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IT Practices and Customer Satisfaction At 138 Large Firms

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IT PRACTICES AND CUSTOMER SATISFACTION AT 138 LARGE FIRMS

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Abstract

This paper explores what high-performing firms specifically do to gain the greatest benefits from their IT investments. It identifies several IT-specific factors such as Data/Process Standardization, Systems Integration and Application Integration as practices that are correlated with significant IT impact on a key business performance metric: customer satisfaction. The firms interviewed in this study represent large companies that invest significantly in enterprise software applications such as customer relationship management, sales force automation, enterprise resource planning and knowledge management. Through a set of matched interviews with multiple respondents at 138 firms, we identify several concrete practices as well as cultural variables that are associated with positive IT impact on customer satisfaction, and perhaps equally importantly, several practices where the effects are not positive.

Keywords: Standardization, Systems Integration, Application Integration, Customer Satisfaction

1 INTRODUCTION

In a survey of 659 CEOs by the London School of Economics (Compass Group 1999), only 25% of the executives were satisfied with the performance outcomes of IT investments made by their firms. Though executive perceptions of the impact of IT investments may be a noisy indicator of actual impact, the finding does seem to suggest that there are considerable differences in performance results firms obtain from their IT investments. It is now well accepted that investments in technology alone cannot lead to guaranteed enhancements in firm performance. However what is still not clear is what else exactly needs to be done to extract the maximum value from IT. When companies invest large amounts in IT but fail to see correspondingly significant increases in performance levels, that may be attributable to the lack of investment in other complementary factors like human and business resources. Achieving competitive advantage from IT is typically dependent on coupling IT with other company-specific, inimitable, and possibly intangible organizational, human, and business resources (Miller and Rice 1967; Walton 1989; Benjamin and Levinson 1993; Keen 1993; Powell and Dent-Micallef 1997). IT-specific intangible assets play a potentially important role in explaining heterogeneity in performance of firms that make similar investments in IT.

There is a real need for more empirical research to identify various specific intangible investments that should be coupled with IT investments to improve the overall IT payoff. Further, though many studies in the past have looked at impact of IT on financial performance of firms, few research studies have looked at process-level impact of IT (Barua et al 1995; Mooney et al 1995; Mukhopadhyay et al. 1997; Ray et al 2005). For example, investments in IT combined with complementary intangible investments may have an impact on the performance metric of a business function such as sales or customer service & support. Ray et al (2005) show that shared knowledge between IT and customer service units moderates the effect of investment in generic information technologies on customer service process performance. There is an increasing level of interest in the impact of IT on non-financial outcomes such as customer satisfaction and quality (Devaraj and Kohli 2000) as these types of process-level outcomes may be more directly and clearly impacted through first-order effects by IT and its intangible complements.

This empirical research study tries to fill an important gap in the IT business value literature: identification of IT-specific intangible investments such as investments in IT practices and organizational culture that allow firms to achieve favorable IT investment outcomes especially at the process-level. Specifically, in this study we address the following research question: what are some effective IT practices and IT-specific cultural elements that help explain performance improvement differentials on a process-level performance metric such as customer satisfaction? We identify, via an econometric analysis of 138 firms, several such practices and cultural variables that allow firms investing significantly in IT to achieve superior improvements in customer satisfaction.

The results are based on analysis of data on firms that invest significantly in enterprise software applications such as customer relationship management (CRM) and enterprise resource planning (ERP). We expect that these firms that are heavy-users of IT would also tend to have the most effective IT practices and cultural variables that would allow them to achieve significant improvements in performance.

2 THEORY AND HYPOTHESES

2.1 Resource-Based View and Contingency Theory

Our primary theoretical lens is the resource-based view (RBV), which has been used to analyze the role of IT intangible assets in impacting firm performance. According to RBV, differences in firm performance arise out of the heterogeneous distribution of resources among firms (Barney 1991, Tippins and Sohi 2003). Firms that have valuable, unique or relatively scarce, inimitable resources have a performance-advantage over firms that do not. In line with RBV, the mere presence of IT does not guarantee improvements in firm performance, as IT can be easily acquired by rival firms (Clemons

and Row 1991; Powell and Dent-Micallef 1997); however, when IT is coupled with other complementary organization-specific intangible resources that are hard to imitate, a performance advantage can be realized. One possible way to make IT give a sustainable performance-related advantage is to embed it in the organization in such a way that maximally leverages the complementarities between IT and different organizational resources (Powell and Dent-Micallef 1997). Co-specialization of complementary resources (such that the resources have little or no value without the others) can also lead to a performance advantage that can be hard to achieve otherwise (Powell and Dent-Micallef 1997). In employing the RBV to assess the impact of IT on the performance of the customer service process, Ray et al (2005) claim that “tacit, socially complex, firm-specific resources explain variation in process performance across firms and that IT resources and capabilities without these attributes do not” (p. 625).

Contingency theory provides additional theoretical support for our hypotheses below. It has been extensively used to analyze the role of intangible assets in the IT and firm performance relationship, and it claims that optimal firm performance can be obtained by using resources that are congruent or that “fit” well with each other. Thus, when IT is combined with complementary (or in one sense “congruent”) organizational resources, better performance can be realized. Specifically, the role of these other resources is that of a mediator (in the sense of “fit as mediation”, see Venkatraman (1989)) and they can be viewed as a significant intervening mechanism that mediate the link between IT and performance. It may not be enough to throw IT at a process to improve its performance. Thoughtful investments in complementary, intangible organizational resources may be crucial to get optimal performance gains from the IT investments.

2.2 Customer Satisfaction

We used perceived IT impact on customer satisfaction as the primary performance variable of interest (or dependent variable) in this study. We believe that impact on customer satisfaction (a process-level performance metric) can be relied upon as a reasonable proxy for bottom-line performance. Several studies in the research literature support the positive relationship between customer satisfaction and financial performance. For example, Agus et al (2000) found evidence that higher level of customer satisfaction leads to higher level of financial performance relative to the firm’s competitors. Anderson et al (1994) in their study of Swedish firms found that firms that achieve higher levels of customer satisfaction also are more profitable. In their sample of firms, they found that an annual one-point increase in customer satisfaction is associated with an increase of \$7.48 million in net income over five years i.e. the annual one-point increase in customer satisfaction has a NPV (net present value) of \$7.48 million. Ittner and Larcker (1998) also found in general a statistically significant positive relationship between customer satisfaction measures and future accounting performance. Why might higher customer satisfaction lead to higher profitability? The marketing literature (Fornell 1992, Anderson et al 1994) points to various possible reasons including increased loyalty on the part of customers, higher customer retention, lower advertising/marketing costs due to positive word-of-mouth on the part of current customers as well as enhanced firm reputation. Given that there is much empirical evidence to the positive impact of customer satisfaction on financial performance, we conclude that the dependent variable, customer satisfaction, in the hypotheses below is not only interesting in its own right, but also as a potential predictor of financial performance.

2.3 Access

It may not be sufficient to invest heavily in network-enabled business applications; access to these applications must be provided to employees in relevant work groups and possibly to external entities such as suppliers, customers, partners for the firms to be able to get the most out of these applications. As more employees in customer-focused groups are granted access to the business applications, more of them are empowered to help customers using information available in those applications and customer problems can potentially be resolved more quickly and efficiently. Similarly, providing

application access to entities in your supply chain, including customers, suppliers and partners, can enable firms to serve their customers better. For example, Customer Relationship Management (CRM) applications are more beneficial when firms share customer-related information with their supply chain partners (Mithas et al, 2005). Further, business applications that are easily accessible (say via web-based mechanisms) may be used more frequently by employees as well as external entities. If we assume that the level of use of these applications might be dependent on their ease of accessibility, it might be reasonable to predict that the higher the number of business applications accessible by web-based mechanisms, the higher the IT impact on customer satisfaction. Judicial provision of IT application access to various entities is highly valuable, very firm-specific and difficult to imitate. Thus, according to the RBV, access should explain performance differential on the customer satisfaction metric. Thus, we have the following set of hypotheses:

Hypothesis 1.1: Higher access to Internet business applications for customer service & support employees should be positively correlated to IT impact on customer satisfaction.

Hypothesis 1.2: Companies that provide customers, suppliers, and partners access to internal data and systems should exhibit higher positive IT impact on customer satisfaction than those that do not.

Hypothesis 1.3: The ease of access to deployed business applications (captured in this study in terms of percentage of network applications that are accessible via internet/web-based mechanisms) should be positively correlated to IT impact on customer satisfaction.

The above hypotheses should be understood in light of an important caveat: proper rationing of access rights is essential to ensuring that higher access to internal IT systems and applications does not indirectly hurt performance. Only authorized individuals should be given access to systems. For example, employees in the corporate finance division of an investment bank should not have access to data or systems meant for the research division in the bank because of regulatory requirements of a Chinese wall between the two divisions. Further access should be promptly revoked when it is no longer needed. For example, when an employee leaves the firm or when a relationship with a partner is terminated, access should be promptly removed for obvious reasons. Secure access is as important as improved level of access. Security mechanisms may be essential to protecting customer data and ensuring that only properly authorized individuals are allowed access.

2.4 Standardization and integration

IT infrastructure has been recognized as an important resource that can influence a firm's ability to use IT strategically (Davenport and Linder, 1994; Ross et al 1996; Weill 1993). The variance in the flexibility of the IT infrastructure among firms, which is reflected in the differential use of standards for hardware, operating systems, communications network, data and applications, produces variance in the business value achieved by different firms from IT-enabled innovation (Ray et al, 2005; Broadbent and Weill 1997; Duncan 1995). Improved sharing of data among systems and applications, enabled by standardized data and processes as well as extensive systems integration and application integration, can lead to better understanding and faster resolution of customer issues that involve multiple, interdependent subunits of the organization. If there are standard definitions for data elements used in the enterprise, it might be easier for different intra-enterprise IT systems/applications to exchange data among them. Standards also facilitate cross-enterprise communication and coordination with supply-chain participants, including suppliers and partners. Integrating different enterprise applications can improve the level of customer service. For example, an order management application might be integrated with inventory, planning, and logistics applications to improve order processing speed. Aggregating data from different data sources and systems can also help improve customer satisfaction and increase customer retention. For example, banks may maintain account data for the same customer in different databases. Checking accounts, savings accounts, investment accounts and mortgage accounts may be maintained in different data sources, but the online banking portal, which is an important customer touch point, might aggregate data from these different sources and present to the customer a summary of all their assets and liabilities on a single web page (Gable, 2002). The

convenience of viewing all account information on a single page can improve customer satisfaction. Investments in data and process standards, systems integration and application integration are highly valuable, very firm-specific and in general difficult to accomplish or imitate. Thus, according to the RBV, those types of investments should explain performance differentials on the customer satisfaction metric. Simply investing in diverse applications and systems without thoughtfully integrating them will not achieve optimal IT payoff; in fact, it may be detrimental to performance. Thus, we have the following hypotheses:

Hypothesis 2.1: Lack of standardized data and processes is negatively correlated to IT impact on customer satisfaction i.e. firms with lack of standardized data and processes exhibit lower positive impact on customer satisfaction.

Hypothesis 2.2: Lack of systems integration is negatively correlated to impact on customer satisfaction i.e. firms with lack of systems integration exhibit lower positive IT impact on customer satisfaction.

Hypothesis 2.3: The level of application integration (captured in this study in terms of the number of business functions such as marketing, sales, logistics, etc. that are linked to customer service & support data via the network applications) is positively correlated to IT impact on customer satisfaction.

2.5 Culture/Attitude

Companies in which IT investments are made in a systematic, thoughtful manner after demonstration of actual needs will be able to better address concerns of their customers, resulting in higher customer satisfaction. IT investments made in a haphazard way without careful consideration of requirements can result in much wastage and in reduction in the capacity to timely and adequately address customer problems. Further, a positive perception that the network and the e-business infrastructure of the firm provides it with a strategic advantage can also lead to higher investments in productivity-enhancing/quality-improving network-enabled business applications, which in turn can lead to higher customer satisfaction. Cultural elements such as those described above can be valuable in extracting the most out of IT investments. They are inherently highly organization-specific and in general difficult for other firms to adopt, as most organizations suffer from cultural inertia and change can often be hard to accomplish. Thus, according to the RBV, these cultural elements should explain performance differentials on the customer satisfaction metric. We have the following hypotheses:

Hypothesis 3.1: Companies in which IT funding occurs only after an existing business need has been demonstrated should exhibit higher positive IT impact on customer satisfaction than those in which that is not the case.

Hypothesis 3.2: Companies that perceive that the network and e-business foundation provides them with a competitive advantage in the market should exhibit higher positive IT impact on customer satisfaction than those in which that is not the case.

3 DATA COLLECTION AND METHODOLOGY

3.1 Data Sample

The cross-sectional dataset is composed of 138 firms, which completed a pair of telephonically-administered structured questionnaires in 2005 about IT operations as well as customer service & support operations. The questionnaires were administered by Momentum Research Group as part of the Net Impact research project sponsored by Cisco Systems. A total of 1087 firms were contacted for the study. Most of the 138 firms are large with approximately 54% of the firms having more than 1000 employees. The firms came from 5 broadly defined industries: public sector (25%), manufacturing (24%), healthcare/pharmaceuticals (19%), retail/wholesale (19%) and financial services (13%). The companies were selected from the Dun & Bradstreet database using a probabilistic sampling

technique. Two separate questionnaires were administered for each firm. The first questionnaire, which was about IT operations, was directed at an IT decision-maker within the firm. The second questionnaire, which was about the customer service & support business function, was directed at a business decision maker within the firm who was familiar with that particular function. The reason for the split-level design (two questionnaires separately targeting IT and business function personnel) was that there can be considerable differences in the depth of knowledge held by the decision-makers responsible for different functions in the organization. Though business decision-makers are increasingly IT-savvy and IT decision-makers are increasingly business-savvy, the possibility that this might not be the case calls for a split-level research design. That data from two decision-makers within each organization was obtained is one of the distinguishing features of this research study. Similar approach has been used by Ray et al (2005), who obtained a matched dataset of 72 firms.

The IT questionnaire focused on the enterprise applications deployed at the company, business functions automated and integrated by those applications, network infrastructure supporting those applications and the corporate culture in regard to the use of technology and networking. The customer service & support questionnaire focused on the business processes supported and automated by technology, metrics used to measure the impact of technology on business operations, perceived impact of the technology on those metrics and business barriers to improved performance. Most of the decision-makers interviewed were at the director level or higher in the organization. We are hopeful that targeting senior decision-makers has improved the quality of data gathered through the surveys. To qualify for the study, the firms had to have at least one fully deployed internet business application that supported customer service & support and that was accessible to more than 20% of the employees within that business function. The qualification criteria hopefully allows us to target firms that are heavy users of IT and that potentially have the most effective IT practices.

3.2 Dependent Variable

The dependent variable in this study is “Perceived IT Impact on Customer Satisfaction.” This variable was operationalized by asking respondents in the customer service & support division the following question: “Estimate the % impact, positive or negative, that your network applications have had on customer satisfaction (with the service interaction) over the last twelve months.” It is important to note that the actual customers of the firms answering the survey were not asked about their satisfaction with the service they were provided. Further, it is unclear from the data whether the customers were retail customers or business customers. Ideally, one could have administered the widely used scale developed by Parasuraman et al. (1988) to the firm’s customers to assess customer service performance. However this would not be feasible for a large number of companies that were surveyed in this study. Given the infeasibility of asking customers of the firms in a large sample, “perceived customer service performance” was used in a recent study on the impact of shared knowledge between IT and customer service units on customer service process performance (Ray et al, 2005) in which managers were asked about their perceptions of customer service quality.

3.3 Limitations of Data

Several caveats about the data should be kept in mind to understand the limitations of the study. First, since many of the firms interviewed in this study were either privately held or were government sector or healthcare/pharmaceutical companies, objective financial performance data such as profitability data is either not reported or is not available. Hence, we are unable to match up for a reasonable sample size of firms the perceived impact on the key functional performance metric, customer satisfaction, with impact on objective financial performance metrics such as profitability. Second, the decision-makers interviewed were asked about their perceptions on the IT impact on customer satisfaction. The numbers reported may not be accurate because of response bias or social desirability bias. Since we do not have multiple respondents from the same firm answering the question about IT impact on customer satisfaction, we have no way to check the validity of the reported numbers. Third,

the sample of 138 firms is a relatively small sample considering that they come from 5 different industries. Given the sample size, the high statistical significance of our results is encouraging. Fourth, as mentioned earlier, the dataset is cross-sectional and hence any conclusions are about associations/correlations and not about causation.

3.4 Analysis

To analyze the collected data, we employed a three-step approach. Since the questionnaires were extensive and covered more ground than the research questions addressed by this study, we used a variable-reduction procedure based on principal components analysis (PCA) to narrow down the number of independent variables for the regression analysis.

First, we tested the relationship between the key variables collected from the interviews and IT impact on customer satisfaction using simple correlation, whose significance was tested using Pearson's product moment correlation coefficient (note for correlations between a dichotomous variable and a continuous variable, one could alternatively have computed point bi-serial correlation coefficient, but this coefficient is algebraically equivalent to Pearson's product moment correlation coefficient). This step yielded a set of additional independent variables that were significantly correlated to our dependent variable (IT impact on customer satisfaction). We added these variables to our existing list of independent/control variables that were covered by the hypotheses. In all, we had 16 observed independent variables that were used in the second step. The variables along with their short descriptions is shown in Table 1 below. The descriptions are useful to understand how data on various variables are actually captured i.e. they help understand the operationalizations of the key variables.

Dependent Variable	Description
ImpactOnCustomerSatisfaction	Estimate the % impact, positive or negative, that your network applications have had on customer satisfaction (with the service interaction) over the last twelve months.
Independent Variable	Description
<i>Access Related Variables</i>	
EmpLevelAccess	% of service & support employees with access to internet business apps
AccessToRemoteEmployees	Do remote employees have access to internal data and systems?
AccessToCustomers	Do customers have access to internal data and systems?
AccessToPartners	Do partners have access to internal data and systems?
AccessToSuppliers	Do suppliers have access to internal data and systems?
EaseOfAccess	% of all applications that are accessible via internet/web-based mechanism
SiteLevelAccess	% of company locations that can access the application
<i>Standardization and Integration Related Variables</i>	
LackStdDataBarrier	Is lack of standard data perceived as a barrier to productivity?
LackStdProcBarrier	Is lack of standard processes perceived as a barrier to productivity?
LackSysIntegBarrier	Is lack of systems integration perceived as a barrier to productivity?
LevelAppInteg	Number of applications integrated
UseOfDataMart	Data from network apps flows into a data warehouse/datamart
DataStdEnforced	Data standardization is strongly enforced across all business units
<i>Culture/Attitude Related Variables</i>	
ITFundingAfter	New IT funding only after an existing business need has been demonstrated
LackWorkerTrainingBarrier	Is lack of worker training perceived as a barrier to productivity?
NetworkAsCompAdv	Network and e-business foundation provides the firm with a competitive advantage in the market

Table 1. Variables and their Descriptions

In the second step, we used PCA to develop a smaller number of principal components than the number of observed independent variables. Since many of the independent variables are significantly

correlated to each other (correlation table not shown here for brevity) interpretation of coefficients on these variables in multi-variate regressions is difficult because of multi-collinearity problems. PCA yields uncorrelated principal components, which can then be used in regression models. Before performing PCA, we standardized the variables so that they all had mean 0 and standard deviation 1.

A criterion that is often used to select the number of principal components for subsequent analyses is the eigenvalue-one or the Kaiser criterion (Kaiser, 1960). The Kaiser criterion yielded six principal components. Alternatively, one could also have chosen the number of principal components to be included in the regression using “proportion of variance accounted for” criterion combined with “interpretability” criteria. PCA on the set of 16 standardized independent variables also yielded 6 principal components, which explained a significant percentage (64%) of variance in the set of variables. The threshold for minimum proportion of variance to be accounted for by the principal component was chosen to be 5%. This reduced the number of principal components from 16 to 7. In interpreting the principal components, we examined loadings of the independent variables on the principal components. Loadings with absolute values greater than 0.4 were assumed to be “large” and significant. Six of the seven principal components were deemed interpretable and retained for further analysis. The loadings of the six components on the different independent variables is shown in Table 2 below. We interpreted the six principal components as follows:

Comp.1 Standardization and Systems Integration which is composed of variables: LackStdDataBarrier, LackStdProcBarrier, LackSysIntegBarrier (*note these variables are negatively described; see Table 1*)

Comp.2 Level of External Access which is composed of variables: AccessToCustomers, AccessToSuppliers, AccessToPartners

Comp.3 Level of Application Integration which is composed of variables: LevelAppInteg

Comp.4 Ease of Access to Applications and Lack of Worker Training which is composed of variables: EaseOfAccess, LackWorkerTrainingBarrier

Comp.5 IT Funding After Demonstration of Business Need which is composed of variables: ITFundingAfter

Comp.6 Network provides a competitive advantage which is composed of variables: NetworkAsCompAdv

	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6
EmpLevelAccess						
AccessToRemoteEmployees						
AccessToCustomers		-0.43				
AccessToPartners		-0.45				
AccessToSuppliers		-0.41				
EaseOfAccess				-0.66		
SiteLevelAccess						
LackStdDataBarrier	-0.42					
LackStdProcBarrier	-0.43					
LackSysIntegBarrier	-0.41					
LevelAppInteg			-0.40			
UseOfDataMart						
DataStdEnforced						
ITFundingAfter					-0.65	

LackWorkerTrainingBarrier				0.40		
NetworkAsCompAdv						-0.74

Table 2. Principal Component Loadings

4 RESULTS

We present in Table 3 results from regression analysis that uses only these six components as independent variables. The table shows that components 1, 2, 5, and 6 are significant at the 5% level, while component 3 is significant at the 1% level. Component 4 is not statistically significant. Since we know the composition of the different principal components, the OLS regression results can be interpreted as follows:

Comp.1: Standardization and Systems Integration are positively correlated to IT impact on customer satisfaction (significant at 5% level). Note that the coefficient on the principal component is positive, whereas the loadings for the variables for the component are negative. However, the variables are negatively described: *lack* of standard data, *lack* of standard processes and *lack* of systems integration (see Table 1). Hence it is the case that standardization of data and of processes and systems integration are positively correlated to IT impact on customer satisfaction. This is consistent with Hypotheses 2.1 and 2.2.

Comp.3: Level of application integration is positively correlated to IT impact on customer satisfaction (significant at 1% level). Note that even though the estimated OLS coefficient on the principal component is negative, the variable that loads on this component has a negative sign. This result is consistent with Hypothesis 2.3.

Comp.5: Policy that new funding occurs only after an existing business need has been demonstrated is positively correlated to IT impact on customer satisfaction (significant at 5% level). Note that even though the estimated OLS coefficient on the principal component is negative, the variables that load on this component have negative signs. This result is consistent with Hypothesis 3.1.

Comp.6: Cultural perception that “network and e-business foundation provides firm with a competitive advantage in the market” is positively correlated to IT impact on customer satisfaction (significant at 5% level). Note that even though the estimated OLS coefficient on the principal component is negative, the variable that loads on this component has a negative sign. This result is consistent with Hypothesis 3.2.

Comp.2: Giving access to internet business application, internal data and systems to customers, partners, suppliers (or external entities) is negatively correlated to IT impact on customer satisfaction (significant at 5% level). Note that even though the estimated OLS coefficient on the principal component is positive, the variables that load on this component have negative signs. This result is *not* consistent with Hypothesis 1.2.

Note **Comp.4** (ease of access (% of applications that are accessible by internet or web-based mechanisms) and lack of worker training perceived as a barrier to productivity) is *not* correlated to IT impact on customer satisfaction (p-value=0.1256).

	Dependent Variable	
Independent Variable	IT Impact on Customer Satisfaction	p-value
Comp.1 (Standardization and Integration) ⁽¹⁾	4.6333*** (1.6192)	0.0051
Comp.2 (Level of External Access) ⁽¹⁾	3.4020* (1.8655)	0.0710
Comp.3 (Level of Application Integration) ⁽¹⁾	-7.0781*** (2.3395)	0.0031

Comp.4 (Ease of Access to Applications and Lack of Worker Training)	3.7147 (2.4061)	0.1256
Comp.5 (IT Funding After Demonstration of Business Need) ⁽¹⁾	-5.8525** (2.7324)	0.0345
Comp.6 (Network provides a competitive advantage) ⁽¹⁾	-5.8178** (2.7591)	0.0373
R ² : 0.2298 F-statistic:5.271 on 6 and 106 degrees of freedom with p-value=0.00008676 OLS standard errors are reported in parentheses *** indicates significance at the 1% level ** indicates significance at the 5% level * indicates significance at the 10% level (1) The loadings for the variables for this component are negative		

Table 3. OLS Regression of IT Impact on Customer Satisfaction on the Principal Components

Note that R² of about 23% is relatively small (albeit acceptable for field studies), indicating that there is much unexplained variance in the dependent variable. The principal components analysis followed by regression analysis were unable to test for Hypothesis 1.1 (as the independent variable, EmpLevelAccess, failed to be part of a principal component) and Hypothesis 1.3 (as Comp.4 was statistically insignificant in the regression). The results do not change much with the addition of industry controls (not shown here for brevity). Overall, the regression results point to the strong positive correlation between IT impact on customer satisfaction and standardization, systems integration and application integration.

5 DISCUSSION

The results are consistent with the assertion that high investments in IT need to be combined with investments in standardization, systems integration and applications integration to reap maximum benefits from IT. Just granting applications and systems access may not be sufficient; what seems to be important in terms of enhancing performance is standardization of data, processes, systems integration, and application integration.

Standardization of data and processes, systems integration and application integration leads to accurate, reliable and comprehensive information that allows for better resolution of customer issues. Lack of standardization of data may lead to inconsistencies in the data and possibly incorrect information being provided to customers. Customer data is often stored in multiple systems/databases and if these systems are not properly integrated, then customer problems may take much longer to resolve. The longer average time to resolution will inevitably lead to dissatisfied customers. Updates to non-integrated databases will not be coordinated and may lead to outdated information in some data sources. Old information may lead to incorrect resolution of customer issues. Different client-focused sub-units of an organization may use different applications to address customer needs. If these applications do not talk to each other i.e. if they do not share customer information, the organization misses an opportunity to view holistic/complete information on its customers and provide higher levels of customer service. Thus, the finding of the paper that standardization, systems integration and application integration are positively correlated to IT impact on customer satisfaction does seem intuitively appealing.

On the other hand, the finding that level of internal data and systems access to external entities such as customers, suppliers, and partners is negatively correlated to IT impact on customer satisfaction is somewhat puzzling. One would expect that customers when allowed access to internal data and applications would have quick access to relevant information and would be able to resolve many of their issues efficiently through self-service. Also, giving access to partners and suppliers would be expected to facilitate maximum information sharing and useful collaboration to meet the needs of the

customer and provide optimal service. Nevertheless, we find in our dataset that providing access to external entities is negatively correlated to IT impact on customer satisfaction. The counter-intuitive result can also be understood from a close examination of the correlations between the variables. From the correlation matrix (not shown for brevity) we see that the level of application integration variable (LevelAppInteg) is negatively correlated with two access variables: (AccessToCustomer) and (AccessToSupplier). The negative correlation helps explain the negative impact of access on IT-related improvement in customer satisfaction. It is not enough for organizations to just provide customers, suppliers and partners access to internal data and systems; what is more important is to standardize data and processes, integrate systems and applications so that accurate, reliable, and comprehensive information is available throughout the organization. Further providing unrestricted access to external parties without carefully addressing security and access control issues might backfire (see caveat section after Hypotheses 1.1-1.3 above). Providing access without integrating internal data, systems, and applications and without addressing security issues adequately may be insufficient for improved positive IT impact on customer satisfaction. This is consistent with the strong complementarities between organization and IT found by Brynjolfsson and Hitt (2000). IT alone is not sufficient for success, and could even be counter-productive in some cases.

Finally, the first cultural finding that IT funding only after demonstration of business need is positively correlated to IT impact on customer satisfaction makes intuitive sense because IT investments in applications that do not adequately address a customer need will fail to improve customer satisfaction. On the other hand, IT projects that come out of systematic study of customer issues and needs will likely most adequately address them and lead to more satisfied customers. The second cultural finding – a shared perception that the network provides the firm with a competitive advantage is positively correlated to IT impact on customer satisfaction – makes sense because a shared understanding that the company's network is a strategic asset will lead to management support for higher investments in network-enabled business applications that have the capability to share data, provide high-quality information and thereby improve customer satisfaction.

6 CONCLUSIONS

Based on a detailed empirical analysis of data about the IT operations and customer service & support operations of 138 large firms that have at least one fully deployed internet business application to support customer service, we conclude that investments in IT-related intangible assets such as data/process standardization, systems integration, and application integration are investments in effective IT management practices that are significantly positively correlated to IT impact on an important business process performance metric such as customer satisfaction. Further, just providing internal data and systems access to external entities such as customers, suppliers, and partners is not correlated to positive IT impact on customer satisfaction; on the contrary, indiscriminately providing access to external entities may backfire, as we see a negative correlation between access to external entities and IT impact on customer satisfaction. Lastly, cultural elements such as thoughtfully spending on IT projects after business needs have been clearly demonstrated and firm-wide perception that the network and e-business foundation of the firm provides competitive advantage are significantly positively correlated to IT impact on customer satisfaction.

Future research may try to address some of the shortcomings of the data used in this study. It would be very useful to collect panel data so that causal hypotheses instead of correlational hypotheses could be explored. It would also be useful to target a larger sample of firms and actually measure directly some of the independent variables used in this research. For example, one could systematically define and precisely measure the level of data/process standardization and systems integration and then have a uniform way of comparing these variables across firms. Further, it would be useful to get *objective* data on IT impact on customer satisfaction or other *objective* financial performance data instead of data on *perceived* IT impact on customer satisfaction that was used in this study. Financial performance may be a better dependent variable as it is more easily comparable across firms than impact on customer satisfaction, as ways of measuring customer satisfaction could vary across firms.

However, as noted earlier, financial performance is not a process-specific performance metric and IT impact on a process metric may be more desirable. Overall, additional scholarly research to point out specific IT-related practices that allow firms that invest heavily in IT to differentiate themselves on the performance dimension from other firms that also invest heavily in IT would be a useful contribution to the management information systems field. Pointing out specific intangible investments that should be coupled with IT investments and even helping firms prioritize those intangible investments can be tremendously valuable to executive decision makers, as they try to use IT to improve firm performance along various dimensions of interest to them.

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