



**INTER-ORGANIZATIONAL INFORMATION
AND COMMUNICATION TECHNOLOGY ADOPTION IN THE
BUSINESS-TO-BUSINESS INTERFACE**

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Abstract

This research contributes to the growing body of Resource Based View (RBV) empirical research by isolating organizational resources and capabilities that impact successful firm performance in the context of Inter-organizational Information and Communication Technology (IICT) implementation in business-to-business customer interface. Despite extensive IICT implementation, many organizations do not maximize potential business value from IICT investments due to human and organizational reasons. This paper empirically tests a theoretical model that makes the connection between organizational resources and capabilities and successful IICT adoption. Results suggest that, in addition to a robust information technology (IT) infrastructure, investment in organizational change management, the ability to sense changes in the technology environment, development of managerial IT knowledge, and a culture of freely shared internal information are key factors in a company's ability to successfully integrate IICT in their exchange relationships with customers.

Keywords: Resource Based View, Information Technology, Business-to-Business, Customer Interface

Introduction

Despite diffusion of information technologies (IT) and Internet technologies into business processes and functions, many organizations do not generate maximum business value possible from these technology investments. Ross and Weill (2002) conclude that “companies that manage their IT investments most successfully generate returns that are as much as 40 percent higher than those of their competitors.” Many companies experience a steep learning curve and initial drop in productivity when they initiate and deploy new IT initiatives (Harper and Utley 2001). Clegg et al. (1997) found that 80-90 percent of IT investments do not meet corporate performance objectives, primarily due to non-technical reasons such as human and organizational aspects of IT implementation and management. In a survey of 1,500 IT project managers in Great Britain across industry sectors, Huber (2003) found that only 16 percent of IT projects met their targets on budget, schedule, and scope.

What causes these inefficiencies and failures in IT adoption and, more importantly, what can organizations do to attain optimal benefit from IT and Internet technology adoption? Ross and Weill (2002) argue that the problems are due to a failure to realize the business challenges in adopting such initiatives. They point out the often encountered misperception that problems in complex information system implementation are the result of technological difficulties in operationalizing such complex systems, but, in fact, they argue that problems are due to senior management failure to realize that adopting complex information systems poses business as well as technological challenges.

Previous research has argued that organizational impediments to implementation of innovative information technologies in the customer interface include: business culture (Vlosky et al. 2000), resistance to share data and knowledge (Anandarajan et al. 1998), degree of centralization (Vlosky et al. 2000), rigid organization structure (Vlosky et al. 2000), unwillingness to relinquish control (Vlosky et al. 2000), management fear (Hamill 2000), difficulties in integrating eBusiness into existing operating processes (Vlosky et al. 2000), lack of change management (Clegg et al. 1997), lack of commitment from senior management and staff (Hamill 2000; Clegg et al. 1997), user resistance (Hamill 2000; Anandarajan et al. 1998), and decision-making challenges (Vlosky et al. 2000).

In this study, we look at Inter-organizational Information and Communication Technology (IICT) implementation. IICT is a term we developed to capture the factors that influence successful IT or Information System (IS) implementation that spans organizations in a business-to-business (B2B) exchange relationship. IICT facilitates inter-organizational communication, commerce, collaboration, and integration in the B2B supplier-customer dyad. In this study, we examined Electronic Data Interchange (EDI), extended mark-up language (XML), extranets, eMarketplaces or other eIntermediaries, and corporate websites as a selection of vehicles that influence IICT.

The overarching objective of this research is to examine organizational capabilities that influence successful IICT implementation. Based on Bharadwaj (2000), heterogeneously distributed resources and skills across firms lead to different patterns of IT effectiveness, despite uniform and significant technology investments. Accordingly, our research posits that IICT implementation is a firm-specific capability that is not only dependent on tangible and intangible IT resources, but is highly embedded in other firm-specific resources and capabilities such as culture, strategy, and management, and hence requires their support and co-existence to have positive effect on business outcomes and consequently derive value for the firm.

After an introduction to the research problem and motivation, this article follows the following steps. First, a theoretical foundation based on the Resource Based View is elaborated and IICT potential as a source of sustainable competitive advantage is introduced as a holistic organizational capability. Second, a conceptual model of organizational resource and capability antecedents for effective customer interface IICT adoption is presented. Managerial, cultural, and strategic variables in the conceptual model are discussed and hypotheses are presented. Third, an overview of the study methodology and is discussed, and finally, research results from empirical model testing are described. We conclude with managerial implications and a discussion of limitations and future research.

Theoretical Foundation

This research is based on the Resource Based View (RBV) theory. RBV attempts to explain business performance in terms of firm-specific skills and resources that are valuable, inimitable, rare, and non-substitutable (Barney 1991). The RBV posits that distinctiveness in a company's offering or operations are directly tied to the distinctiveness in the input (resources and skills) employed (Conner 1991). Beyond the traditional tangible resources of labor, capital, and land, the RBV literature recognizes and emphasizes the importance of intangible resources and capabilities in generating above normal rent (Conner 1991). Tangible resources' ownership and value are easy to measure. They are relatively imitable, substitutable (Barney 1991), and transparent (Grant 1991) and hence easily duplicated by competitors. Intangible resources are harder to duplicate than the tangible resources due to their non-physical and often ambiguous nature. Intangible resources include organizational routines, organizational processes, management skills, knowledge, information (Conner 1991), customer orientation, organizational know-how (Bharadwaj 2000), intellectual property, quality, brand image, reputation, company networks and databases (Grant 1991; Fahy and Smithee 1999). Firms create competitive advantage by combining resources that work together to create organizational capabilities (Bharadwaj 2000). Capabilities are the combination of resources, organizational routines, and interactions through which the firm's resources are coordinated (Grant 1991). They are based on tacit knowledge and hence are often inimitable and non-substitutable. Their interaction-based nature and casual ambiguity make them more difficult to duplicate.

The core assumptions in RBV are that resources are heterogeneously distributed across competing firms and that these differences can be long lasting due to resource immobility, causal ambiguity, social complexity, and historical uniqueness, which explain why some firms outperform others (Barney 2001). The IT literature has used RBV to examine IT as a potential source of sustainable competitive advantage (e.g. Barney 1991; Mata et al. 1995; Ross et al. 1996; Bharadwaj 2000; Clemons and Row 1991).

Research has shown that firms using identical information and communication technologies and demonstrating equivalent IT spending have great variability in profitability (Stewart et al. 2003). Competitive advantage rests not in IT or IICT itself but in the firm's capabilities to use it. Although IT infrastructure (hardware and software) may have become ubiquitous and readily available, the insight and ability required for it to create economic value and competitive advantage are very much in short supply (Stewart et al. 2003). Thus, despite overall high IT investment across companies and industries, IT capability tends to be heterogeneously distributed, leading to different patterns and effectiveness of IT (Bharadwaj 2000).

Research Objective

Our main premise is that IICT is more about the enterprise-wide capability to leverage technological innovation than about technological functionality. Accordingly, the objective of this research is to empirically investigate the core characteristics and resources that support successful IICT implementation.

Theoretical Model of Effective IICT Adoption

Based on Grant's (1991) transparency logic, an outcome that is the consequence of complex coordination between number of resources and co-occurring capabilities is more difficult to comprehend than a capability which rests upon the utilization of a single dominant variable. This logic is followed in this research to understand the challenges in IICT adoption and implementation. We view IICT effectiveness as a heterogeneously distributed firm capability, and hence, this research investigates IICT embeddedness in non-IT related organizational resources and capabilities.

A conceptual model was developed and tested that examines cultural, strategic, and managerial factor relationships with successful IICT implementation in the customer interface of the supplier-customer dyad. **Figure 1** shows the conceptual research model with hypothesized antecedent firm capabilities influences on effective IICT adoption. The influences of each variable and associated hypotheses are discussed in the following section.

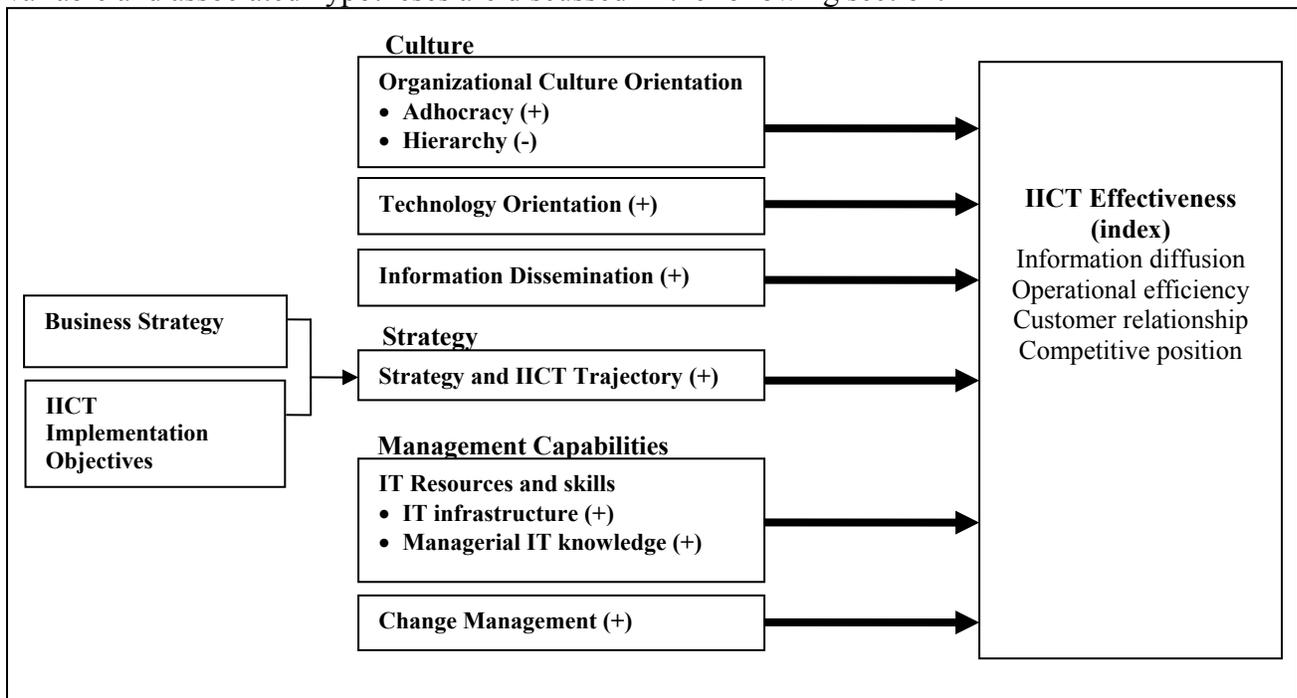


Figure 1. A conceptual model of antecedents for effective IICT adoption in the customer interface

Dependent Variable-IICT Effectiveness

Mizik and Jacobson (2003) argue that companies can create competitive advantage through value creation or value appropriation. IICT adoption can enhance value creation by enabling business process innovation and providing value-added services. Bharadwaj (2000) pointed out that IT has an enabling role with respect to several intangible organizational resources that are linked to superior financial performance, such as customer orientation,

customer service, information management, and product quality. IICT adoption may mitigate value appropriation by improving operational efficiency, deepening relationships through created asset specificity or relational exchange, increasing information diffusion, and strengthening competitive position. IICT effectiveness describes how successful an organization has been in integrating customer interface IICT adoption as a part of their business. In other words, how successful an organization has been in inducing positive impact on operational efficiency, customer relationships, information diffusion with customers, and competitive position from customer interface IICT adoption. IICT effectiveness is hypothesized to have a relationship with managerial (tangible IT resources, intangible managerial IT knowledge, change management), cultural (organization's culture orientation, information dissemination, technology opportunism), and strategic capabilities.

Independent Variables

Management Capabilities

IT Resources and Skills-IT Infrastructure

Information system infrastructure is defined by Byrd (2001) as the computer resources (hardware and software), communication technologies, data, and core applications that provide the technological foundation for widespread communication interchange across organization, and design, development, implementation, and maintenance of present and future business applications. Armstrong and Sambamurthy (1999) found that the sophistication of IT infrastructure has a significant impact on IT adoption. Byrd (2001) argued that the development of an information system infrastructure is the most important aspect of managing IT resources in an organization. Chan and Davis (2000) noted that if a company doesn't already have a sound information infrastructure, infrastructure problems will be magnified by eBusiness implementation. Accordingly, the first hypothesis investigates the relationship between tangible IT (hardware and software) and IICT effectiveness, hypothesizing that a solid information infrastructure supports successful customer interface IICT implementation.

H₁: Robust information technology infrastructure has a positive relationship with IICT effectiveness

IT Resources and Skills- Managerial IT Knowledge

Technical resources are essential in IT application implementation, but the RBV of the firm suggests that the most important aspect in IT implementation is the process of organizing and managing IT within the firm (Mata et al. 1995). IT management's ability to manage relationships between other functions, suppliers, and customers is a base for sustainable IT based competitive advantage (Mata et al. 1995; Bharadwaj 2000). Based on Mata et al. (1995) IT managerial skills should include an ability to: 1) Understand and appreciate the business needs and needs of other functional managers, suppliers, and customers; 2) Communicate and work with other functional managers, suppliers, and customers in developing appropriate IT applications; 3) Coordinate IT activities in ways that support other functions, suppliers, and customers; and 4) Anticipate the future IT needs of other functions, suppliers, and customers. Bharadwaj (2000) noted that senior management's ability to coordinate the broad set of required activities is closely associated with successful IT system implementation. Armstrong and Sambamurthy (1999) suggest that senior leadership, Chief Information Officer's (CIO) technical and business knowledge, and IT-literate business management has an essential role in successful

innovation implementation. We suggest that in order to successfully employ IICT, management must understand it in the context of business objectives, strategies, and processes.

H₂: Managerial (IT management, business management) IT knowledge has a positive relationship with IICT effectiveness

Change management

In many IT projects the technology itself functions, but the organization is not ready to use it effectively and efficiently. The importance of an effective change management team is highlighted in Koch's (2002) argument that IT initiatives don't fail because of technology but because the organization fails to effectively define and implement the change required to achieve business improvement. A change management approach is needed when the historical processes of the business must be overridden, changed, or supplemented in order to implement change (McLagan 2003). Based on a survey at the IT Director's Forum, of 321 U.S. information technology managers surveyed, 17 percent ranked change management as the number one management challenge (Riley 2002).

Grant (1991) argued that adaptability to change is a detrimental factor for the firm's strategic flexibility. In highly competitive environments, the resources of organizations and the way they are utilized must constantly change to produce continuously changing temporary advantages (Fiol 2001). Hence, change management is a core organizational resource and the ability to learn and change is likely to be among the most important capabilities a firm can possess (Barney 2001).

H₃: Employment of change management principles has a positive relationship with IICT effectiveness

Organizational Culture Orientation

Beyond tangible IT and IT related managerial resources and capabilities, this research posits that the overall organizational culture, which defines "the pattern of shared values and beliefs that help individuals understand organizational functioning and thus provide them with the norms for behavior in the organization" (Deshpande et al. 1993) have a relationship with how effectively an organization is able to employ IICT. Conner (1991) argues that organizational culture affects behavior throughout the firm. In the literature, organizational culture has been found to influence an organization's information acquisition, transmission, and utilization (Moorman 1995) and business performance (e.g. Barney 1986; Deshpande et al. 1993). Berthon et al. (2001) suggest the following connection between culture and decision making: culture specifies what information is valuable for the organization; culture influences the interpretation of information; culture can determine the speed at which decisions are made; culture defines how information is communicated across the organization; culture coordinates collective action taking.

Empirical research has found that cultures that harness entrepreneurship and competitiveness outperform those cultures reflecting organizational rules and internal cohesiveness (Deshpande et al. 1993). Adhocracy culture has been argued to be the most effective culture in Western cultures (Berthon et al. 2001). Srinivasan et al. (2002) found that adhocracy culture is positively and hierarchy culture is negatively related to an organization's capability to detect new technologies in its environment as well as to react to new emerging opportunities through technology innovation. Harper and Utley (2001) analysis revealed positive correlation with successful IT implementation: autonomy, trust, team oriented work, flexibility,

and sharing information freely. These attributes reflect the attributes of an adhocracy culture. Negative correlations were found with rule orientation, compliance, carefulness, preciseness, and predictability (Harper and Utley 2001). These attributes accurately describe hierarchy culture.

H₄: Adhocracy culture has a positive relationship with IICT effectiveness

H₅: Hierarchy culture has a negative relationship with IICT effectiveness

Information Dissemination

“The focus in supply chain management has shifted from engineering efficient manufacturing processes to the coordination of activities in supply chain networks through knowledge management” (Tan et al. 2000). Information has become the unit of exchange and source of competitive advantage (Vargo and Lusch 2004) and one of the primary wealth-creating assets (Achrol 1991). Organizational culture has been found to influence an organization’s information acquisition, transmission, and utilization (Moorman 1995) and business performance (e.g. Barney 1986; Deshpande et al. 1993).

Anandarajan et al. (1998) found that resistance to share data and knowledge both internally between departments and functions and externally with customers impedes IICT adoption in many organizations. Organizations with successful IT adoption have realized the value of a free flow of information between individuals and groups (Harper and Utley 2001). Increased information sharing between trading partners may result in lower total transaction costs, higher order fulfillment rates, shorter order cycle times, and more accurate demand forecasting. Armstrong and Sambamurthy (1999) argue that an organization’s ability to disseminate business and IT knowledge throughout the organization is essential for superior IT adoption. This research will empirically test this argument:

H₆: Cross functional information dissemination has a positive relationship with IICT effectiveness

Technology Orientation

Srinivasan et al. (2002) investigated why some firms readily adopt radical technologies, whereas other firms are either unwilling or unable to do so. The authors found that differences in adoption of radical technologies among firms can be attributed to a sense-and-response capability of firms with respect to new technologies. The technology opportunism has common ground with the market orientation (Kohli and Jaworski 1990; Narver and Slater 1990) concept’s overall logic of an organizational capability to generate, disseminate, and act on market intelligence, with the difference of technology opportunism being contained to sensing new (radical) technologies and responding to them with a response ranging from new technology adoption to the decision to ignore the technology. It is argued that organizational culture that fosters sensing of change in technology environment in general, also prepares the organization to successful adoption through acclimated familiarity and knowledge in evaluating opportunities from technological change.

H₇: Technology opportunism (ability to sense trends in the technology environment) has a positive relationship with IICT effectiveness

Strategy Variable

Business Strategy Fit with IICT Implementation Objectives

Business strategy specifies how a business will compete and achieve competitive advantage in the marketplace. The primary focus of business strategy is the leveraging of a firm's distinctive skills and resources to implement a value-creating strategy (Varadarajan and Jayachandran 1999). Based on the RBV, firm resources are fundamental to strategy execution. If a firm seeks to become a cost leader in an industry, it needs to develop resources that contribute to attaining such a position (Fahy and Smithee 1999). For any generic competitive strategy there is an associated resource set (Grant 1991). In order to create optimal value to the firm, the decision to implement IICT should be derived from the business strategy (Chan and Davis 2000).

It is important to remember that technology itself should not be the starting point in any IT project, but should result in the achievement of business goals. Hence, it is argued that an organization with cost leader strategy would achieve most success with customer interface IICT implementation if the decision to implement and the following project design and scope were driven by such objectives as: enhancing operational efficiency and inventory turns, reducing transaction cost, reaching new customers, or reducing transaction costs. Business strategy based on differentiation advantage would require a different IICT configuration. In this case the objectives might include: deepening customer relationships, improving customer service, facilitating joint product development, improving brand image, and shortening distribution channels.

H₈: Alignment of business strategy and IICT objectives has a positive relationship with IICT effectiveness

Methodology

The research was conducted using mail surveys. In general, survey procedures, follow up efforts, and data analysis were conducted in accordance with the Tailored Design method developed by Dillman (2000). The conceptual research model was tested on a cross industrial sample of manufacturing firms operating in the U.S. The sample frames for the study were 250 largest companies by 2004 sales for each of four manufacturing sectors: paper, wood products, chemicals, and food. The chemical and food sectors were selected as being important industrial sectors. The paper and wood products sectors were selected as they are of particular interest to the authors. Marketing executives were identified in Srinivasan et al. (2002) as frequently being responsible for eBusiness implementation decisions and as such were selected as key informants.

A total of 1,000 questionnaires were mailed to companies in the selected manufacturing industry sectors. Accounting for undeliverables and companies in inappropriate sectors, the adjusted sample size was 886. Of these, 106 usable returns resulted in an adjusted response rate of 12 percent. Given that typical response rates for industrial studies range from 15 to 30 percent (Adams 1986; Donald 1960) the response rate is somewhat low, but is similar to lower response rates in studies investigating B2B eBusiness (e.g. Chuang and Shaw 2005; O'Leary 2003; Kallioranta 2003; Vlosky and Pitis 1999, Vlosky and Wilson 1996, Wilson and Vlosky 1998).

Measures

The questionnaire was developed based on existing measures from the literature when available. If measures were not available for a model construct, new measures were developed based on theories and items found from existing literature. To collect data on the resource and capability constructs, Likert-type scales were used when applicable, anchored by 1= strongly disagree, 3= somewhat agree, 5= strongly agree.

Culture orientation was measured using the scale developed by Moorman (1995) for adhocracy and hierarchy culture orientations. The Fisher, Malz, and Jaworksi (1997) scale assesses perceptions of the extent to which organizational guidelines and expectations foster the free exchange of information between functional areas and was used to measure organization's tendency towards internal information diffusion.

Technology opportunism was measured using the scale developed and tested by Srinivasan et al. (2002). For IT infrastructure, a new scale was developed, including items for infrastructure, system integration, and IT budget.

Managerial IT skills were captured by modifying the "IT knowledge" scale by Boynton et al. (1994). An existing scale was not found for change management in the IT context. As a result, a new measure was developed based on change management principles found in the literature.

To capture the fit between business strategy and IICT objectives, respondents were asked to indicate their objectives for customer interface IICT implementation among five cost leader strategies (improve operational efficiency, reach new customers, reduce transaction costs, reduce employee count, enable faster inventory turns) and five differentiation strategies (improve customer service, deepen existing customer relationships, cut out middlemen in distribution channel, enable joint product development, improve brand image) related objectives. IICT objectives were then compared to business strategy type. The respondent firm's business strategy was identified using the Miles and Snow strategy type descriptions developed by McKee, Varadarajan, and Pride (1989). The resulting match/no-match yields the independent variable for business strategy and IICT objective alignment.

Respondents were asked to compare pre- and post- adoption of customer interface IICT relative to business activities and outcomes. IICT implementation effectiveness was measured by creating an IICT Effectiveness Index that in aggregate measured IICT impact on 1) operations efficiency along the value chain, 2) customer relationship, 3) information diffusion with customers, and 4) competitive position (Kallioranta 2006). The index is a summated scale of 15 items (**Table 1**) measured on a scale anchored by 1= highly decreased, 2= somewhat decreased, 3= no effect, 4= somewhat increased, 5= highly increased. Due to difficulties in objective assessment of IT performance this research relied on executive (subjective) judgment in identifying and isolating the specific effect of IICT adoption on the items measured in IICT Effectiveness Index. In addition, this was not a dyadic study and, as such, customer interface IICT effectiveness was measured from the suppliers' perspective.

Bias, validity, and reliability

In order to ensure that the questionnaire was appropriately designed to collect the desired information, it was pre-tested on a selected convenience sample of 20 marketing research and industry experts. Face validity of the questionnaire constructs were assessed by establishing a consensus among the (marketing) research experts that the survey instrument completely and comprehensively covered the concepts that it intended to measure.

Overall, missing data was infrequent and random throughout the questionnaire. Mean replacement was chosen as the most suitable imputation option. Non-response bias was assessed by comparisons between respondents from the first and second mailings (Adams 1986; Donald 1960). Two-sided Pearson's Chi-Square and t-test statistics for independent samples did not indicate significant group mean differences between the early and late respondents at the $\alpha=0.05$ level.

Table 1. IICT Effectiveness Index

Effectiveness			
Business process efficiency	Customer relationship	Information	Competitive position
On-time delivery	Customer satisfaction	Amount shared	Image
Order processing efficiency	Trust	Timeliness	Competitiveness
Production planning efficiency	Leverage	Quality	
Timely reporting	Dependence	Quality of service	
	Reliance on long-term relationships		
The response scale was anchored by 1= highly decreased, 2= somewhat decreased, 3= no effect, 4= somewhat increased, 5= highly increased.			

Source: Kallioranta (2006)

Before testing the hypothesized antecedents for effective IICT implementation, the validity of the organizational capability constructs in the conceptual research model (IT resources, managerial IT knowledge, change management, culture orientation, information dissemination, and technology opportunism) were confirmed by principal component factor analysis with varimax rotation.

Principal component factor analysis identified strong intercorrelations among the organizational capability items. The identified factors were equal to the scales as they were found in literature (adhocracy culture and hierarchy culture by Moorman (1995), information dissemination by Fisher et al. (1997), technology opportunism by Srinivasan et al. (2002), or modified from the existing scale in the literature (managerial IT knowledge by Boynton et al. (1994) or developed based on theory (IT resources and change management). All factors had high factor loadings (>.58) only on the specific isolated factor. Hence, the factor solution demonstrated good convergent validity. With respect to discriminant validity, the items loaded higher on their predicted construct than on their cross-loadings. In addition, Cronbach's α was used to measure reliability (internal consistency) of the constructs. High ($\geq .70$) Cronbach's alphas indicate that all measures are reliable and summated scales for each construct could be used in subsequent hypothesis testing.

Results

In the following section, statistical analysis performed to test the conceptual research model and hypotheses are discussed and the results obtained are presented. Multiple regression analysis was performed to examine the variance in the "IICT effectiveness index" dependent variable uniquely explained by organizational resource and capability variables identified in the conceptual model. Backward elimination¹ process for variable selection was used to identify the set of variables that most explain the variability in the "IICT effectiveness". Respondents who

¹ Backward elimination starts with the full model (including all variables), and sequentially removes independent variables from the model if the significance level of the partial correlation F value is less than 0.10. The procedure stops when there are no variables in the equation with an F value less than 0.10 (Freund and Wilson 2003).

indicted that no IICT applications were adopted in their organization, outliers, and influential cases were omitted from the analysis resulting in a sample size of n=88.

In addition to the managerial variables (“IT resources”, managerial IT knowledge”, “change management”), culture variables (“adhocracy corporate culture”, “hierarchy corporate culture”, “information dissemination”, “technology opportunism”), and strategy variable (“alignment of business strategy and IICT objective”), three control variables were introduced for “industry sector”, “revenue”, and “IT spending”. The control variables were used as dummies. The “industry” sector dummy variable was coded: 0=eCommerce laggard sector (wood and paper manufacturing), 1=eCommerce fore-runner sector (food and chemicals manufacturing). The “revenue” variable was coded: 0=revenue less than \$100 million, 1=revenue more than \$100 million in 2005 to reflect the potential effect of organization size. The “IT spending” variable was coded: 0=IT spending less than \$50,000, 1=IT spending more than \$50,000 per year to investigate the relationship between IT spending and IICT effectiveness. In addition the “alignment of business strategy and IICT objectives” was integrated in the model through dummy coding: 0=not aligned, 1=aligned.

Regression results show that there is a relationship between the dependent variable of “IICT effectiveness” and four independent variables ($F(4,83)=18.01, p<.001$). The four variables identified to have a significant relationship with IICT effectiveness were “change management”, “industry”, “technology opportunism”, and “IT resources”. The estimated model explained approximately 46 percent of variance in the “IICT effectiveness index”. According to the estimated model, the predictive equation for “IICT effectiveness” is:

$$IICT\ effectiveness = 39.974 + .461(Change\ management) + 2.159(Industry) + .243(Technology\ opportunism) + .321(IT\ resources)$$

Table 2 displays the regression coefficients and standardized beta coefficients (β) for variables that were found to be significant determinants of IICT effectiveness. Standardized beta coefficients for the variables that were statistically excluded from the model of organizational antecedents for effective IICT implementation are also presented. With a sample size of 88 and five parameters with significant partial regression correlation coefficients (intercept and four independent variables), the data set is able to detect significant relationships with an R^2 of approximately 12 percent at a power of .80 and .05 significance level (Hair et al. 1998). Standardized beta coefficients allow for direct comparison among independent variables in terms of their contribution to the regression variate. “Change management” ($\beta = .362, p<.001$) made the greatest positive contribution to the variate, followed by “industry” ($\beta = .256, p=.003$), “technology opportunism” ($\beta = .198, p=.038$), and “IT resources” ($\beta = .195, p=.031$).

Hypotheses 1 and 2 examined the effects of tangible and intangible IT resources on customer interface IICT adoption effectiveness. Specifically, the hypotheses suggested that robust IT infrastructure and managerial IT knowledge would both have a positive effect on IICT adoption effectiveness. For robustness of information technology infrastructure the analysis revealed a significant regression coefficient ($\beta=.321, p=.031<.05$). The multiple regression analysis did not find significant association ($\beta=.062, p=.559>.05$) between managerial IT knowledge and IICT effectiveness and hence eliminated the variable from the regression model. However, further analysis of bivariate correlation coefficients for managerial IT knowledge revealed a significant bivariate correlation coefficient ($b=.348, p<.01$). Therefore the results obtained lend full support for the hypothesis that robust IT infrastructure positively correlates with IICT effectiveness, but only partial support for the significance of managerial IT

knowledge. With regard to Hypothesis 3, results provide strong support ($\beta=.461$, $p<.001$) for the expected direct relationship between employment of change management principles and IICT adoption effectiveness.

Table 2. Regression results explaining IICT total effectiveness

1. Included Variables	Coefficients		Standardized Coefficients		
	b	Std. Error	β	t-value	Sig.
Total effectiveness (n=88)					
(Constant)	39.974	1.554		25.729	0.000
Change management	0.461	0.121	0.362	3.806	0.000***
Industry sector	2.159	0.694	0.256	3.113	0.003**
Technology opportunism	0.243	0.115	0.198	2.111	0.038*
IT resources	0.321	0.146	0.195	2.191	0.031*
* Significant at $\alpha=0.05$; ** Significant at $\alpha=0.005$; *** Significant at $\alpha=0.001$					

Hypotheses 4-7 examined the effects of organizational culture on IICT adoption effectiveness in the customer interface. The results did not support relationship between adhocracy culture ($\beta=-.064$, $p=.493>.05$) or hierarchy culture ($\beta=.050$, $p=.540>.05$) and IICT effectiveness. The analysis did not find a significant regression coefficient ($\beta=.140$, $p=.136>.05$) for cross-functional information dissemination and eliminated the variable from the multiple regression model. However, additional bivariate correlation coefficient analysis found a significant correlation ($b=.319$, $p=.01$) between cross-functional information dissemination and IICT effectiveness. Therefore the results obtained lend partial support for hypothesis 6. The regression analysis revealed a significant relationship ($\beta=.243$, $p=.038<.05$) between technology opportunism and IICT effectiveness in the hypothesized direction.

The final hypothesis (Hypothesis 8) examined the effect of aligning the business strategy with IICT implementation objectives on IICT adoption effectiveness. The analysis did not yield a significant regression coefficient ($\beta=-.017$, $p=.841>.05$). Therefore the results did not support the hypothesized association between business strategy fit with IICT implementation objectives and IICT effectiveness.

In addition, regression results indicated relationship between industry sector and IICT effectiveness ($\beta=.256$, $p=.003<.01$). The industry sector classified as eCommerce leaders (chemicals and food) had been more successful in achieving positive business impact from IICT adoption in the customer interface than the industry sectors classified as eCommerce laggards (paper and wood products). Revenue ($\beta=.061$, $p=.450>.05$) and IT spending ($\beta=-.047$, $p=.610>.05$) were not found to have a significant association with IICT effectiveness.

Figure 2 presents the empirically tested research model of organizational antecedents for effective IICT adoption in the customer interface with a summary of the multiple regression and bivariate correlation results for the organizational resources and capabilities found to have a significant association with customer interface IICT effectiveness index.

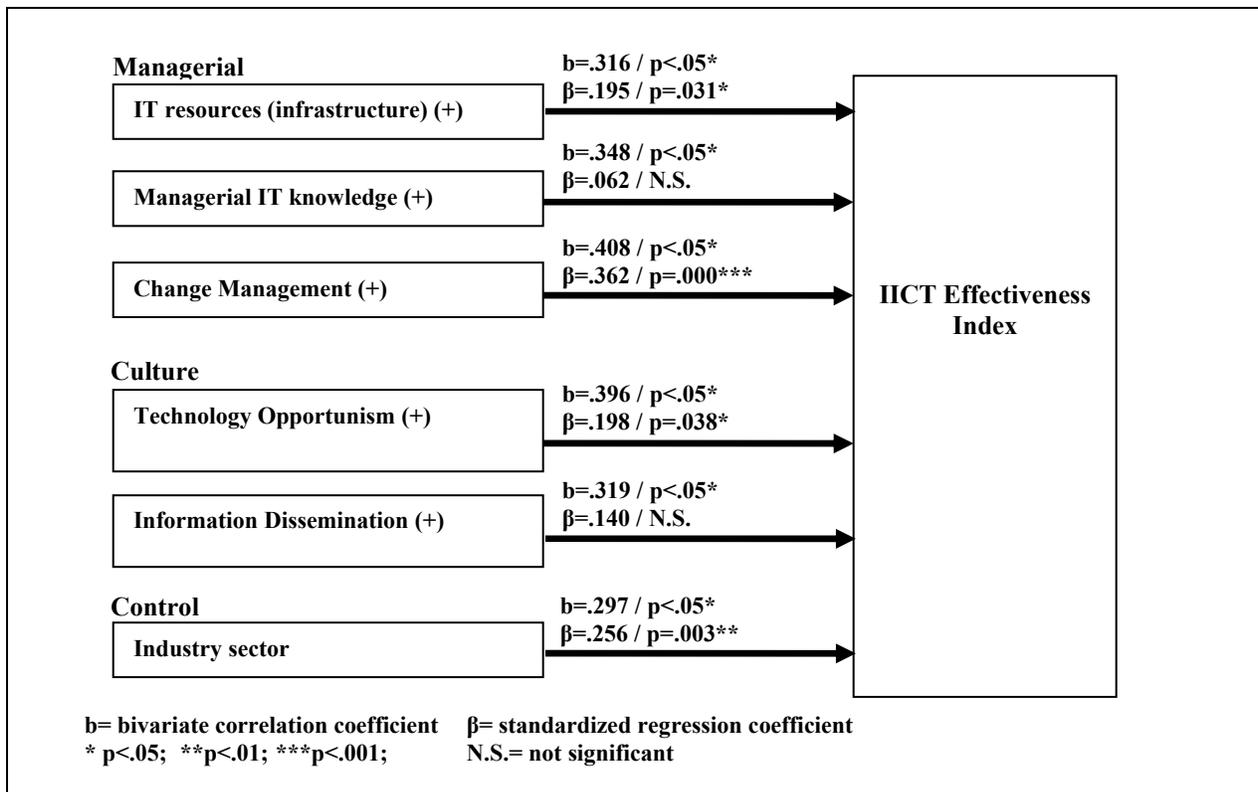


Figure 2. Empirical research model: Antecedents for effective customer interface IICT implementation

Conclusions and Discussion

This research examines inherent organizational characteristics and structures that relate to business benefit and value from implementing customer interface IICT. Further, the study contributes to the growing body of Resource Based View (RBV) empirical research by isolating organizational resources and capabilities that affect successful firm performance in the context of customer interface IICT implementation. But more importantly, this research suggests a model of organizational resources and capabilities, which can be affected internally by managerial decision making, in the context of successful IICT adoption. The results can direct business managers' attention beyond the tangible IT resources in managing customer interface IICT.

Based on the multiple regression analysis “change management”, “technology opportunism”, “IT resources”, and “industry sector” were significant determinants of customer interface IICT adoption effectiveness. Employment of change management principles had the strongest relationship with IICT effectiveness. This signifies that organizations who want to take active role in assuring that customer interface IICT adoption will have business impact should dedicate resources and attention on their organizational change management capability. Successful change management communication includes an ongoing effort to keep the organization enthusiastic and committed, which reduces the typical decline experienced in the IT enthusiasm curve after initial excitement wanes and realization of the required hard work sets in, coupled with expected and unexpected problems. A strategy to combat the potential decline in project enthusiasm and commitment is to plan to deliver early tangible results and publicize successes to build momentum and support for the strategy. Managers should understand that

successful implementation of IICT requires carefully managed changes in existing business processes because old ways of working will typically not yield optimal results in Internet enabled virtually integrated business environment. If sufficient resources are not dedicated to business process re-design, IICT implementation can end up being a resource consumer rather than value contributor to firm success. Also, new metrics for successful performance need to be developed and users need to be effectively trained and rewarded for performing to the new metrics. Not surprisingly, the results point out that the tangible IT resources, in terms of IT infrastructure, are important for IICT success. If a company doesn't have a sound information infrastructure, infrastructure problems will be magnified by IICT implementation requiring ad-hoc investments in fixing the problems, and in worst case scenario causing frustration and disbelief either in new ways of doing business or organization's ability to succeed in the 21st century information driven network economy. Further, the results suggest that organizations' who have refined capability to generate, disseminate, and act on market intelligence on potential changes in technology environment in general, are better positioned to ripe benefit from customer interface IICT implementation. This might be due to organizations' learned ability to identify the technology that best fits their business and resources with greatest potential to contribution. The results also show that the industry sectors identified as fore-runners in eCommerce adoption had been more successful in gaining positive business impact from IICT implementation than the sectors with less experience in eCommerce. This points out the effects of learning by doing and the existence of learning curve in effective IICT adoption.

Additional investigation of bivariate correlations added "managerial IT knowledge" and "information dissemination" to the list of positive antecedents of "IICT effectiveness". Hence the results provided partial support that overlapping IT and business knowledge structures in different managerial layers of a firm, as well as the connections, relationships and open information sharing between the IT and business managers are related to organization's ability to effectively integrate new technologies in their business operations and strategies. Interestingly, results indicate that corporate revenue, which in previous research has been associated with organization's likeliness to use IICT (Vlosky 1999; Vlosky 2002), did not have a relationship with IICT effectiveness. This finding suggests that company size does not limit organizations' ability to effectively integrate IICT in their business operations and relationships.

In essence, the results imply that companies that are planning, or already have, customer interface IICT should take a holistic perspective on IICT implementation and realize that other variables than just tangible IT resources affect IICT adoption success. Results suggest that investment in an organization's change management capabilities, as well as in the capability to sense changes in the technology environment, development of managerial IT knowledge, and a culture of freely shared internal information, in addition to a robust IT infrastructure, support companies ability to successfully integrate customer interface IICT in their business activities.

Limitations and Future Research

The findings of this study need to be viewed in light of its limitations. However, these limitations provide a platform for future research. Further research should be conducted to identify further organizational resources and capabilities that have an effect on IICT implementation effectiveness. This research was limited to customer interface IICT and four IICT applications. Future research could consider a broader set of applications in a broader business context. IICT effectiveness was measured perceptually using Likert-type scales rather than through objective, quantifiable measurements (e.g. revenue, stock market value). As such, results must be treated as respondents' subjective opinions without a guarantee of underlying

objective measurement of IICT impact. It is very likely that most of the respondent organizations lack an objective performance measurement system for customer IICT implementation. Potential future research could investigate what kind of metrics companies use in evaluating IICT success.

The results were obtained from a small sample of companies operating in only four manufacturing sectors in the U.S. There is a future research opportunity to extend the investigation on other industry sectors and geographical areas. The respondents were marketing executives. Despite previous research findings that marketing executives are often responsible for eBusiness implementation in the customer interface (Srinivasan et al. 2002), future research could consider other informants. Chief Information Officer (CIO) could be argued to have most familiarity with IICT project metrics tracking, whereas Chief Executive Officers (CEO) could be argued to possess the most comprehensive picture of firm's resources effect on overall performance.

References

- Achrol, R.,K., Evolution of the Marketing Organization. *Journal of Marketing*. (October 1991); 55: 77-91.
- Adams, J.S., An experiment on question and response bias. *Public Opinion Quarterly* 1986; 20: 593-597.
- Anandarajan, M., Anandarajan, A. and Wen, J., Extranets: A Tool for Cost Control in a Value Chain Framework, *Industrial Management & Data Systems* 1998; (98)3 and 4: 120-128.
- Armstrong, C. and Sambamurthy, V., Information technology assimilation in firms: the influence of senior leadership and IT. *Information Systems Research*. 1999; (10)4: 304-327.
- Barney, J., Resource-based Theories of Competitive Advantage: A ten years retrospective on the resource-based view. *Journal of Management* 2001; (27): 625-638.
- Barney, J., Firm resources and sustained competitive advantage. *Journal of Management* 1991; (17)1:99-117.
- Barney, J., Organizational Culture: Can it be a source of sustained competitive advantage?. *Academy of Management Review* 1986; (11)3: 656-664.
- Berthon, P., Pitt, L., and Ewing, M., Corollaries of the Collective: The influence of organizational culture an memory development on perceived decision-making context. *Journal of the Academy of Marketing Science* 2001; (29)2: 135-149.
- Bharadwaj, A., A resource-based perspective on information technology capabilities and firm performance: an empirical investigation. *MIS Quarterly* 2000; (24)1: 169-196.
- Boynton, A., Zmud, R., and Jacobs, G., The influence of IT Management Practice on IT use in large organizations. *MIS Quarterly* 1994; (18) 3: 299-318.
- Byrd, T., Information technology: core competencies, and sustained competitive advantage. *Information Resources Management Journal* 2001;(14).2: 27-37.
- Chan, S. and Davis, T., Partnering on extranets for strategic advantage. *Information Systems Management* 2000; (7)1: 58-64.
- Chuang, M.L. and Shaw, W., 2005. A roadmap for e-business implementation. *Engineering Management Journal* 2005; (17)2: 3-13.
- Clegg, C., Axtell, C., Damodaran, L., Farbey, B., Hull, R., Lloyd-Jones, R., Nicholls, J., Sell, R., and Tomlinson, C., Information technology: a study of performance and the role of human and organizational factor. *Ergonomics* 1997; (40).9: 851-871.

Clemons, K. and Row, M., Sustaining IT advantage; the role of structural differences. *MIS Quarterly* 1991; (15)3: 275-292.

Conner, K., A Historical Comparison of Resource-based Theory and Five Schools of Thought Within Industrial Economics: Do we have a new theory of the firm? *Journal of Management* 1991; (17)1: 121-154.

Deshpandé, R., Farley, J., and Webster Jr., F., Corporate Culture, Customer orientation, and Innovativeness in Japanese Firms: A Quadrad Analysis. *Journal of Marketing* 1993; (57)1: 23-37.

Dillman, D. 2000., *Mail and Internet Surveys: The Tailored Design Method*. Second Edition. John Wiley & Sons, Inc. New York, NJ.

Donald, M.N., Implications of non-response for the interpretation of mail questionnaire data. *Public Opinion Quarterly* 1960; (24): 99-114.

Fahy, J. and Smithee, A., Strategic Marketing and the Resource Based View of the Firm. *Academy of Marketing Science Review* 1999; (1999)10: Electronic version: <http://www.amsreview.org/articles/fahy10-1999.pdf>

Fiol, C., Revisiting an identity-based view of sustainable competitive advantage. *Journal of Management* (July 2001); (27)6: 691-699.

Fisher, J., Maltz, E., and Jaworski, B., Enhancing communication between marketing and engineering: The moderating role of relative functional identification. *Journal of Marketing* (July 1997); (61)3: 54-70.

Freund, R. and Wilson, W. 2003. *Statistical methods*, 2nd edition. Academic Press, London. ISBN: 0-12-267651-3

Grant, R., The Resource-Based Theory of Competitive Advantage: Implications for strategy formulation. *California Management Review* 1991; (33) 3: 114-135.

Hamill, J., Internet Forum. *International Management Review* 2000; (17).2/3: 176-181.

Harper, G. and Utley, D., Organizational culture and successful information technology implementation. *Engineering Management Journal* 2001;(13)2: 11-15.

Huber, N. 2003. Hitting targets? The state of UK IT project management. *Computer Weekly* (November 4, 2003); 22-24.

Kallioranta, S. 2006. *Effective Inter-organizational Information and Communication Technology Adoption in Business-to-Business Customer Interface*. PhD Dissertation . Forest Products Marketing Program, Louisiana State University. Baton Rouge, LA. 11 August, 2006

Kallioranta, S., Role of eIntermediaries in the United States Paper Supply Chain. Master's Thesis. Forest Products Marketing, Louisiana State University. Baton Rouge, LA. 4 April, 2003

Koch, D., IT Focus Must Change For New Technology To Succeed. National Underwriter/Life & Health Financial Services 2002; (106) 33: 17-18.

Kohli, A. and Jaworski, B., Market Orientation: The Construct, Research Propositions, and Managerial Implications. Journal of Marketing (April 1990); (54)2: 1-18.

McLagan, P., The Change-Capable Organization. T+D 2003; (57)1: 50-59.

Mata, F., Fuerst, W. and Barney, J., Information technology and sustained competitive advantage; a resource-based analysis. MIS Quarterly 1995; (19) 4: 487-505.

McKee, D., Varadarajan, P. and Pride, W., Strategic adaptability and firm performance: a market contingency perspective. Journal of Marketing (July 1989); (53)3: 21-35.

Mizik, N. and Jacobson, R. Trading off between value creation and value appropriation: the financial implications of shifts in strategic emphasis. Journal of Marketing (January 2003); (67): 63-76.

Moorman, C., Organizational Market Information Processes: Cultural antecedents and new product outcomes. Journal of Marketing Research (August 1995); (32)3: 318-335.

Narver, J. and Slater, S., The effect of a market orientation on business profitability. Journal of Marketing (October 1990); (54)4: 20-35.

O'Leary, B., Factors separating winners and losers in e-business. Dissertation. Florida Atlantic University. 2003 . 109.

Riley, J., Managing change is IT directors' toughest job. Computer Weekly (June 27, 2002); 8-15.

Ross, J. and Weill, P., Six IT Decisions Your IT People Shouldn't Make. Harvard Business Review 2002; (80)11: 84-91.

Ross, J., Beath, C. and Goodhue, D., Develop Long-Term Competitiveness through IT Assets. Sloan Management Review 1996; (38)1: 31-42.

Srinivasan, R., Lilien, G., and Rangaswamy, A., Technological Opportunism and Radical Technology Adoption: An Application to E-Business. Journal of Marketing (2002);(66)3: 47-60.

Stewart T., Brown, J., Hagel, J. McFarlan, F., Nolan, R. Strassman, P. and Carr, N., Does IT Matter? Letters to the Editor Harvard Business Review, Web Exclusive 2003. 1-17. Available: http://harvardbusinessonline.hbsp.harvard.edu/b02/en/files/misc/Web_Letters.pdf

Tan, G., Shaw, M. and Fulkerson, B., Web-based Supply Chain Management
Web-based Supply Chain Management. Information Systems Frontiers 2002; (2)1: 41-55.

Varadarajan, R. and Jayachandran, S., Marketing Strategy: An Assessment of the State of the Field and Outlook. Journal of Academy of Marketing Science 1999; (27)2: 120-143.

Vargo, S. and Lucsh, R., Evolving to a New Dominant Logic for Marketing. Journal of Marketing (January 2004); (68)1: 1-17.

Vlosky, R., Corporate culture the main obstacle to forest products eCommerce. The Engineered Wood Journal. APA-The Engineered Wood Association. Madison Publications LLC. April 2, 2002. Electronic version <http://www.agctr.lsu.edu/Inst/Extension/Departments/Extension_Forestry/Forestry/documents/ebusiness.pdf>

Vlosky, R., Fontenot, R. and Blalock, L., Extranets: impacts on business practices and relationships. The Journal of Business & Industrial Marketing 2000; (15)6: 438-457.

Vlosky, R., eBusiness in the forest products industry. Forest Products Journal 1999; (49)10: 12-20.

Vlosky, P. and Pitis, O., A comparison of the U.S. forest products industry and other U.S. industries. Working Paper #38. Louisiana Forest Products Laboratory, Louisiana State University Agricultural Center, Baton Rouge, La. October 12, 1999. 15p.

Vlosky, R. and Wilson, D., Effects of UPC Barcoding on the Relationships Between Homecenter Buyers and Wood Products Suppliers. Forest Products Journal 1996; 46(4):32-40.

Wilson, D., and Vlosky, R., Interorganizational Information System Technology and Buyer-Seller Relationship Disruption. Journal of Business and Industrial Marketing 1998; 13(3):215-234