

Meeting and Surpassing Service Quality Thresholds: Quality Dimensions in Software Development and Maintenance Outsourcing^{*}

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ABSTRACT

This paper investigates the drivers of client satisfaction in software development and maintenance outsourcing services. Using data collected from 185 outsourcing agreements from a leading global vendor of IT services, we analyze several service quality drivers in terms of their relationship to overall satisfaction. We find that delivery of services within the originally estimated costs is the key driver that can elevate customers

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from being dissatisfied to satisfied. The results also suggest that the key service quality driver that moves satisfied customers toward higher levels of satisfaction is the vendor's dedicated adherence to the terms of the service level agreement.

Keywords: Service quality, Software project management, Outsourcing software development, Software maintenance, Software engineering

1. INTRODUCTION

The information technology (IT) outsourcing market has been growing, and the estimated size of the global IT outsourcing market is expected to reach \$481.37 billion by 2022, according to Statistics MRC. Due to the growth of IT outsourcing businesses and increased competition among vendors, vendors have emphasized the importance of client satisfaction as a competitive differentiator (Levina and Ross 2003; Savolainen, Ahonen and Richardson 2012). Prior research recognizes, from the perspective of vendors, the importance of providing high-quality service as an effective way to increase client satisfaction (Buttle 1996; Haverila and Fehr 2016). Given that vendors are subject to the constraints of budget and resources (Atkinson 1999), however, they need to prioritize the dimensions of IT outsourcing to maintain a high level of client satisfaction in a cost effective manner (Sudhaman and Thangavel 2015). Thus, understanding the effects of different quality dimensions of IT outsourcing on client satisfaction will help vendors prioritize services and resources in ways that efficiently ensure client satisfaction.

In this investigation of the drivers of software development and maintenance (SD&M) outsourcing, we focus on the managerial concerns, from the viewpoint of the vendor, inherent in delivering SD&M services of high quality. Our specific focus is the importance of boundary-spanning processes between the client and the vendor, which are necessary to accompany the traditional inward-focused vendor investments in quality and efficiency.

The following two anecdotes from senior experts from this industry underscore the importance of effective boundary-spanning processes:

Many people think that the only point of concern is technical knowledge ... They forget about other aspects such as ... people retention, formal change management . . . and managing the transition . . .

–Atul Vashistha, Founder/CEO of neoIT Advisory

...there's a fair amount of knowledge transfer required not only on the technical side, but the business side. . . . [Our] providers did not know what certain processes meant . . . for example "delivering a bond" . . . "cornering a security". . . was difficult for them to understand . . .

–John Beyman, CIO Lehman Brothers

The specific aim of this research is to identify drivers of SD&M outsourcing satisfaction. We consider two types of drivers that affect overall client satisfaction: process performance and boundary-spanning capabilities of the vendor. Altogether, we examine five factors inherent in outsourcing of SD&M activities and their effect on overall client satisfaction: (1) risk and issue management, (2) adherence to the service level agreement (SLA) terms, (3) proactive communication, (4) delivery within the estimated cost, and (5) successful handling of the transition of resources from the client organization to the vendor and vice versa. To this end, we analyze a set of project data collected from one of the market leaders in the global IT service industry. Our study applies the Quality Function Deployment (QFD) framework to identify the drivers of client satisfaction and their implications for the software development and maintenance services domain.

Our research contributes to the growing body of literature on the quality of IT outsourcing services. Only a limited number of studies have investigated the quality attributes of IT services from the perspective of the vendor. The focus of most prior research on IT outsourcing has been from the standpoint of the client firm, although there have been certain exceptions (Gopal and Gosain 2010; Levina and Ross 2003; Mani, Barua and Whinston 2010; Williams, et al. 2015). The present study centers on capabilities and resource allocation from the standpoint of the vendor. Further, to date, the predominant research domains of prior research have been – IS services provided by internal IS groups within a firm (Kettinger and Lee 1994; Kettinger and Lee 1997; Pitt, Watson and Kavan 1997; Van Dyke, Kappelman and Prybutok 1997). In this study,

however, we investigate the quality of SD&M services in the context of a vendor's delivering software products and maintenance services to a customer organization.

Our empirical results, based on rich, real-world data, will complement established findings from prior research and further develop the literature. SD&M services data for our study were collected from one of the leading global IT service providers. The vendor, headquartered in India, is a leading global company that provides customers in various industries with diverse IT services, including application development and maintenance, infrastructure services, and packaged application services. Our study identified determinants of client satisfaction and tested the impact of each determinant on the feedback provided by the client organization at the conclusion of the SD&M services delivery. We collected data across 185 SD&M services agreements that form the basis of our analyses. We specifically examine the drivers of the satisfaction improvement from *dissatisfied to satisfied* customers and from *satisfied to highly satisfied* customers.

Using a generalized ordered logit regression, we find that the adherence of the vendor to the SLA and delivery of the software within estimated costs are the most important factors in making *satisfied customers even more satisfied*. Along similar lines, our results suggest that the delivery within estimated costs, followed by the ability of the vendor to manage risks and issues, are the two most important factors in making *dissatisfied customers satisfied*.

We begin with a review of the literature to provide the background for our study. Subsequently, we explain the research design and define key variables in our model. We then discuss the empirical models used in our analysis. Our empirical analysis section is followed by the presentation of our results and a discussion of implications. In the final section, we present our conclusions.

2. LITERATURE REVIEW

A dominant view of quality is "conformance to requirements" expected by customers (Crosby 1979). Many companies, regardless of whether they are service-oriented or product-oriented businesses, set achieving high quality as one of their strategic objectives, notwithstanding their current budget and resource constraints.

QFD, which was initiated in Japan in the late 1960s, was developed mainly to bring the concept of quality to manufacturing businesses in an effort to meet customer needs. This effort has been widely successful and has attracted many practitioners and academic researchers to the field of QFD (Chan and Wu 2002). Nonetheless, this research stream can benefit considerably from insights in the area of service quality.

The software development and maintenance services outsourcing context can be viewed as a collection of boundary-spanning processes. Across these processes, the roles and capabilities of vendors are critical to successful outsourcing (Levina and Vaast 2008). The complementary knowledge of the vendor across boundary spanning activities and managed economies of scale obtained through SD&M outsourcing can confer production cost advantages to the client firm (Levina and Ross 2003). Prior research also highlights the beneficial role of boundary spanning processes between vendors and clients in facilitating formal control modes, which have a significant impact on project outcomes (Gopal and Gosain 2010), and in mitigating outsourcing risks (Aron and Singh 2005).

In our research model, SD&M outsourcing is viewed as a service delivered by an IT vendor to a customer; thus, the service management literature and the IT outsourcing literature provide the bases for our model. Services are meaningful in the presence of customers, and service life cycles are changed by customer perceptions (Chase and Heskett 1995). Client satisfaction with services is associated with the confirmation or disconfirmation of client expectations (Smith and Houston 1983). Services are distinguished from goods by certain characteristics, namely, intangibility, simultaneity, perishability, heterogeneity, and customer contact (Metters and Marucheck 2007; Parasuraman, Zeithaml and Berry 1985); thus, services require the adaptive view of quality (Prahalad and Krishnan 1999).

The importance of quality and of listening to the voices of customers has been emphasized in service-oriented businesses; for such businesses, service quality is considered a driver of higher financial performance in the long term. Service quality appears to be associated with various factors, such as the cost of delivering a service, profitability, customer retention, and customer satisfaction (Buttle 1996). Roth and Jackson (Roth and Jackson 1995) argue

that service quality is influenced by the operational capabilities of the service provider, which include factor productivity, technological leadership, people capability, and process capability. Grönroos (Grönroos 1982) address two types of service quality: technical quality, which is what the customer is actually receiving from the service, and functional quality, which refers to the manner in which the service is delivered.

Service quality is “a measure of how well the service level delivered matches customer expectations” (Lewis and Booms 1983) and is presented as a multidimensional construct. Concerted efforts of practitioners and academicians to characterize service quality resulted in the development of SERVQUAL framework for measuring and managing service quality (Buttle 1996; Kettinger and Lee 1994; Kettinger and Lee 1997; Parasuraman, Zeithaml and Berry 1985). One key aspect of this framework is its focus on the gap in service between customer expectations and experience, which is different from the focus of traditional quality studies on goods (Buttle 1996; Parasuraman, Zeithaml and Berry 1985). In the manufacturing industry, product quality is often measured by the number of errors and defects (Garvin 1983; Levendel 1990). However, service quality is viewed and assessed differently from product quality because the services provided are intangible, heterogeneous, and inseparable, and these attributes distinguish service quality from product quality (Parasuraman, Zeithaml and Berry 1985). In this line of work, information systems literature has primarily examined services provided by internal IT groups within firms. In our study, however, we focus on the service quality of outsourced SD&M services, with a particular focus on the vendor-related drivers of client satisfaction.

Our study follows a research design dominant in the literature on leveraging product design dimensions to enhance customer satisfaction (Hauser and Clausing 1988; Kekre, Krishnan and Srinivasan 1995). Analogously, we map customer needs to service design dimensions. Multiple dimensions of product quality have been defined for both manufacturing and service industries in prior literature (Garvin 1987; Zeithaml 1990). Our work is designed in the spirit of Quality Function Deployment (QFD), and provides a framework for using customer feedback in making *service design* choices to enhance customer satisfaction as an extension of Kekre et al.’s model (Kekre, Krishnan and Srinivasan 1995).

3. RESEARCH DESIGN AND DATA

This study primarily employs empirical analysis of survey data. The survey administered by our research site is based on the adapted version of the product design survey used in prior management literature [59] but customized to the context of Software Development and Maintenance outsourcing. The data were collected by one of the leading global IT outsourcing firms that operates in the United States. The QFD framework was applied for the firm to understand customer needs and to identify factors that are critical to customers. These surveys were frequently audited and were an integral part of contractual and financial negotiations between the clients and the outsourcing vendor as well.

3.1. Data

As noted earlier, we gathered project data from one of the market leaders in the US and Global IT Services industry. This firm was assessed at level-5 of the Capability Maturity Model (CMM) and the People Capability Maturity Model (PCMM), indicating high process and personnel capability. Our analysis is based on the service satisfaction survey administered by the organization to their client firms. The IT service firm asked clients to respond to a client satisfaction questionnaire within 30 days of the date of delivering the IT projects. The client organizations were asked to rate their overall satisfaction and to respond to questions on five potential sub-dimensions (detailed below) of their satisfaction. These five sub-dimensions concern important activities that occur during the upfront, midstream, and downstream project stages. Figure 1 presents the overall research framework used in the paper, with the broad rationale summarized next.

Our research framework is based on QFD, which we adapted to identify drivers of overall client satisfaction in a service setting. More specifically, our model is suitable for contexts in which service is the main deliverable to the customers, unlike traditional product plus post-sales service contexts. We consider two types of drivers that affect overall client satisfaction: *process performance* and *boundary-spanning capabilities* of the vendor. First, SLA adherence and delivery within the estimated cost are factors that represent

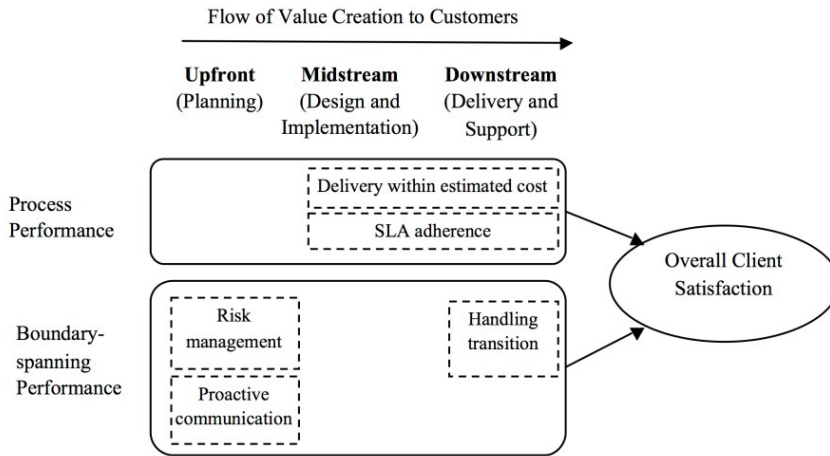


Figure 1. Research framework

process performance capabilities of the vendor that confer quality and efficiency benefits. Second, risk and issue management, proactive communication, and handling the transition are variables that represent boundary-spanning process capabilities. In managing SD&M outsourcing, these five factors come into play at different stages in the IT investment stream. Risk and issue management and proactive communication are issues that should be considered at the time of upfront investments as a means to manage task uncertainty, while SLA adherence and delivery within the estimated cost should be considered at the time of midstream and downstream investments, and handling the transition should be considered at the time of downstream investments. Definitions of the variables are provided next.

3.2 Variables

Our dependent variable, overall satisfaction, was assessed across four levels. The five sub-dimensions of satisfaction were captured along a seven-point Likert-type scale that ranged from *very dissatisfied* to *very satisfied*. As noted earlier, five dimensions of service quality were used as independent variables. In addition, we accounted for certain project specific controls. First, to account for managerial capability, we gathered independent data on whether the

project managers in each project had obtained certification in project management training. Next, to account for the inherent complexity of large projects, we captured data on project size and, finally, on whether a project involved new development or maintenance of previously designed software.

3.2.1 Dependent Variable. Overall satisfaction (OS): The overall satisfaction with the SD&M outsourcing indicates the extent of client satisfaction with software development services or software maintenance services provided by the vendor, as assessed from the customer's perspective. This could be a dual indicator of success, encompassing client goodwill and organizational performance. Especially, OS has been positively associated with firm profitability (Anderson, Fornell and Lehmann 1994; Anderson, Fornell and Rust 1997; Anderson and Mittal 2000). Higher profitability can be attained through the loyalty of clients (Anderson, Fornell and Lehmann 1994; Anderson and Sullivan 1993) or through reductions in the cost of future transactions (Reicheld 1996).

Customers were asked to provide responses to this measure within 30 days of project delivery. Perhaps due to the high vendor capability of the outsourcing provider, as assessed by several industry experts, we seldom found customers who indicated that they were extremely dissatisfied with the provider. This resulted in the re-coding of the OS variable as follows. The first anchor of the dependent variable corresponds to customers who reported that they were *dissatisfied* and spanned from *very dissatisfied* to *neutral* customers. The second anchor corresponds to customers who were *moderately satisfied*, and the third anchor consists of customers who were *highly satisfied* with the services provided by the vendor.

3.2.2 Independent Variables. Risk and issue management (RM): This variable entails the degree of user satisfaction with how well the vendor managed risks and issues. Project risk is defined as the possibility of suffering harm or loss from a project (Lewis 1998). During the execution of SD&M services, the IT group that implements the project may face several kinds of risks, including technical risks and managerial risks. Project risk management includes activities that prevent, recognize, and evaluate risk as well as handle risk when it occurs. The management of project risk is considered an important factor in project success (McFarlan 1981; Wallace, Keil and Rai 2004), especially since the risk of development and maintenance outsourcing can be even higher than that of

insourced IT (Djavanshir 2005; Earl 1996; Limam and Boutaba 2010; Power and Trope 2005).

Service level agreement adherence (SA): This factor concerns the extent to which the vendor actually provided services at the level described in the client-specific service level agreement. This variable captures terms in the agreement pertaining to schedules, resource commitments, quality, and service scope, and captures measurable “non-cost” performance features. The SLA is “an agreement between an IT service provider and a customer, which describes the IT service, documents service-level targets, and specifies the responsibilities of the IT service provider and the customer” [Information Technology Infrastructure Library (ITIL) v.3]. The SLA is a legally binding contract between parties (Lodi, et al. 2007). In delivering IT services, the SLA is generally necessary because the mechanisms of the relationship are still not thoroughly defined in many projects, and, therefore, the contents of the agreement can vary from case to case (Larson 1998). Asymmetric information between the vendor and the customer might lead to opportunistic behavior from either party; thus, both parties often choose formal contracting (Williamson 1981), and most outsourcing relationships are usually governed by formal SLAs (Goo, et al. 2009). Effective SLAs can mitigate the risk of outsourcing IT (Huang and Jahyun 2009; Skene, Raimondi and Emmerich 2010). Because customers expect to receive the level of services described in the SLA, providing services below that level would cause customer dissatisfaction.

Proactive communication (PC): This variable is the degree of user satisfaction with how proactively the vendor communicated with the customers and solved problems during the project. Communication is important for managing customer expectations and delivering quality service (Griffin and Hauser 1993; Zeithaml, Berry and Parasuraman 1988). Knowledge overlaps between clients and vendors, which can be enhanced by proactive communication, are important for successful outsourcing (Bhat, Mayank and Murthy 2006; Tiwana 2004). What matters is not whether the vendor solved problems but whether the vendor proactively initiated communication to avoid potential problems. From the customer perspective, the proactive attitude of the vendor is helpful in identifying potential problems and solving existing problems efficiently.

Delivery within cost (DC): This variable is measured as the

degree of user satisfaction with the vendor's ability to deliver the project within the estimated cost. The project budget is one of the most important constraints in executing a project. Whether a project is delivered within the budget is one of the most important performance measures because clients' primary objective in outsourcing is to cut costs (Earl 1996; Levina and Ross 2003). Empirical research has found that saving effort and reducing costs by reusing software is positively correlated with client satisfaction (Succi, Benedicenti and Vernazza 2001). In 2001, the Standish Group reported that 49% of IT projects exceeded the time and cost estimates. Vendors tend to submit underestimated costs of IT projects to clients in order to win the contract, which is referred to as the "winner's curse" in IT sourcing (Kern, Willcocks and van Heck 2002). Considering the cost-cutting objective of outsourcing and the risk of the vendor's underestimating costs, extra costs for project delivery are likely to decrease client satisfaction.

Handling the transition (HT): This variable is the degree of user satisfaction with how well the vendor was able to handle the transition of resources from and to the client firm without causing difficulties for the customer. At the onset of the project, resources, including people, need to be transitioned to the vendor to ensure a smooth handover of information and control. Similarly, when the finished software is launched, users, including end users and administrators, face various changes. The changes could be minor but are often significant enough to discourage users from adopting new systems. This variable refers to transitional activities at the onset and the closing stages, unlike proactive communication, which refers to the early-middle and middle stages of a project. For a successful transition, the vendor needs to make the hurdle low to mitigate the users' resistance.

3.2.3 Control Variables. Project manager program (PMP): This binary variable represents whether the project manager holds PMP certification. This information was gathered from the vendor and is considered a signal of the project manager's qualifications. For example, according to a survey by Carbone and Gholston (Carbone and Gholston 2004), 73% of the project managers who had participated in project management programs reported that the PMP training prepared them to play their roles. From the vendor's perspective, having certified project managers has an effect on project outcomes and, thus, has important managerial implications.

Development project (DP): This binary variable indicates whether the project is a new development project or a maintenance project. Because the purpose of the two types of projects is different, drivers of client satisfaction might differ. For instance, Subramanyam et al. (Subramanyam, Weisstein and Krishnan 2010) note that the relationship between user satisfaction and user participation is not equal in new development projects as compared with maintenance projects, *ceteris paribus*.

Peak team size (SIZE): Project size, captured from the vendor side, is measured by the team size, particularly the highest number of team members during the project. Team size is critical to the outcome of IS projects, and thus, it is crucial to understand the effect of team size on project performance (Aladwani 2002). The marginal effect of team size on the productivity of projects can be represented by a decreasing function over size (Aladwani 2002; Hare 1976; Koushik and Mookerjee 1995). This decreasing effect can be explained by the ease with which a person can become a free-rider and by the person's ability to relieve the pressure on other individuals to enable them to perform well (Shaw 1981).

To empirically test our hypotheses, we collected data from a leading Indian IT services company. The company provides IT and consulting services to clients across the world. At the time of the study, the company had over \$1 billion in revenue and approximately 50000 employees across the U.S., Europe, Asia, and Australia. The company was assessed at level-5 of the Capability Maturity Model (CMM) and the People Capability Maturity Model (PCMM), indicating high levels of process maturity, which had

Table 1. Descriptive Statistics and Correlations

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
Overall Satisfaction (OS)	5.74	1.57	0	7
Risk and Issue Mgmt. (RM)	5.73	0.95	2	7
SLA Adherence (SA)	6.06	0.82	4	7
Proactive Communication (PC)	5.81	0.98	3	7
Delivery within Costs (DC)	5.97	0.9	3	7
Handling Transitions (HT)	5.79	0.99	3	7
Project Mgr. Certification (PMP)	0.09	0.29	0	1
Development Project (DP)	0.15	0.36	0	1
Team Size (SIZE)	12.42	10.01	1	62

enhanced its reputation for high quality services and recognition as one of the “best companies to work for” in India. Thus, the research site provided us with a good context to test our hypotheses with access to reliable and high quality data on project manager training and competences. The summary statistics for the variables are provided in table 1.

4. EMPIRICAL ANALYSIS

The empirical model based on the research framework is presented in figure 2. As noted in the figure, we assume that higher levels of overall satisfaction are associated with client loyalty and future revenue streams.

Because the dependent variable is an ordered measure rather than a continuous one, ordinary squares regression is not appropriate because it may result in inefficiency of the regression, and the estimates are likely to have values outside the range of the dependent variables (Greene 2000). Instead, an ordered probit and an ordered logit are options for an ordered ordinal dependent variable (McKelvey and Zavoina 1975). Kekre et al. (1995) used an ordered probit model to identify determinants of client satisfaction as related to software quality. Because the probit and logit show

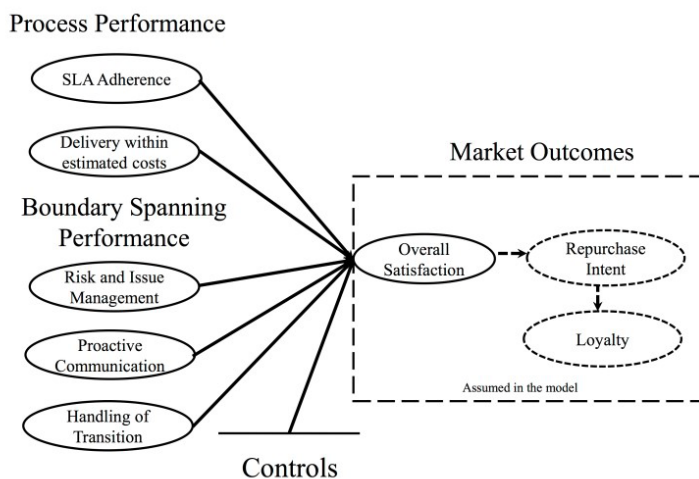


Figure 2. Empirical model

Table 2. Equations used with the ordered logit model

Equation j	Pooled categories compared to	Pooled categories
Equation 1	<i>Not Satisfied</i>	<i>Satisfied + Highly satisfied</i>
Equation 2	<i>Not Satisfied + Satisfied</i>	<i>Highly satisfied</i>

little difference in their cumulative density functions, both models are considered appropriate to use with ordered dependent variables as in our dataset.

The ordered logit simultaneously estimates multiple equations based on categories of the dependent values. Table 2 shows how we categorized the ordinal values of the dependent variables and equations of our logit model.

The ordered logit model has the following form:

$$\log it(p_j) = \log \frac{p_j}{1 - p_j} = \alpha_j + \beta'X, \quad j = 1, 2, 3. \quad (1)$$

$$p_j = P(Y > j + 3)$$

The variable p_j refers to the probability of being in the set of categories on the right versus in the set of categories on the left in Equation j of table 2. The ordered logit regression (OLR) yields results that are similar to those found when running a series of logistic regressions (Williams 2006). The OLR provides only one set of coefficients for each variable because it assumes that the coefficients for variables in the equations are not significantly different (OLR assumes proportionality of odds across response categories). However, this assumption is often violated (Williams 2006).

We performed a likelihood-ratio test of proportionality of odds across response categories (to test this assumption). The results indicated that the proportionality of odds assumption was not met; thus, the ordered logit model was not appropriate for our study. Thus, we developed a generalized OLR model. The generalized ordered logit model is similar to Equation 1, but it allows the model to have different coefficients for variables:

$$\log it(p_j) = \log \frac{p_j}{1 - p_j} = \alpha_j + \beta'_j X, \quad j = 1, 2, 3. \quad (2)$$

We studied the effect of five factors on client satisfaction, as described in Section 3. In addition, as noted earlier, our model

includes controls for team size, project management certification, project type: whether the project is for new system development or for system maintenance:

$$\begin{aligned} \log it(p_j) = \alpha_j + \beta'_j X = \alpha_j + \beta_{1j} RM + \beta_{2j} SAP \\ + \beta_{3j} PC + \beta_{4j} DC + \beta_{5j} HT + \beta_{6j} PM + \beta_{7j} DP + \beta_{8j} SIZE, \end{aligned} \quad (3)$$

where PMP is equal to one for a project manager who holds project management certification and zero otherwise, and DP is equal to one for a project of new system development and zero for a maintenance project.

5. RESULTS AND DISCUSSION

5.1. Results

The parameter estimates for Equations 1 and 2 appear to be different, even though all coefficients of the independent variables are positive. Among the five independent variables, *risk management*, *SLA adherence*, and *delivery within the estimated cost* are significantly associated with satisfied clients, whereas *handling the transition*, as well as the *three* factors above, are significantly associated with clients who are very satisfied. The estimates of the generalized OLR model are presented in table 3.

From the magnitude of the coefficients derived from Equation 1, we observed that, among the independent variables, *delivery within the estimated cost* was the most important determinant of customer satisfaction, closely followed by *risk and issue management*. Among the control variables, project managers who held a project management certification were able to provide a significantly greater extent of client satisfaction.

From solving Equation 2, we found that *SLA adherence* was the most important factor that determines a high level of client satisfaction. *Delivery within the estimated cost* and *risk and issue management* were the next significant determinants of a high level of customer satisfaction. A differentiating aspect across the estimates for the two equations was that *handling the transition*, which was not a significant factor in converting dissatisfied clients to satisfied clients, was an important factor in enhancing the service experience

Table 3. Parameter estimates of the generalized OLR model

Parameter	Variable ¹	Not satisfied Satisfied + Very satisfied	Not satisfied + Satisfied Very satisfied
β_{11}, β_{12}	RM	1.761***	1.127**
β_{21}, β_{22}	SA	1.181**	1.540***
β_{31}, β_{32}	PC	0.601	0.209
β_{41}, β_{42}	DC	1.944***	1.333***
β_{51}, β_{52}	HT	0.665	0.751**
β_{61}, β_{62}	PMP	2.997**	-0.403
β_{71}, β_{72}	DP	1.837	-0.585
β_{81}, β_{82}	SIZE	0.498	-0.509
a_1, a_2	Intercept	-33.437	-30.566
Log likelihood		-79.0957	
$\chi^2 (16\ df)$		214.04	
Prob. > χ^2		0.0000	
Pseudo R^2		0.5750	

¹RM = risk and issue management; SA = service level agreement adherence; PC = proactive communication; DC = delivery within cost; HT = handling transitions; PMP = project manager program; DP = development project; SIZE = peak team size.

*** Significant at p<0.01; ** Significant at p<0.05

of satisfied customers.

Similarly, by comparing the two coefficient estimates for each variable across the two equations (columns in table 3.), we find that the effects of *risk and issue management* and *delivery within the estimated cost* decreased as the vendor was able to deliver a higher level of client satisfaction. However, the effect of *SLA adherence* increased in Equation 2. Handling the transition was statistically significant only when a higher level of client satisfaction was obtained, whereas the project manager’s certification was significant only in Equation 1.

5.2. Sensitivity Analysis

A sensitivity analysis, which can be used to assess the relative importance of individual factors, is useful for answering the question, “What service quality attribute should a vendor with limited resources focus on to improve the overall quality efficiently?” (Kekre, Krishnan and Srinivasan 1995). In practice, this analysis

Table 4. Results of Sensitivity Analysis

	Initial dist.	RM + 1	SA + 1	PC + 1	DC + 1	HT + 1
<i>V.satisfied</i>	53	102	121	62	112	85
<i>Satisfied</i>	98	76	52	103	68	81
<i>Neutral</i>	34	7	12	20	5	19
Total	185	185	185	185	185	185

¹RM = risk and issue management; SA = SLA adherence; PC = proactive communication; DC = delivery within cost; HT = handling transitions.

can help vendors find the most efficient choices to increase their client satisfaction. Although the results of the regression can provide an idea of the relative importance of each factor, a sensitivity analysis offers additional realistic and tangible insights. Results of the sensitivity analysis are reported in table 4, with the numbers in the second column showing the initial distribution. In addition, we have estimated a shift for a unit increase in each factor, holding all other factors at their present levels. The numbers in successive columns represent the estimated distribution, with the score for each factor increased by one level. The estimation was calculated using the results presented in table 4.

The relative importance of the five factors across all types of projects is presented in figures 3(a) and 3(b) to show percentage gains across our independent variables. In figure 3(a), the bars represent the effect of each factor in determining the shift from *not satisfied* or *satisfied* to *highly satisfied*. A 1-unit increase in adherence to the SLA is likely to increase the percentage of *highly satisfied* customers by 35%. One-unit increases in the delivery within the estimated cost and in risk management are likely to result in increases of 25% and 30%, respectively. In figure 3(b), the bars represent the importance of each factor in determining the shift from *not satisfied* to *satisfied* or *highly satisfied*. As seen in the figure, 1-unit increases in delivery within the estimated cost and in risk management are likely to reduce the percentages of dissatisfied customers by 16% and 14%, respectively.

One explanation for the considerable impact of delivery within the estimated cost is that, for most clients, one of the main objectives of outsourcing is to cut costs (Earl 1996; Levina and Ross 2003). The results for adherence to the SLA also are meaningful. The impact of enhancing the SLA is greater for *satisfied* customers than for

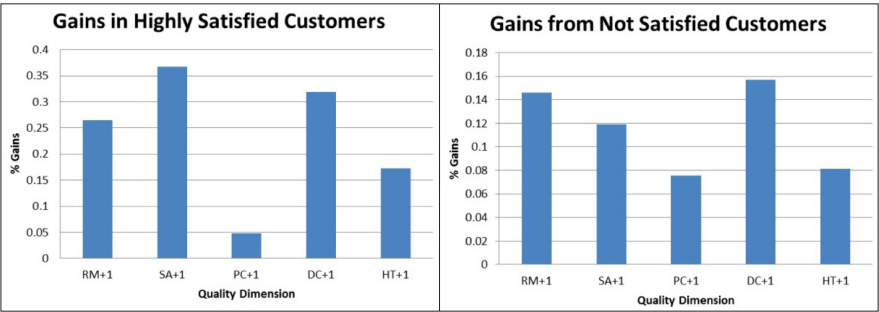


Figure 3. (a) Gains in very satisfied customers across all projects. (b) Gains from dissatisfied customers across all projects

dissatisfied customers. This means that the SLA could be a key concern for customers who expect a high level of service quality, and providing high SLA adherence is necessary to satisfy them. On the contrary, the ability of vendors to manage risk is more important for customers who expect a lower level of service quality than for customers whose expectations are higher.

Of the data collected from 185 outsourcing projects, 156 were maintenance projects; thus, we conducted a sensitivity analysis only for the maintenance projects. The relative importance of the five factors for maintenance projects is reported in figures 4(a) and 4(b). In *maintenance* projects, *risk and issue management* and *delivery within the estimated cost* are the two most important factors, and *adherence to the SLA* follows the two, as shown in both figures 4(a) and 4(b). Increasing the service quality in the areas of risk management and delivery within the estimated cost by a 1-unit level

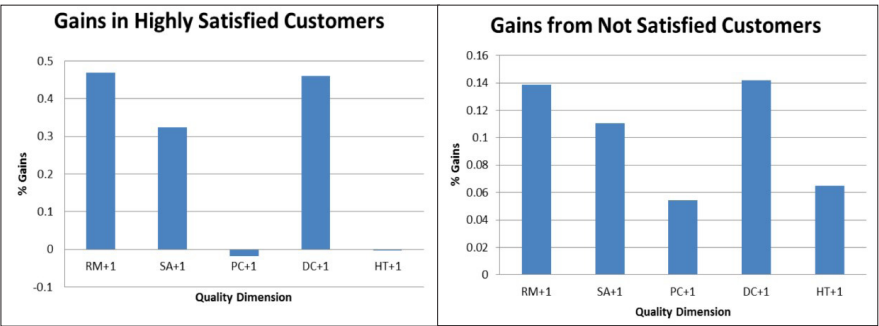


Figure 4. (a) Gains in very satisfied customers for maintenance projects. (b) Gains from dissatisfied customers for maintenance projects.

is likely to increase the number of *very satisfied* customers by about 45%, and an increase in adherence to the SLA is likely to increase this number by about 30%. By increasing the two factors, a vendor is likely to be able to reduce the number of *dissatisfied* customers by about 14%.

5.3. Managerial Implications: Meeting the Quality Threshold or Surpassing It?

Ideally, vendors should provide high service quality in all dimensions, but this is not pragmatic to expect since vendors operate with limited resources. Thus, identifying the key drivers of client satisfaction enables vendors to make efficient investments in service quality. Vendors might benefit more by focusing on dimensions that will significantly increase client satisfaction, rather than by trying to improve all dimensions.

From our results, we find that customers across different ranges of client satisfaction are influenced to different extents by different service quality dimensions. For more efficient resource allocation to result in a higher level of client satisfaction, vendors need to



Figure 5. A managerial decision rationale based on our findings

measure their current client satisfaction. Figure 5 presents a managerial decision rationale based on our findings.

Meeting the quality threshold. If a vendor finds that its clients are dissatisfied, focusing on *delivery within the estimated cost* as well as *risk and issue management* would be more efficient if the vendor wished just to meet the client satisfaction threshold. Of course, the level of such a threshold would differ based on client needs and vendor capabilities. For dissatisfied customers, although improvement in any factor will increase the level of client satisfaction, the order of significance would be (1) delivery within the estimated cost, (2) risk and issue management, (3) adherence to the SLA, (4) handling resource transition, and (5) proactive communication. Thus, it is more likely that providing improved service quality by delivering the service within the estimated cost and risk management will make clients more satisfied.

Surpassing the basic quality thresholds. If a vendor finds that its clients are satisfied with its service, improving *adherence to the SLA* and *delivery within the estimated cost* is likely to be effective in further increasing the level of client satisfaction. For satisfied customers, providing a higher service quality by adhering to the SLA, delivery within the estimated cost, risk and issue management, and handling the transition (listed in order of significance) are the important drivers.

In the case of maintenance projects, focusing on delivery within the estimated cost and risk and issue management is likely to be an efficient approach to increase the level of client satisfaction.

6. CONCLUSION

We have examined five factors that drive overall client satisfaction and have found that determinants of client satisfaction differ depending on the degree of client satisfaction. In making dissatisfied clients satisfied, delivery within the estimated cost, as well as risk and issue management, are the dominant factors. In contrast, in making customers who are already satisfied highly satisfied, adherence to the SLA and delivery within the estimated cost are the dominant factors.

Customer satisfaction is an essential element in business because customers are a firm's primary source of revenue and profit, and

customers are less likely to choose the firm's products or services unless they are satisfied. Firms should understand factors to increase levels of customer satisfaction for their competitiveness. Most prior studies have identified factors of customer satisfaction, assuming that a factor's effect would not significantly vary over the different levels of customer satisfaction at that time. The results of our analysis imply that important factors that contribute to overall client satisfaction can vary depending on their satisfaction level at that time, and we also found that clients' prioritized needs differ depending on the level. The findings provide firms with a more efficient and effective way to increase client satisfaction. Issues of and adherence to SLA appear to be fundamental concerns for both types of customers, but delivery within costs and risk management are more critical to firms that are not very satisfied with the service. In addition, having certified project managers is important to obtaining some degree of overall client satisfaction but not necessary in obtaining exceptionally high degree of satisfaction. On the contrary, handling the transition accrued from adopting new information systems is significant in obtaining an exceptionally high degree of satisfaction but not effective in obtaining some degree of overall satisfaction.

A practical contribution of this study is that we provide vendors with a framework and components of a decision model that they can use to manage service quality effectively and efficiently. Client satisfaction is a key metric in the performance of vendors, and given the premise that improving client satisfaction will help vendors achieve long-term profitability, understanding the drivers of client satisfaction is critical for vendors. Academic contributions of this study include that we provide a framework where determinants of customer satisfaction are examined for different types of customers, classified by the current level of satisfaction of the client. To our knowledge, in the outsourcing service literature, this study is the first that provides a framework to customize the vendors' service response depending on the current level of satisfaction of the client. In addition, we apply QFD framework into the software outsourcing domain. QFD have been applied onto manufacturing business domains mostly, and this study propose to apply QFD onto the service domain.

There are a few limitations to this study. First, the results of our analysis have a limitation in being generalized because we use the

data collected by a single vendor's customers. Firm-specific factors such as brand value, reputation, and firm size may influence customer satisfaction as well as the five determinants examined in this study. For example, the good reputation of the vendor may lead to a positive bias in clients' evaluations. Another limitation is accrued from the cross-sectional nature of our data. If we can collect multiple responses from the same clients at multiple time points, we might be able to find more interesting results.

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