference	**Type**	**Synopsis**
		action that can be taken.
Thite (1999)	Conceptual (article)	This paper explores the nature and importance of leadership in technical projects. It suggests that a combination of transformational and technical leadership behaviors augments the effectiveness of transactional leadership leading to high project success.
Kirsch (2000)	Conceptual (article)	This article advises that project management encompasses both hard skills, such as estimating and scheduling tasks, and soft skills, which include motivating and managing team members.
Byrd and Turner (2001)	Survey based research	The study uses survey data from CIOs of Fortune 2000 companies. It investigates relationships between IT personnel skills to IS success variables (IS infrastructure abilities and competitive advantage). The findings indicate that the technical skills have maximum impact on IS success but does not find any positive relationship between softer IS personnel skills and these variables.
Martin et al. (2004)	Survey based research	This exploratory paper looks at current IS project management practices related to projects of varying size and complexity across diverse industries. The findings suggest that IS project size influences budget and project quality, while project complexity influences the use of specific project management practices. The project manager is empirically linked to project budget.
Espinosa et al. (2007)	Archival data and survey based research	This paper explores how task and team familiarity interact with task and team coordination complexity to influence team performance. The findings indicate that team familiarity helps performance for more complex coordination problems such as larger teams and greater geographical dispersion. Task and team familiarity are more substitutive than complementary in their joint effects on team performance:
Joseph et al. (2008)	Survey based research using critical incidents	This article adapts Wagner and Sternberg's measure of practical intelligence for IT professionals. Authors define four main dimensions of PI as managing task, self, careers, and others. In particular they explore how differences in experience impact this measure in different dimensions, and the effect on career performance.

Table 2. Results		
Project outcome measure: CostPerformance		
	Coefficient (Std Error)	VIF
logFP	-1.3011 (0.1786) **	3.12
SchedulePressure	-0.2701 (0.1449) +	3.46
AvgTeamExp	0.4751 (0.1060) **	2.07
TeamSize	-0.2972 (0.1450) *	3.20
TeamFamilarity	0.4060 (0.0881) **	1.52
TeamHardSkills	0.6780 (0.1129) **	2.52
OnsiteRatio	-0.5356 (0.0866) **	1.47
PriorProjectOrg	0.2622 (0.0831) **	1.34
Contract=TM	-0.9132 (0.2439) **	1.62
ProjectType=M	0.4820 (0.1784) **	1.41
ProjectTech=L	-0.9490 (0.1709) **	1.28
PMRating	-0.2521 (0.1767)	1.19
ITWorkEx	-0.1128 (0.1119)	2.08
PMWorkEx	0.0725 (0.1118)	2.01
PriorProjectPM	-0.1492 (0.1247)	3.27
SoftSkills	0.4083 (0.0886) **	1.08
ClientExp	-0.1496 (0.1050)	2.29
HardSkills	0.3913 (0.1581) **	2.01
Project outcome measure : ClientSatisfaction		
	Coefficient (Std Error)	VIF
logFP	0.1921 (0.0845) *	2.99
SchedulePressure	-0.2549 (0.0711) **	3.45
TeamSize	-0.1117 (0.0550) *	3.01
TeamFamilarity	0.1070 (0.0420) *	1.50
TeamHardSkills	0.0723 (0.0281) *	2.04
OnsiteRatio	0.0824 (0.0418) *	1.46
PriorProjectOrg	-0.0588 (0.0414)	1.44
dVendorClient	0.6361 (0.2394) **	1.20
Contract=TM	-0.1828 (0.1182)	1.63
ProjectType=M	0.1669 (0.0844) *	1.27
ProjectTech=L	-0.2239 (0.0820) **	1.43
PMRating	-0.0234 (0.0366)	1.19
ITWorkEx	0.2017 (0.0542) **	2.65
PMWorkEx	0.1799 (0.0542) **	2.56
PriorProjectsPM	0.0781 (0.0603)	3.24

SoftSkills	0.7060 (0.0430) **	1.13
ClientExp	0.1217 (0.0567) *	2.87
HardSkills	0.0644 (0.0675)	2.15

Note: + Significant at 10%; * significant at 5%; ** significant at 1%.

Model Fit Statistics	
N	530
R^2 (Performance)	0.3885
R^2 (Satisfaction)	0.2502
Condition index (collinearity)	12.0105

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