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# EFFECT OF INFORMATION TECHNOLOGY ON BUSINESS RELATIONSHIPS AND FIRM PERFORMANCE

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## Abstract

*This dissertation aims to further enquiry into business value of IT by identifying customer satisfaction and relationship oriented measures of IT effectiveness and firm performance. We draw on IT value, transaction cost and customer satisfaction streams of literature to test several hypotheses relating effect of IT on firm performance. Using a combination of archival and primary data, this study advances our understanding of the effect of IT investments (both in dollar terms and at the individual technology application level) on several outcome variables such as customer satisfaction, buyer-supplier relationships and aggregate firm performance measures. In contrast with previous research on business value of IT focusing on tangible measures of firm performance, this dissertation examines intangible and more comprehensive measures of firm performance.*

**Keywords:** Business value of IT, IT value, customer satisfaction, firm performance, supply chain, electronic markets, reverse auctions, firm boundaries, supplier relationships, IOS, customer relationship management

## Introduction

From its beginnings in the so-called IT productivity paradox, the research on the business value of IT is entering a vibrant phase of enquiry (Brynjolfsson 1993; Prahalad et al. 2002). There are at least three promising avenues for new research activity. First, the search for IT value is no longer limited to tangible and relatively quantifiable measures such as sales, value added or market value measures. Increasingly, researchers need to consider the contribution of IT to intangible value creation (Sambamurthy et al. 2003). There is a need to employ more encompassing measures of outcome performance beyond the traditional emphasis on aggregate measures such as sales revenues, value added or market value measures (Prahalad et al. 2002). Second, there is a need to understand the effect of IT at a disaggregated level in terms of effect of individual applications or IT enabled mechanisms. Although several scholars have highlighted the need for studying the effect of IT at the process level, barring few exceptions, very few studies have actually used process level approach (Banker et al. 1991; Barua et al. 1995; Mooney et al. 1996; Mukhopadhyay et al. 1997a). Third, the research needs to focus on mediating and moderating influences of organizational processes and mechanisms in determining the effect of IT on performance variables. In other words, there is need to examine the effect of IT on more encompassing measures of performance at a disaggregated level considering other mediating and moderating processes and mechanisms (Bharadwaj et al. 1999; Bharadwaj et al. 2002; Devaraj et al. 2003).

This dissertation aims to further enquiry into business value of IT by identifying customer satisfaction and relationship oriented measures of IT effectiveness and firm performance. We draw on IT value, transaction cost and customer satisfaction streams of literature to test several hypotheses relating effect of IT on firm performance. Using a combination of archival and primary data, this study advances our understanding of the effect of IT investments (both in dollar terms and at the individual technology application level) on several outcome variables such as customer satisfaction, buyer-supplier relationships and aggregate firm performance measures.

## Overview of Research Problems

Our research seeks to explore the effect of information technology (IT) on firm performance. According to an estimate, the worldwide spending on information technology (IT) and related investments runs into billions of dollars annually (WITSA 2002).

Academic researchers have attempted to quantify the effect of IT on firm performance. However, previous research suffers from at least three limitations. First, the effect of IT investments was measured in terms of a limited set of metrics such as productivity, profits and consumer surplus (Hitt et al. 1996). While these measures are helpful in advancing our understanding, they are proving inadequate in capturing the long-term success of firms that are increasingly dependent on customer franchise (Fornell et al. 1996; Porter et al. 1985; Prahalad et al. 2002). Second, with few exceptions, much of the previous research has focused on aggregate IT investments neglecting the need for analysis at the level of individual IT technologies or IT enabled mechanisms. Given that the effect of IT applications are more visible and have causal implications at the process level, we employ a process centric approach to investigating the effect of an electronic market mechanism in the procurement process. This approach allows us to empirically test and extend the previous work based on case studies or analytical models (Dai et al. 2001; Hess et al. 1994). Third, the prior academic work did not specify causal mechanisms that may underlie the effect of IT investments on firm performance. Researchers focused on IT investments and paid little attention to the effective management of IT and integration of IT with business processes and other IT systems in relating dollar IT investments to firm performance. In the absence of a rigorous understanding of the mechanisms that help firms in leveraging their IT investments, most IT investments remain vulnerable to failure. It has also been argued that disappointing results from investments in IT in recent times may have contributed to the ongoing dip in the investor confidence in the economy. Both business managers and academic researchers are pointing to the need to discover and understand the key mechanisms that may help firms create and measure business value from their IT investments. In contrast with previous research, this research examines a more comprehensive set of measures for firm performance including external measures such as customer satisfaction and customer loyalty. We are interested in discovering and specifying the causal mechanisms that explain when IT adoption and implementation will positively affect firm performance. An important objective of this research is to test previously untested theories that are important in studying the impact of IT applications and suggest appropriate refinements based on our fieldwork (Bakos et al. 1993a; Clemons et al. 1993b; Davis et al. 1992; Malone et al. 1987; Masten 1984). By taking a more comprehensive view of firm performance and by investigating specific causal mechanisms, this program of research is expected to make substantial contribution to a better theoretical understanding of how IT contributes to enhanced firm performance. Our research is also likely to contribute to a greater understanding of leading and forward-looking metrics for measuring business value created by IT.

## Scope and Summary of Dissertation Proposal

Current scope of this dissertation research has three interrelated parts. In the first part, we explore an overall effect of IT investments on firms' customer satisfaction performance. Unlike previous work that focused on production function based estimate of IT productivity, we measured IT returns in terms of a consumer surplus based metric i.e. customer satisfaction. In this work, we conducted a longitudinal study of the effect of IT investments on firms' customer satisfaction during the period 1994-2000 by gathering the most comprehensive dataset comprising firm specific IT investments and customer satisfaction to date. Based on this work, we concluded that investments in IT have had a positive impact only for services during the period 1994-96. However, this positive effect disappeared during the period 1999-2000. We found negative effect of IT investments in the manufacturing sector during both the periods. We also noted the positive effect of IT labor on firms' customer satisfaction and negative effect of IT capital during 1999 and 2000. This research explored the effect of IT on customer satisfaction for the first time and challenged the assumed but unsubstantiated positive effect of IT on customer satisfaction and customer loyalty (Prahalad et al. 2002). This work has since evoked a significant amount of interest and is shaping new research to explore the implications of our findings (Chabrow 2002). The complete working paper is available on the web at <http://eres.bus.umich.edu/docs/workpap/wp02-012.pdf> (Mithas et al. 2002b).

Our second study examines the effect of specific IT applications (e.g. electronic market applications) on buyer-supplier relationships in business-to-business (B2B) context. In this study, we used transaction cost and resource based views to explain the electronic markets adoption behavior by buyer firms in the U.S. automotive industry. This research specifically tested two of the rival theories about the effect of IT on buyer-supplier relationships and adoption of newly emerging electronic markets. For example, 'electronic market hypothesis' postulated an across the board adoption of markets as the preferred mode of transaction while the 'middle to move' hypothesis proposed greater collaboration with a few suppliers (Bakos et al. 1993b; Clemons et al. 1993b; Malone et al. 1987). By capitalizing on the natural experimentation that the Internet unleashed, we decided to test these theories in the context of the automotive industry setting by collecting primary data through a field survey. Our research provides the most definite test of these theories to date and lent support to the 'move to the middle' theory. In addition, this work also helped us refine the transaction cost based theory of the firm by emphasizing the role of non-contractible factors (e.g. quality, trust, innovativeness, responsiveness, flexibility, information sharing) in buyer-supplier relationships. A research-in-progress version titled 'Non-contractible factors as determinants of electronic market adoption' was presented at International

Conference on Information Systems (ICIS) 2002 held at Barcelona (Mithas et al. 2002a). The work has been completed since then incorporating suggestions received at the ICIS and the full paper is currently in review at one of major IS journals.

The third research project (currently under progress) extends the work done in above two research projects and tries to look at the contribution of customer interface related IT applications. In this research, we propose and investigate two causal mechanisms that may explain the returns from IT: business process integration and IT integration. We hypothesize that IT applications contribute to customer satisfaction when they are aligned with business processes redesign and when new IT applications are integrated with legacy IT investments that already exist. Figure 1 shows the conceptual model for this research. By highlighting the role of specific causal mechanisms, this research aims to contribute to theory building in the information systems domain.

In summary, the specific goals of this dissertation are:

1. To analyze the effect of dollar investments in IT on overall customer satisfaction performance of firms
2. To examine the effect of IT on governance mechanisms and buyer-supplier relationships. In order to make this research problem tractable, we examine the effect of IT enabled mechanisms such as reverse auctions on the use of markets by buyers in B2B context.
3. To analyze the effect of investments in CRM applications in business-to-business setting on customer relationship and firm performance.

As noted previously, our third research project is in early stages of execution. We next discuss methodology, data sources and expected findings for this research. We shall discuss our preliminary results of this research at the AMCIS conference.

## **Methodology**

Our first two research projects used archival and survey data respectively. For the third research project, we intend to collect data on firms' IT investments (including those in customer facing IT systems) and perceptual outcome measures from these firms. This data collection will employ development of a survey instrument. We have already pilot tested our survey instrument in consultation with several academic researchers, industry executives and experts in customer relationship management systems. Currently, we have launched our survey in the automotive industry and we will roll out the survey in high tech and consumer goods industries subsequently. By studying three industries, we hope to be in a position to judge the generalizability of the research findings. We also intend to do in-depth case studies of selected companies in each of the industries to enhance our understanding of the key mechanisms for successful deployment of IT systems. The analysis will use a combination of econometric methods such as regression analysis and structural equation modeling to estimate the proposed research models and theories.

## **Data Source**

As noted earlier, we will be collecting primary data for our third and ongoing research. We are contacting some agencies and firms to get access to archival data on IT investments and customer satisfaction. Collection of archival data, in addition to the primary data that we are collecting, will allow us to do a longitudinal analysis for inferring causality and increase the robustness of our findings.

## **Expected Findings**

We expect to find that implementation of IT systems is positively associated with superior business performance when such IT systems are well integrated with suitable redesign of business processes and integration with legacy IT investments. Given the novelty of the research questions we have posed, our task involved conceptualizing and operationalizing some of the key concepts for the first time. For example, we have developed scales to measure the concept of IT systems maturity and IT-business process integration. Our research, if validated, will spawn a new body of research that looks at forward looking and predictive measures of firm performance. We also expect that future research in this area will significantly benefit from our theory building and conceptualization related to IT-business process integration and its role in explaining business performance. The findings are also expected to influence managerial practices associated with management of IT resources in firms.

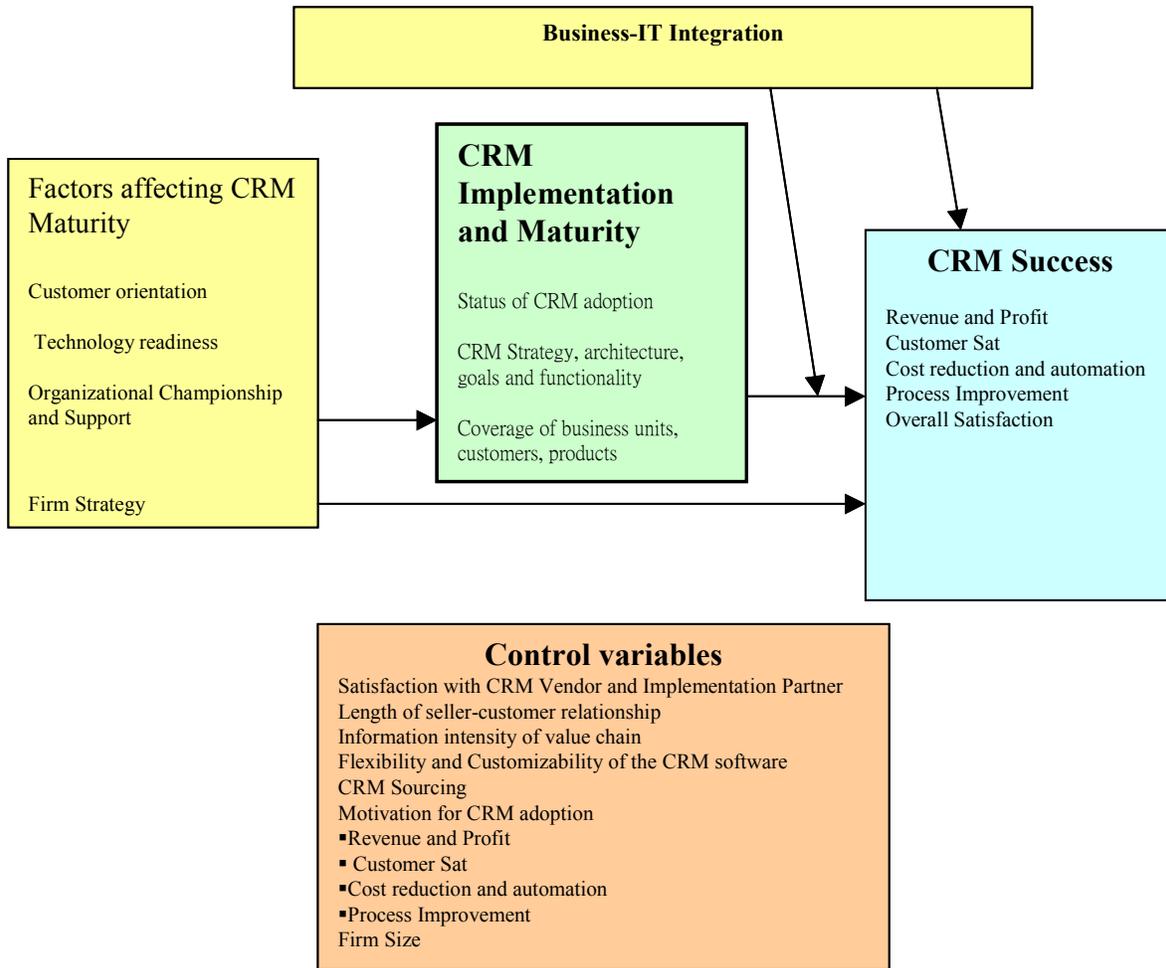


Figure1. CRM Maturity and CRM Success Conceptual Model

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