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Effective Inter-Organizational Information and Communication Technology Adoption in Business-to-Business Customer Interface

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EFFECTIVE INTER-ORGANIZATIONAL INFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION IN BUSINESS-TO-BUSINESS CUSTOMER INTERFACE

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ABSTRACT

Past research has 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. When Inter-organizational Information and Communication Technology (IICT) implementation is properly managed IICT can help manage the flow of goods, services, and information between business partners in the supplier-customer dyad, thus reducing transaction costs along the entire value chain.

Using the underlying Resource-Based View theoretical foundation, this research approaches effective IICT implementation capability as a holistic organizational capability that extends beyond tangible IT resources. This research investigates business outcomes of IICT adoption in the customer interface of supplier-buyer dyad from the supplier's perspective. A conceptual model was developed and tested that examines cultural, strategic, and managerial factors' effects on successful IICT implementation.

The research identified four facets of customer interface IICT adoption impact on business: 1) internal business process efficiency, 2) customer relationships, 3) information diffusion with customers, and 4) competitive position.

"Change management", "industry sector", "technology opportunism", and "IT resources" were found to be significant determinants of customer interface IICT adoption effectiveness. Partial support was gained to indicate that also "managerial IT knowledge" and "information dissemination" had a positive relationship with IICT adoption effectiveness. The findings in the respondent profile revealed that the organizational capabilities that were found most to affect IICT effectiveness were the weakest organizational capabilities in respondent organizations.

The research results show that the forest industry sector is lagging non-forest products industry sectors in appropriating value from customer interface IICT implementation. In light of the research results, it can not be concluded that forest industry and non-forest industry respondents would have any significant gaps in the investigated organizational capabilities that have a relationship with IICT effectiveness. However, the findings show that forest industry respondents had adopted IICT later and are currently using it less in their business functions than non-forest industry respondents.

The findings indicate that websites, extranets, and direct integration are perceived as valuable eBusiness tools, as opposed to eIntermediaries which are not considered to bring as much value, regardless of customer relationship type.

1. INTRODUCTION

1.1. Motivation

Armstrong and Sambamurthy (1999) argue that effective application of information technology (IT) supports, shapes, and enables business strategies and value-chain activities. Although many organizations have successfully implemented Internet-based business (eBusiness) technologies, there are numerous examples of failed efforts (Harper and Utley 2001; Armstrong and Sambamurthy1999). For example, many companies have experienced a significant learning curve and an initial drop in productivity as they try to initiate and employ new innovative customer interface information technology initiatives (Harper and Utley 2001). A survey of 1,500 IT project managers in Great Britain across industry sectors found that a mere 16 percent of IT projects hit their targets on budget, schedule, and scope (Huber 2003). 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. Also, Ross and Weill (2002) argue that the problems are due to a failure to realize the business challenges in adopting such initiatives.

When technology implementation is properly managed from both the technical, but more importantly from the business perspective, Internet-based information technologies can help manage the flow of goods, services, and information within and between organizations, thus reducing transaction costs along the entire value chain (Clemmons and Row 1991). Improved production planning, reduced inventories, increased sales, reduced sales costs, improved delivery times and customer service, faster trading cycles, and improved market and customer knowledge have all been reported from eBusiness implementation. Although returns on eBusiness investment (ROI) are often difficult to estimate, staggering ROIs and payback periods have been

documented: 1,700 percent ROI within the first year of an intranet implementation; 1,522 percent ROI with annual cost savings of $33.7 million for a large retail chain that implemented extranets (Anandarajan et al. 1998).

This research investigates the impact of inter-organizational information and communication technology (IICT) adoption on value chain activities and customer relationships, and antecedents for effective IICT implementation in the customer interface. Anandarajan et al. (1998) segment Internet technology benefits into three categories: strategic, operational, and marketing/tactical. This classification directs attention and investigation of the effects of information and communication technologies in the customer interface to a strategic level in the context of generic competitive strategies, to the operational level with linkages to value-chain activities, and to a marketing/tactical level as a potential tool for gaining competitive advantage. In this study, the impact of IICT adopted in the customer interface, is investigated in terms of operational (value chain) and tactical (customer relationship) outcomes.

This research is based on the Resource Based View management and marketing theory and approaches effective IICT implementation capability as a holistic organizational capability that extends beyond tangible and technical IT resources. A conceptual model with three cultural (organization culture orientation, technology opportunism, and information dissemination), one strategic (business strategy fit), and three managerial (IT resources, managerial IT knowledge, and change management) factors are used in the research framework to investigate antecedents for effective IICT implementation in the customer interface of the supplier-customer dyad. Investigating IICT implementation effectiveness and associated antecedents in the business-to-business (B2B) environment offers a framework to guide companies to successful IICT adoption.

1.2. Objectives

Past research has focused primarily on intensity of eBusiness technology adoption in business-to-business (B2B) markets, how companies use eBusiness or the Internet, or how companies are able to benefit from virtual integration, collaboration, and electronic communication (e.g. Angeles 2001; Anghem and Meyers 1997; Anandarajan et al. 1998; Bharadwaj et al. 1993; Bharadwaj 2000; Chan and Davis 2000; Ling and Yen 2001; Porter 2001; Tan et al. 2000; Vlosky et al. 2000; Vlosky and Fontenot 1999; Vlosky and Punches 1999; Vlosky 1994). One area that has not been studied in depth is the organizational factors that impact successful eBusiness adoption. Accordingly, the overarching objective of this dissertation research is to examine organizational capabilities that influence successful Inter-organizational Information and Communication (IICT) implementation. Specific objectives are to:

1. Investigate organizational resources and capabilities that affect IICT implementation effectiveness in the business-to-business supplier/customer interface from a theoretical perspective.
2. Construct and test a conceptual model of organizational antecedents of effective IICT implementation in the customer interface of supplier-customer dyad.
3. Explore effects of customer interface IICT implementation on business performance outcomes.
4. Compare the United States forest and paper products industries to other industrial sectors in terms of IICT implementation success and capability.
5. Preliminarily explore eBusiness value evaluation by IICT application, by customer relationship implemented in, and by the interaction of the two.

1.3. Definitions

Information technology (IT) plays a key role in enabling organizations to be competitive and profitable. The use of IT has become a prerequisite for existence in many industries and markets and has become a common and frequent term in everyday language. The Alliance for Telecommunications Industry Solutions (ATIS) Telecom Glossary gives the following definition for IT:

> Information technology (IT): The branch of technology devoted to 1) the study and application of data and the processing thereof; i.e., the automatic acquisition, storage, manipulation (including transformation), management, movement, control, display, switching, interchange, transmission or reception of data, and 2) the development and use of the hardware, software, firmware, and procedures associated with this processing (ATIS 2005).

In essence, IT can be defined both from process and product perspectives. From the process perspective, IT is the technology required for information processing. From the product perspective, IT is the combined use of computers and equipment (i.e. hardware) and computer programs (i.e. software) to convert, store, protect, process, transmit, and retrieve information. In other words, IT can be viewed as an information system infrastructure.

> Information system (IS): 1. A system, whether automated or manual, that comprises people, machines, and/or methods organized to collect, process, transmit, and disseminate data that represent user information. 2. Any telecommunications and/or computer related equipment or interconnected system or subsystems of equipment that is used in the acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of voice and/or data, and includes software, firmware, and hardware. 3. The entire infrastructure, organization, personnel, and components for the collection, processing, storage, transmission, display, dissemination, and disposition of information (ATIS, 2005).

The term Inter-organizational Information and Communication technology (IICT) was developed to capture the specific research interest of investigating factors that influence successful IT/IS implementation that span across organizations in a business-to-business (B2B) exchange relationship, i.e. is inter-organizational. In this research, IT used to facilitate inter-

organizational integration, collaboration, commerce, and communication, in the supplier-customer dyad is termed Inter-organizational Information and Communication Technology, abbreviated as IICT. In this study context IICT includes Electronic Data Interchange (EDI), extended mark-up language (XML), extranets, eMarketplaces or other eIntermediaries, and corporate websites. Hence, the term IICT will be generally used to describe Internet-based (or proprietary) inter-organizational information technologies in the supplier-customer exchange dyad. IT or IS is used to depict technologies or systems that are not necessarily inter-organizational in scope but rather limited inside the implementing organization. The term eBusiness is also used to describe business processes, strategies, or technologies implemented to achieve virtual integration, collaboration, commerce, or communication by electronic networks. Figure 1 illustrates the IT/IS/IICT infrastructure of a firm in a supplier-customer dyad.

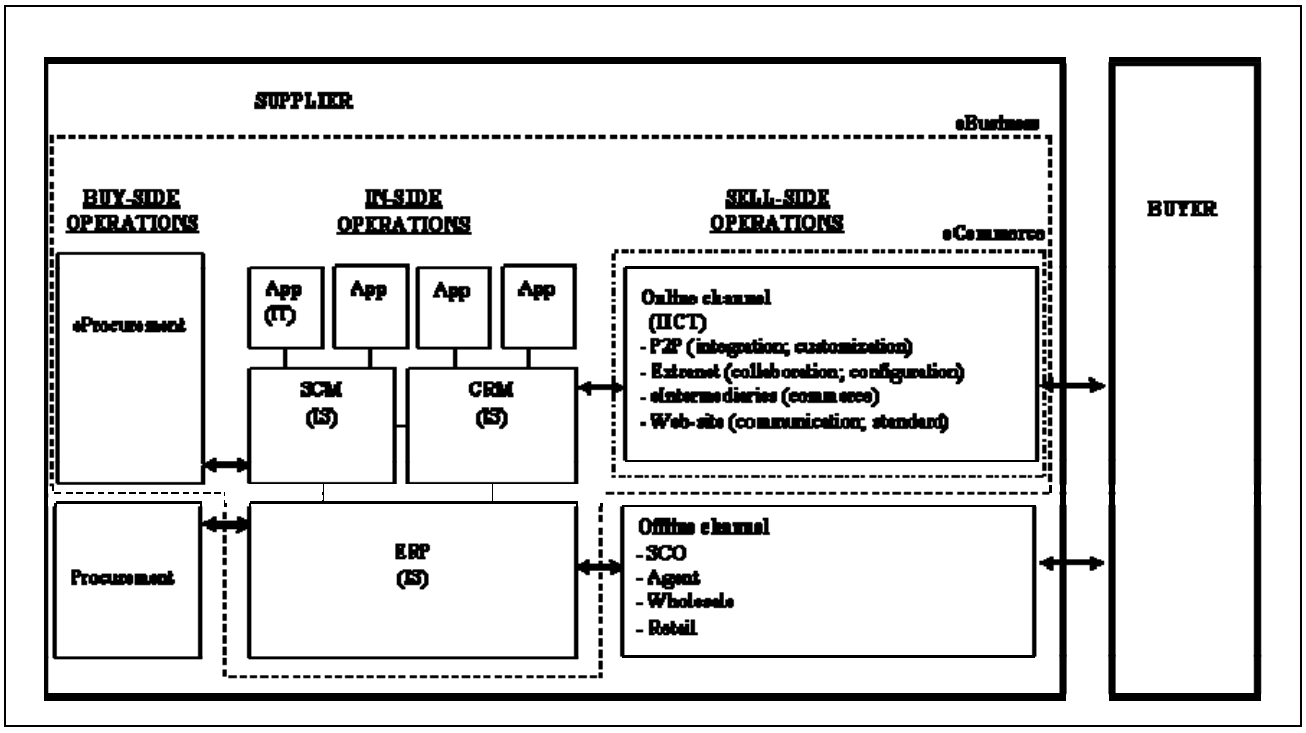


Figure 1. IT/IS/IICT infrastructure in a supplier-buyer dyad

2. LITERATURE REVIEW

2.1. Challenges in Information Technology Implementation

Over the past four decades technology implementation concentrated on production automation. Industries gained great success with automation, but in recent years, an alarmingly high percentage of IT initiatives have not gained the same straight forward success. IT projects fail mainly due to missed delivery dates, implementations that fall below expectations and projects that go over budget (Koch 2002). A survey of 1,500 IT project managers across Great Britain in all industry sectors, by Computer Weekly, found that just 16 percent of IT projects hit their targets on budget, schedule and scope. The survey indicated that only 55 percent of projects were completed on time, 41 percent were completed on or within the agreed budget, and 41 percent of projects delivered the planned-for functionality (Huber 2003).

While many firms are making significant investments in IT, not all have been able to successfully integrate IT into their value-chain activities and business strategies (Harper and Utley 2001; Armstrong and Sambamurthy 1999). Many companies have experienced a significant learning curve and initial drop in productivity as they try to initiate and deploy new IT initiatives (Harper and Utley 2001). Clegg et al. (1997) found that 80-90 percent of IT investments in general do not meet performance objectives mostly due to non-technical reasons such as human and organizational aspects of IT implementation and management.

For example, many might believe that the often encountered problems with Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP) system implementation are the result of technological difficulties in operationalizing complex systems, but in fact, as Ross and Weill (2002) argue, problems generally are due to senior executives'

failure to realize that adopting such systems poses business and not just technological challenges. A survey of IT project managers across Great Britain, by Computer Weekly, (in Huber 2003) found that lack of management commitment is the biggest risk to an IT project, followed by confusion over the objectives and a lack of commitment from end-users or clients. Other cited factors for project failure included complexity (the extent a project has to link with other technology and business processes) and changing targets and management for the project (Huber 2003). Kosch (2002) argues that high failure rates with IT implementation projects are not due to failure of the new technology, but in the failure of effective "change management" and commitment to change in business process.

Information technology is often used as an instrument for realizing downsizing goals. Thus, organizational resistance to new technology implementation may result from employee perceptions that their jobs are in jeopardy (Clegg et al. 1997). Clegg et al. (1997) identify the following additional concerns affecting successful IT implementation: "objective setting, performance review and evaluation; managing business, organizational and technical complexity; techno centrism and technology-led change; competitiveness and cost reduction; project management; structured methods; human and organizational factors, especially concerning structures and processes; organizational design and change; the role of end-users and the barriers to their participation; the role of managers, their understanding and values; organizational fragmentation and politics; managerial and organizational susceptibility to fads and fashions; the dissemination and diffusion of knowledge between organizations and different communities; the fragmentation that exists within and between spheres of economic activity; and so on."

2.2. IICT Integration via Proprietary Technologies

Before the Internet was launched, companies were already trying to reach out beyond their organizational boundaries to exchange information with vendors and customers. During the 1970s and 1980s, companies extended their computing power beyond company walls by exchanging data in the form of electronic documents with supply chain partners using peer-to-peer, point-to-point (P2P) or system-to-system (S2S) connections over value-added networks (VAN) and proprietary systems (Chan and Davis 2000). Traditional P2P connections are based on Electronic Data Interchange (EDI). EDI is computer-to-computer, i.e. P2P, electronic communication mode whereby trading partners exchange business transactions. The transactions consist of documents in structured formats that can be processed by the sender's and recipient's computer application software (Senn 1998). Data transferred by EDI from an IS in one location to an IS in another location is delivered in computer readable language, creating a direct link between the two connected computer systems eliminating the need to re-key the information. EDI formats have been standardized for a wide array of industries and business documents. The American National Standards Institute (ANSI) has approved a set of EDI standards known as the X12 standards. In addition, many industries have developed their own standard formats, such as the paper industry's EDIPAP and the Nordic sawmilling industry's EDIsaw (Juslin and Hansen 2002).

Vlosky (1994) identified the following value propositions or drivers for EDI implementation: 1) customer/supplier request; 2) desire to gain fast access to information and hence, better plan production schedules; 3) cut operating costs; 4) increase data accuracy; 5) increase responsiveness; 6) improve delivery of products/services; and 7) gain competitive advantage. However, the expense, complexity, lack of flexibility, and limited functional scope of

EDI implementation has generally limited its use to large enterprises with large transaction volume and an ability to incur large investments (Acly 2000; Kleindl 2001). Since the commercialization of the Internet, EDI has moved from VANs and proprietary connections to the Internet, which has reduced the investment required for implementation.

2.3. IICT Integration via Internet Technologies

The Internet is a global network that enables computers to communicate and share services around the world. The Internet is an enormously valuable shared global resource of information and knowledge, as well as means of collaboration and cooperation among diverse communities (Internet Society 2001). Internet-based technologies offer numerous applications that increase efficiency and productivity, such as linking employees, offices, customers, and partners from remote locations, regardless of time or place, distributing sales information more promptly and efficiently, and reducing operation costs (Vlosky and Fontenot 1999). Internet-based IT can manage the flow of goods, services, and information inside and across organizations, thus reducing the basic transaction costs involved in the vertical flow of goods and services along a value chain (Clemons and Row 1991).

Technically, what distinguishes the Internet is its use of a set of protocols called TCP/IP (Transmission Control Protocol/Internet Protocol). TCP/IP is the basic communication language of the Internet. The Internet Protocol (IP) describes how the information should be segmented into smaller packets of information for transmission through the Internet infrastructure (i.e. backbone, routers, point of presence, servers, and user computers), while Transmission Control Protocol (TCP) describes how the arriving packets should be reconstructed (Afuah and Tucci 2003). The World Wide Web (WWW) is the content stored in HyperText Markup Language

(HTML) and linked via Hypertext Transfer Protocol (HTTP) that is accessible through the Internet and viewable through a browser (Afuah and Tucci 2003).

The Internet and eBusiness have not only changed the way companies do business and communicate with their partners but, for many, have become a requirement for business survival. In order to be competitive in today's networked business environment, companies must be able to deliver applications and services with real value for their partners (Ling and Yen 2001). Afuah and Tucci (2003) have identified 10 key properties of the Internet that have the potential to influence business models and industry structures (Table 1). They argue that these properties have profound impact on many firm activities that are undertaken to conceive and deliver value to customers. Afuah and Tucci (2003) discuss five of these activities: coordination, commerce, community, content, and communication, and name them the 5-Cs.

Table 1. Properties of the Internet

Internet Properties	Explanation
Mediating technology	Facilitates exchange relationships among parties distributed in time and space
Universality	"Enlarges" and "shrinks" the world; Anybody anywhere can make products available anybody anywhere
Network externalities	The value of network increases as the square of the number of people in the network (Metcalfe's law)
Distribution channel	Distribution channel for digital products and information; can replace or extend exiting channels
Time moderator	Instant access; 24/7
Information asymmetry shrinker	Increases access to information
Infinite virtual capacity	Ever growing capacity (Moore's law)
Low cost standard	Open standard; One network instead of many proprietary networks
Creative destroyer	Lowers barriers to entry; interactive; virtually unlimited possibilities (e.g. eBay)
Transaction cost reducer	Reduces search, contract, monitoring, enforcement, and transportation cost

Source: Afuah and Tucci 2003

2.3.1. Extensible Markup Language (XML)

As in the case of EDI, Extensible Markup Language (XML) is a set of standards used for data interchange in a structured format. XML messages use the Internet as the data transfer platform as opposed to private networks used by traditional EDI. XML standards are defined by the World Wide Web Consortium (W3C) and, as with EDI, industries have created their own sets of standards for industry-specific transactions (such as papiNet by the paper industry). XML is a fairly new standard. Its development work began in a W3C working group in the mid-1990's (W3C 2005).

The Internet and XML have lowered the entry barriers to eBusiness, in both cost and complexity, in comparison to integration by proprietary technology connection (Table 2). The emergence of XML, however, should not be interpreted as the end of EDI. XML does not replace EDI, but rather extends eBusiness to small and midsize companies (Ricker et al. 2002). XML uses the Internet platform and is compatible with most common software, such as Microsoft Office®, Internet Explorer®, various databases and commerce systems, without conversion (Juslin and Hansen 2002), lowering implementation costs. In addition, the flexibility and simplicity of the standard makes it more cost effective to manage compared to EDI.

Table 2. XML and EDI comparison

XML	EDI
Cost	
Low initial investment cost	High initial investment cost
Requires a web serve ($0 to $5,000)	Requires an EDI server ($10,000 to +$100,000)
Uses the Internet	Uses VAN charging $1 to $20 per message delivery
Technical implementation	
Optimized for easy programming	Optimized for compressed messages
Requires simple programming staff	Requires highly trained C++ programmers
Standards still under development	Established standards
Usage	
Messages readable by people	Messages are not readable by people (computer to computer only)
Flexible to use	Complex, rigid, inflexible to use

Modified from Ricker et al. 2002 and Vanderbist 2002

2.3.2. Extranets

Suppliers have long realized the need to offer customers easy access to customer-specific information. This has led to the development of password-secured extranets over the Internet. "An extranet is a private network that uses the Internet protocol and public telecommunication systems to securely share business information with suppliers, vendors, partners, customers, or other businesses" (Whatis.com 2003). Extranets can offer customers value-added services, fulfilment services, and order management functions (Biros 2001). Extranets can also be used to automate supply chain activities, jointly develop new products, and transform business processes (Ling and Yen 2001). Ling and Yen (2001) distinguish four important characteristics of an extranet:

1. Is a part of the World Wide Web, or at least based on the major Internet protocols and backbones.
2. Is private in contrast to the Internet, and is public compared to an Intranet.
3. Is mainly for business-to-business information sharing and access.
4. Must provide means for security and access-control.

Extranets connect business partners on-line behind virtual firewalls, where "those who share in trusted circles" can network in order to achieve "commercial-oriented objectives" (Tan et al. 2000). Extranets are flexible, scalable, extensible, and able to integrate across distributed and heterogeneous system environments and platforms (Siegel and Hartman 1998). Extranets can extend key information to business partners throughout the supply chain and facilitate collaborative relationships with business partners that are separated geographically (Vlosky and Fontenot 1999). Ling and Yen (2001) argue that extranets increase customer loyalty,

commitment, and confidence, all of which drive revenue and contribute to competitive advantages.

Developing an extranet solution does not require high IT competence from an organization, because it is based on the Internet connection (Vlosky et al. 2000). An extranet uses a Web browser front-end making it very user-friendly, shortening the learning curve for new information system applications (Ling and Yen 2001). Extranets are based on open standards web technology allowing communications across disparate platforms and eliminating software incompatibility (Ling and Yen 2001; Hamill 2000).

Extranets started to gain interest and enthusiasm among businesses in the latter half of 1990's. In 1998, 13 percent of the 2,500 companies surveyed by ActivMedia Inc., a market research company, said they had implemented an extranet (McCune 1998). In a cross-industrial survey by Vlosky et al. (2000) electronic communication with trading partners was the number one use of extranets (89 percent of the respondents) followed by customer contacts (71 percent), vendor contacts (59 percent), sales to customers (48 percent), product and service promotion (45 percent), and purchases (41 percent). According to Vlosky and Punches (1999), order management services such as order tracking, status enquiries, and shipping notices were the most frequently used extranet applications in the forest products sector.

Extranet connections are an economical alternative to creating and maintaining one-to-one connection. Chan and Davis (2000) estimated that cost to establish a supply chain link via an extranet is $1,000 per partner compared to $50,000 using EDI. The typical initial investment of a large scale extranet has been estimated to be $40 or less per user (Ling and Yen 2001). However, to be successful, extranets may require changes in business culture. Information that has traditionally been unavailable to customers becomes far more broadly available (Vlosky et al.

2000). Beyond startup costs are costs associated with redesigning business processes, integration of existing databases and applications, purchase of hardware upgrades, technical support, and project management (Ling and Yen 2001). According to Chan and Davis (2000) the most significant extranet implementation costs are "people costs" (such as training, change management). In a large retail chain branch setting, Anandarajan et al. (1998) documented the total cost of an extranet implementation at $2.2 million, including hardware, software, telecommunication, training, and maintenance costs.

Many companies have had difficulties in measuring the costs, benefits and return on investment (ROI) associated with extranet implementation (Ling and Yen 2001; Hamill 2000). However, some staggering returns on investment and payback periods have been documented. Anandarajan et al. (1998) calculated ROI of 1,522 percent for extranet implementation in a large retail chain setting with annual cost savings of $33.7 million. However, these results need to be treated with caution because the numbers are largely based on estimation instead of hard financial data. Furthermore, as Anandarajan et al. (1998) note, "Even though the company has implemented an extranet, any improvements in profit cannot be directly attributed to the implementation of the extranet technology. It could be attributed to a wide variety of market factors. However, the reduction in estimated cost is significant enough to warrant the claim that the extranet technology is a sound investment."

A major impediment of extranet adoption is that from the customers' perspective it is supplier specific. A customer with multiple suppliers would need to use several separate supplier-specific extranet log-ins and sessions in order to interact with these suppliers.

2.3.3. eIntermediaries

A marketing channel is "a set of interdependent organizations involved in the process of making a product or service available for use or consumption" (Kotler 2000). Traditional (off-line), marketing channel intermediaries include wholesalers, brokers, agents and distributors while electronic (on-line) intermediaries include eExchanges, eMarketplaces, eAuctions and other Internet-based transaction facilitators and market information providers.

Conflicts in marketing channels may rise from incompatible goals, unclear roles, power asymmetry, or opportunistic behavior (e.g. Stern and El-Ansary 1992; Kotler and Armstrong 2001). Such tension, in concert with the emergence of the Internet and eBusiness, created opportunities for eIntermediaries to step in and attempt to gain a market toehold by claiming to provide supply chain efficiencies and competitive advantage for their clients (i.e. buyers and suppliers). Some eIntermediaries attempted to position themselves as a part of the existing marketing channel structure; for example between a manufacturer and a merchant, while others attempted to replace traditional channel members through disintermediation (Shook et al. 2004). Both strategies caused concern and uncertainty about future channel structures and roles in existing traditional channels.

There are two general Internet marketing channel intermediary ownership structures. Independent exchanges are typically funded by venture capital or private investors, while consortia exchanges rely on industry consortia ownership arrangements. There are also two basic linkage structures, vertical marketplaces that operate inside an industry boundary, for example trading only pulp and paper products, and horizontal marketplaces which operate across multiple industries offering common applications/solutions, such as logistics services.

eIntermediaries have a multitude of business models, in other words means to generate revenue. According to Afuah and Tucci (2003), the dominant eBusiness eIntermediary models generate (or try to generate) revenue through advertising, sales commissions, markups for value-added services, referrals, subscriptions, and other fee-for-service scenarios. These various eIntermediary business model taxonomies include terms such eMarketplace, eExchange, eShop, eAuction, collaboration platform, virtual community, catalog aggregator, value-chain integrator, information broker etc. Currently, many business-to-business (B2B) eIntermediaries have evolved from a single business model to include a combination of business models with the goal of creating multiple revenue streams (Mahadevan 2003).

2.3.4. Websites

Every company seems to have a web presence and a website that contains at least a brief description of its operations and a list of its products and services. However, many company websites provide a broad range of additional information, such as company history, mission statement, investor information, financial statement, employment information, company contact information, promotional information, information about company and community projects and initiatives, while others go even further by offering eCommerce transaction capabilities.

A website can be considered as a collection of related web documents (i.e. web pages) that are stored on a server as files written in Hyper Text Markup Language (HTML) and are connected by hyperlinks. The pages of a website are accessed by entering a common root Uniform Resource Locator (URL) on the web browser; which is an address that specifies the location of the homepage file on the Internet.

Anghern and Myers (1997) proposed a four-category framework to describe website business opportunities: 1) virtual information space (VIS); 2) virtual communication space

(VCS); 3) virtual distribution space (VDS); and 4) virtual transaction space (VTS). According to Quelch and Klein (1996), companies set up corporate websites for two primary reasons: 1) as a communication channel between the company and its business stake-holders (such as customers, suppliers, distributors, shareholders, community); or 2) as a sales channel (eCommerce platform). Yeung and Lu (2004) used this framework in their website functionality grid for analyzing, comparing, and improving commercial websites. Yeung and Lu (2004) named these two different website orientations as information-orientation and transaction orientation, and described the specific functions of each (Table 3). Chakraborty et al. (2003) found that B2B customers consider website organization, non-transaction related interactivity, privacy/security, and informativeness as the most important B2B website characteristics, followed by transaction-related interactivity, personalization, and entertainment.

Table 3. Corporate website functions: information and transaction orientation

Activity	Website Orientation	
	Information-oriented	Transaction-oriented
	Functions	
Advertising & Promotion	Publish company and product information	Maintain on-line customer profile database for tailor-made advertising; Monitor customers' browsing behavior
Sales order processing	Publish "how-to-buy" information	Process orders and payments on-line; Track on-line orders
Customer service	Publish customer service information	Provide on-line customer registration and knowledge base for technical support
Financing	Publish financial information	Process on-line applications; Support account inquiry and payments
Physical distribution	Publish delivery and collection information	Support order tracking

Modified from Yeung and Lu 2004

Advantages of a corporate website over traditional media include its multimedia capabilities and cost effectiveness. Informational and promotional content on the web pages can be displayed in text, audio, and video, and interactive functions can be used, e.g. database search. These capabilities can provide companies with tools to build modern and attractive brand images. Websites are a cost effective media to distribute up-to-date information to broad and

geographically dispersed audiences at fairly low cost. However, drawing the traffic to the site can be challenging. Keindl (2000) incorporated two classic attitude and marketing communication models (AIDA model by Edward Strong and the ABC or tripartite attitude formation model from social science) with website communication strategy to propose a framework for describing how to use websites to reach communication goals (Table 4). According to Keindl (2000), incorporating the website address (URL) in offline promotional materials and search engine presence should be used to make the audience aware of the website and attract their attention to it. Drawing interest to the product or service the website is mediating can be accomplished by personalized content and push marketing through e-mail contacts sent with receiver's permission. Personalized content is a strong tool for creating affect toward the service. Audiences can be enticed to desire products by making the site visually appealing to the target audience's tastes. At the final stage, buying behavior and action can be promulgated by on-line promotions.

Table 4. Attitude formation-model, AIDA-process, and website communication strategy

Attitude Model	AIDA Process	Website communication strategy
Cognition	Attention	Offline media, search engines, and on-line advertising to attract audience's attention
Affect	Interest	Customization to meet individual's needs; Permission marketing; Push strategy to send information out
	Desire	Content and design to appeal; Relationship development components to keep the audience at the site
Behavior	Action	Promotions to entice action

Source: Keindl (2000)

Figure 2 summarizes and illustrates the previously discussed portfolio of Inter-organizational Information and Communication Technologies (IICT), which may facilitate supplier-buyer integration, collaboration, commerce, and communication. Figure 2 also includes examples of non-IT enabled methods of communication between suppliers and customers. Technological sophistication of the presented methods increases while moving upwards on the

list of applications. In the context of this research e-mail is excluded from the portfolio of IICT applications despite e-mail's use of the Internet platform for inter-organizational communication. The exclusion is due to its relatively low sophistication in terms of technology, collaboration, and communication.

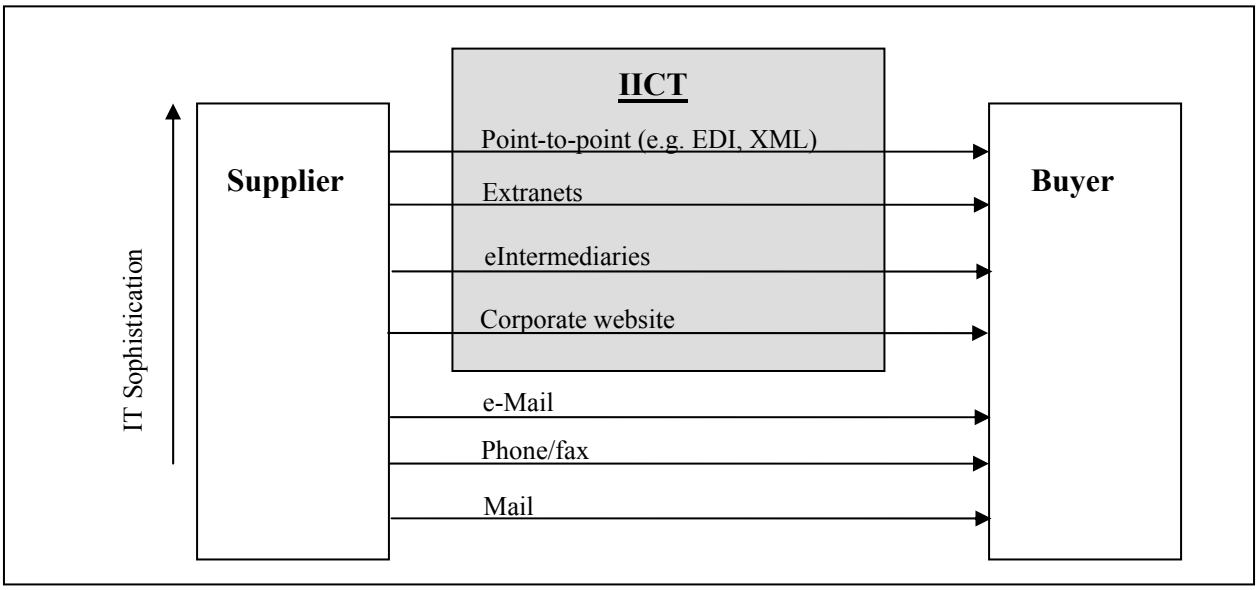


Figure 2. IICT framework: Supplier-buyer interface communication methods

2.4. Resource Based View

Based on neoclassical economic theory and industrial organization economics, Porter (1985) provided a framework for how the environment and the industry structure with pursued business strategy jointly determine the performance of a business. According to his Five-Force Model, some industries are inherently more profitable than others. Empirical research has in fact found differences in firm performance across industries; however, overall the firm effects are found to be greater than differences between industries (e.g. Rumelt 1991; Grant 1999; Barney 1991). This pattern of empirical research has given rise to increased interest in firm-specific variables that enable firms to out-perform their rivals in "equal" environmental settings and industry structure. The Resource-Based View (RBV) (Barney 1991) attempts to explain business

performance in terms of firm-specific skills and resources that are valuable, inimitable, rare, and non-substitutable, hence suggesting that the unit of analysis should be the firm, instead of the industry.

This research is based on the Resource-Based View (RBV) theory, which is one of the most acknowledged theoretical perspectives in the strategic management literature. The RBV posits that distinctiveness in a company's offering or operational efficiency are directly tied to the distinctiveness in the input (resources and skills) employed (Conner 1991). RBV attempts to explain why some resources are more advantage-generating than others and why resource asymmetries persist even in conditions of open competition (Fahy and Smithee 1999). RBV argues that firm performance is driven by costly-to-copy firm resources and skills (e.g. Barney 1991; Conner 1991). These resources and skills are heterogeneously distributed among competitors and differences in resources tend to be stable over time; in other words the resources are imperfectly mobile and cannot be purchased (Barney 1991).

Economists have a long tradition of investigating firms in terms of their resources. However, the resources of interest for economists have been limited to labor, capital, and land. Beyond these traditional tangible resources, the RBV literature recognizes intangible resources and emphasizes their importance as generating above normal rent (Conner 1991). 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, which can help explain why some firms outperform others (Barney 2001b). Following this logic, performance can be extended from firm (financial) performance to IICT implementation performance. Hence, this research uses the RBV as the framework for investigating antecedents for successful IICT implementation in the customer interface.

Fahy and Smithee (1999) propose an RBV framework where relationships between firm key resources and superior performance is mediated by sustainable competitive advantage in terms of value delivered to customers, and moderated by management's strategic choices executed to identify, develop, protect, and deploy the key resource (Figure 3). The conceptual foundation for this research follows the logic presented in the Fahy and Smithee (1999) RBV framework. The research posits that IICT capability (the capability to effectively implement IICT) is a firm-specific capability that is not only dependent on tangible and intangible IT resources, but is highly embedded in other firm-specific capabilities and resources (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 (Figure 4).

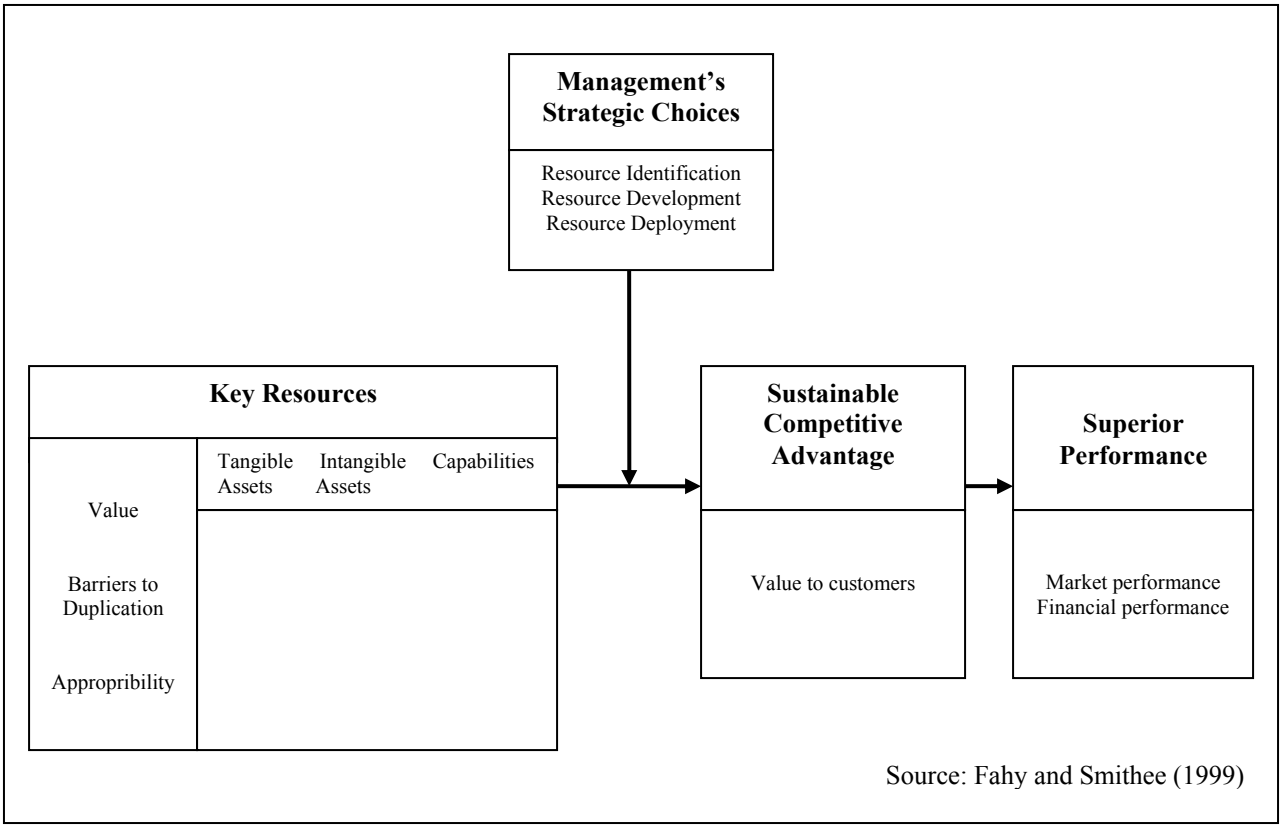


Figure 3. RBV framework

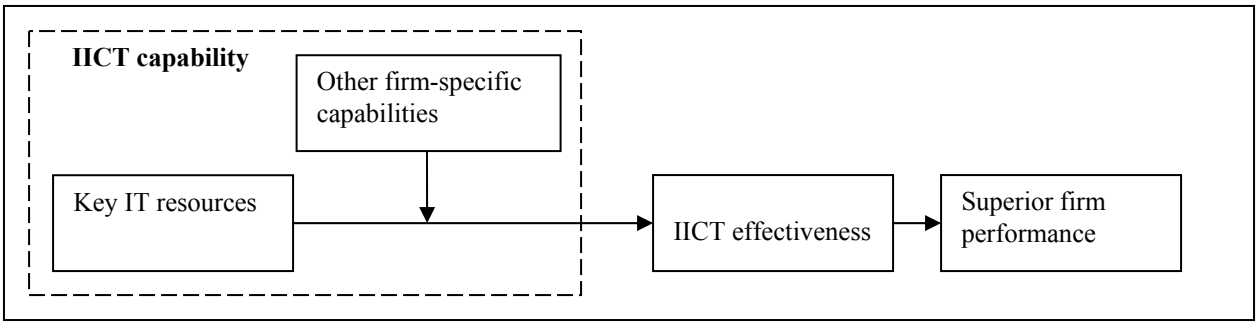


Figure 4. Conceptual RBV framework for IICT implementation effectiveness

The research views IICT capability as a firm-specific capability, thus it is important to understand resources from an RBV perspective. Grant (1991) distinguishes between resources and capabilities, and classifies resources into tangible, intangible, and personnel-based resources. Tangible resources are the conventional assets from classical economic theories; capital, labor, land, and physical assets. 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 include intellectual property, trademarks, patents, brand image, reputation, product quality, company networks and databases (Grant 1991; Fahy and Smithee 1999), customer orientation, organizational know-how (Bharadwaj 2000), routines, organizational processes, management skills, knowledge, and information (Conner 1991). They can be valued by the difference between balance sheet and stock market valuation (Grant 1991). Intangible resources are harder to duplicate than the tangible resources due to their non-physical and often ambiguous nature. Personnel-based resources include the skills of employees and management. Firms create competitive advantage by combining resources that work together to create organizational capabilities (Bharadwaj 2000). Capabilities are the combination of skills, organizational routines, and interactions through which the firm's resources are coordinated (Grant 1991); e.g. organizational culture, team work. 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 RBV literature has tended to favor capabilities as the most likely source of sustainable competitive advantage (Fahy and Smithee 1999).

In accordance with the proposed "new" dominant marketing logic's view on products (see Vargo and Lusch 2004) it can be argued that in the RBV framework resources are not considered as the inputs of production but rather in terms of the service they render. Hence, "services yielded by resources are a function of the way in which the resources are used, in that exactly the same resource when used for different purposes or in different ways or in combination with other resources provides a different service or set of services" (Penrose 1959 in Fahy and Smithee 1999).

Companies gain greater than normal economic performance and competitive advantage by controlling the firm's unique skills and resources to implement a value-creating strategy that competitors cannot replicate at equal cost (Barney 1991; Varadarajan and Jayachandran 1999). When considering sustainability of a competitive advantage it is important to note Barney's (1991) notion that sustained competitive advantage does not imply that the advantage will hold forever, but rather that it will not be outdone by duplication efforts of rivals.

Barney (1991) proposes that for a resource or skill to have the potential to be a source of sustainable competitive advantage it must: 1) be valuable (exploits opportunities and/or neutralizes threats in a firm's environment); 2) be rare among firm's competitors (current and potential); 3) not have any strategically equivalent substitutes; 4) imperfectly imitable (Table 5). Resources endure competitive imitation when protected by the following isolating mechanisms: historical uniqueness, causal ambiguity, embeddedness, and social complexity (Barney 1991;

Conner 1991). According to Grant (1991) levels of resource durability, transparency, transferability, and replicability determine potency as a source of sustainable competitive advantage. The mentioned isolating mechanisms are elaborated in Table 5.

Table 5. Sustainable competitive advantage resource characteristics and isolating mechanisms

Resource Characteristics for Sustainable Competitive Advantage				
Valuable	Rare	Non-substitutable	Inimitable	(Barney 1991)
Exploits opportunities or eliminates threats	Rare among competitors (current and potential)	No strategically equivalent substitutes	Difficult to imitate by competitors	
Isolating mechanisms / Barriers to imitability and mobility				
Durability	Transparency	Replicability	Transferability	(Grant 1991)
Rate at which the resource becomes obsolete	Understanding on how the advantage is achieved	Based on how embedded the resource is in organizational routines	Ability of rivals to acquire (with same cost) the required resources	
Historical uniqueness	Causal ambiguity	Embeddedness/social complexity		(Barney 1991; Conner 1991)
Advantage accrues due to unique place in time and space, e.g. first mover advantage, location	Ambiguity in connections between resources and performance	Value linked to presence of complimentary (intangible) resources		

2.4.1. IICT Capability

The Information Technology literature has used RBV to examine IT as a potential sustainable competitive advantage and proposes several frameworks for IT capability investigation. There is empirical evidence to indicate that firms with high IT capability tend to outperform rivals on a variety of profit and cost-based performance measures (Bharadwaj 2000). Bharadwaj (2000) defines a firm's IT capability as the ability to mobilize and deploy IT-based resources in combination with other resources and capabilities. He adopted Grant's (1991) classification schema in classifying IT-based resources in 1) tangible IT resources (physical IT infrastructure); 2) human IT resources (technical and managerial IT skills); 3) intangible IT resources (knowledge assets, synergy). Ross et al. (1996) defined IT capability as the ability to

control IT related costs, and that IT capability contains technology, human, and relationship assets in forms of a strong IT staff, reusable technology, and partnerships between IT and business management. Mata et al. (1995) modeled IT capability based on four resources: capital requirements, proprietary technology, technical IT skills, and managerial IT skills.

Because resources and skills are heterogeneously distributed across firms, this leads to different patterns of IICT effectiveness, despite uniformly high technology investments (Bharadwaj 2000). Mata et al. (1995) concluded that managerial IT skills are rare and firm-specific, providing a source of sustainable competitive advantage. IT managerial skills in the Mata et al. (1995) framework included management's 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.

All the frameworks proposed by Bharadwaj (2000), Mata et al. (1995), and Ross et al. (1996) recognize that IT capability includes tangible IT infrastructure resources, intangible IT technical managerial skills, and intangible managerial resources. These resources in concert with the embedded IT fabric of firm-specific capabilities enable firms to leverage pre-existing organizational intangibles, such as customer orientation and market orientation, to gain sustainable competitive advantage and deploy IT to meet strategic business objectives (Bharadwaj 2000).

This research views IICT capability as a heterogeneously distributed firm capability and extends previous IT capability constructs by taking a more holistic view on the interplay of

technology with non-IT-related intangible organizational resources and capabilities. The research argues that in order for IICT to be effectively implemented in the supplier-customer interface, it requires an organizational culture that fosters flexibility and open information dissemination, IICT implementation objective congruence with business strategy, and managerial support for IICT management (Figure 5).

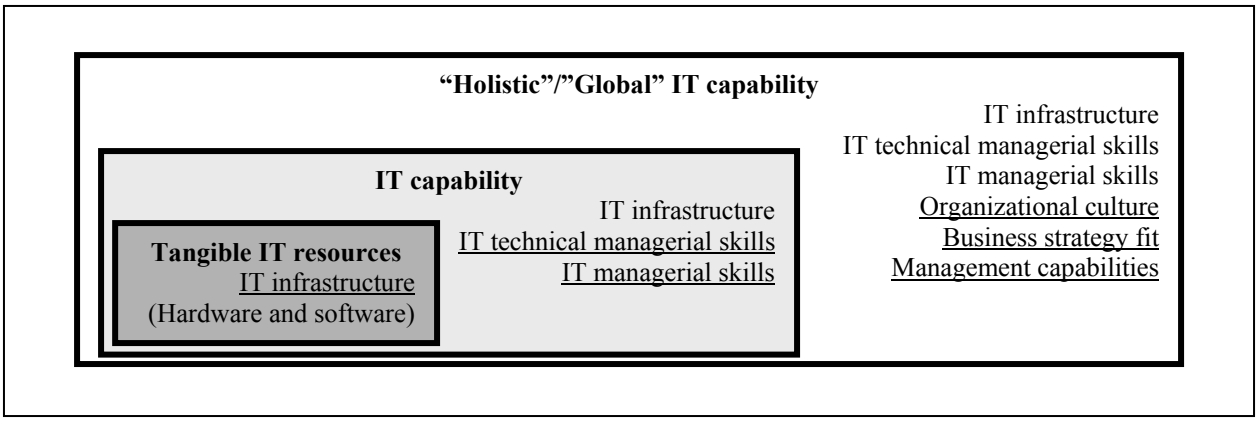


Figure 5. Holistic framework for IT capability

2.4.2. Sustainable Competitive Advantage

Because sustainable competitive advantage is the fundamental concept of RBV, it is imperative to discuss and validate IICT as a potential source of sustainable competitive advantage. The potential of IT or IICT in creating competitive advantage has been debated in the literature (e.g. Barney 1991; Mata et al. 1995; Ross et al. 1996; Bharadwaj 2000; Clemons and Row 1991). One school of thought argues that because tangible IT systems can be purchased and hence duplicated easily, physical IT systems are likely not to be considered as a competitive advantage. However, according to Bharadwaj (2000) such a reductionist view of technology fails to recognize the synergistic benefits of integrated systems and the required time, skill, and learning to overcome inherent system incompatibilities. Research has shown that firms using identical information and communication technologies and demonstrating equivalent IT

spending have great variability in profitability (in 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 resources and skills tend to be heterogeneously distributed, leading to different patterns and effectiveness of IT (Bharadwaj 2000).

Next, IICT is discussed in terms of Barney's (1991) criteria for sustainable competitive advantage. IICT can be regarded as a valuable resource because it enables firms to capture and implement strategies that improve efficiency and effectiveness by either reducing firm costs or differentiating products or services. Resource value is necessary but alone is not a sufficient condition for competitive advantage. Implementing IICT, which can be copied by competitors, leads to only temporary competitive advantage, whereas implementing a valuable IICT solution simultaneously implemented by several competing firms, provides competitive parity (Mata et al. 1995). Mizik and Jacobson (2003) argue that companies can create competitive advantage on the functional strategy level through value creation or value appropriation. IICT adoption can enhance value creation by enabling business process innovation and providing value-added services. IICT adoption may mitigate value appropriation by erecting entry barriers through virtual integration with exchange partners. As business partners' information systems are integrated, it becomes more difficult and expensive for a customer to change vendors due to increased switching costs. 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, market orientation, knowledge management, organizational learning, customer service, and product quality.

As more companies adopt IT or IICT, it is becoming a less effective tool for creating competitive advantage (Anandarajan et al. 1998; Clemmons and Row 1991). In addition, competitive and institutional pressures often force firms to deploy the current IT simply to keep ahead or in pace with competition or customers. However, Barney (1991) notes that valuable but common resources can help a firm to ensure its survival when they are exploited to create competitive parity, and thus should not be neglected. Because hardware-software packages can be easily purchased, any strategy that exploits only the tangible part of an IICT system is likely to be imitable and thus not a source of sustainable competitive advantage (Barney 1991). On the other hand, according to Mata et al. (1995) managerial IT skills are rare and firm-specific and thus provide a source for sustainable competitive advantage (Mata et al. 1995). Managerial IT skills together with an IT infrastructure, intangible IT, and other firm-specific intangible resources form the IT embedded fabric of firm specific capabilities that is likely to serve as a source of sustainable competitive advantage and influence the firm's ability to successfully deploy IT (Bharadwaj 2000). Bharadwaj (2000) also noted that firms that incur the cost of IT investment without IT capability will be at comparative disadvantage.

Mata et al. (1995) argue that if managerial IT skills are valuable and heterogeneously distributed across firms, they can be a source of sustainable competitive advantage and not imitable. Since IT managerial skills and cross-functional and inter-organizational relationships are developed over time, are tacit, socially complex, and causally ambiguous, they are hard to imitate, hence confirming to Barney's (1991) inimitability criteria of sustainable competitive advantage. In support, Bharadwaj (2000) concludes that IT capability is an imperfectly imitable

complex organizational capability due to time compression diseconomies, casual ambiguity, and path dependencies. Creating compatible and integrated IT infrastructure is a time-consuming task, in other words has time compression. The value of an IT infrastructure is entirely dependent on other system components, and hence, is embedded in and with complimentary resources. In addition, the process of integrating commodity-like components of hardware and software into a tailored infrastructure to fit the firm context and strategic objectives has great causal ambiguity. IT managerial skills are often tacit and required interpersonal relationships across departments in an organization may take years to develop (time compression). Knowledge about how to productively combine and manage IT resources and communicate and coordinate with other functional managers is socially complex and becomes ultimately embedded in organizational routines (Bharadwaj 2000; Mata et al. 1995).

Carr (2003) noted that IICT provides innovative first-mover companies with opportunities for competitive advantage early in the IICT "build out" or innovation adoption curve, but investments in IICT are less and less likely to deliver competitive advantage to firms over time, as IT's power, ubiquity, and affordability grow. Again, this argument considers IICT from the reductionist view and fails to see IICT's interaction with other intangible resources and capabilities. Another argument can be made for lack of durability with IICT investment based on continuous technological evolution and change (Moore's Law[1]). A rapid rate of change with IT has given rise to the Change Management concept. Change Management is an integral part of most IT projects and as such, in this research, is included in IT capability. Ability to change is also embedded in the cultural orientation of the firm, which is also included in the holistic IT capability conceptualization proposed for this research.

[1] Moore's Law, named after Gordon Moore, made a notion and prediction in 1965 of the trend that the performance of memory chips doubles every 18 to 24 months, while the cost remains the same (in Afuah and Tucci 2003)

In summary, as IICT has become readily available, several firms may acquire the same physical IICT, but only a few may have the complimentary capabilities and intangible resources to fully exploit the technology. Bharadwaj (2000) found empirical evidence that IT capability is a rent generating resource that is not easily imitated or substituted. Isolating mechanisms allow firms with high IT capability to achieve and sustain superior performance. Research has also shown that firms using identical information and communication technologies and demonstrating equivalent IT spending have great variability in profitability (in Stewart et al. 2003). Thus, it can be concluded that IICT is more about the enterprise-wide capability to leverage information attained by technological innovation than about technological functionality. The goal of this research is to empirically investigate those capabilities and resources that drive successful IICT implementation.

2.5. IICT in Value Chain Activities

Possibilities for achieving competitive advantage in the context of IT capability have been suggested by Porter and Millar (1985) (in Bharadwaj et al. 1993). They suggested that an innovative IT system can provide a company with competitive advantage by: 1) enabling companies with new ways of doing business; 2) lowering cost of doing business; 3) improving ability to quickly respond to market shifts; 4) differentiating or customizing the value offer; 5) improving service quality; 6) outperforming competitors by extended value offerings; and 7) building switching costs and barriers to entry. Srivastava et al. (1999) argue that product development, supply chain management, and customer relationship management (CRM) are the three core marketing embedded business processes that generate value for customers. IICT resources and capabilities can be used to support all of these processes.

The potential impact of IICT on business operations can be approached through Porter's value chain. In 1985, Porter developed a widely cited value chain framework for companies to critically analyse their processes in order to gain competitive advantage. Porter identified a chain of activities that are common to a wide range of firms. The goal of these activities is to create an output that exceeds the cost of performing these activities. The primary activities defined by Porter (1985) are:

- Inbound Logistics: relationships with suppliers; activities required to receive, store, and disseminate inputs.
- Operations: activities required transforming inputs into outputs (products and services).
- Outbound Logistics: activities required to collect, store, and distribute the output.
- Marketing and Sales: activities to inform buyers about products and services; induce buyers to purchase them, and facilitate the purchase.
- Service: activities required keeping the product or service working effectively for the buyer during and after it is sold and delivered.

The secondary activities are:

- Procurement: acquisition of inputs or resources for the firm.
- Human Resource Management: activities involved in recruiting, hiring, training, developing, compensating, and when necessary dismissing personnel.
- Technological Development: equipment, hardware, software, procedures and technical knowledge brought to bear in the firm's transformation of inputs into outputs.
- Infrastructure: ties organization's various parts/departments together.

Table 6 summarizes inefficiencies and potential IICT contribution related to primary value chain activities. Secondary activities are omitted from the scope of this discussion.

Table 6. Value chain activities, inefficiencies, and potential IICT implementation impact

Value Chain Activity	Inefficiency	IICT impact
Inbound logistics & Procurement	Long lead time Incompatible IT systems Supplier selection	• Increased collaboration • Reduced order cycle • Reduced search cost • Enables JIT and CRP • More responsive supply • Small and frequent purchases
Production & Operations	Inaccurate demand forecast Bullwhip effect Excess inventory	• Sharing supply and demand information • Integration of timely and accurate data into planning • Better demand forecast • Reduced bullwhip effect • Reduced inventory
Outbound logistics & Distribution	Multiple middlemen Delivery costs	• Elimination of intermediaries • Electronic delivery • Accurate shipment • Improved availability of tracking information
Marketing & Sales	Costly and difficult market information attainment	• Improved market and customer information • Faster documentation process • Faster payment cycle • Lower communication costs • Improved relationship
Service (during & after)	Response time Costly customized information	• 24/7 information access • Faster response • Customized service at low cost

Sources: Porter 1985; Anandarajan et al. 1998; Chan and Davis 2000; Ling and Yen 2001; Tan et al. 2000; Vlosky et al. 2000

"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). Virtual integration allows for the incorporation of timely and accurate data into the company's planning and control system (Anandarajan et al. 1998; Vlosky et al. 2000). In the past, manufacturers estimated future demand based on previous consumption. However, fluctuating order patterns made this method inaccurate and resulted in high stock-levels. By sharing manufacturing schedules, production capacity information, and consumer demand information, companies are better able to coordinate and streamline production and value chain activities via improved demand forecasting (Tan et al. 2000). Thus, IICT integration has potential to reduce the excess inventory building bullwhip effect caused by

lack of accurate upstream demand information. Programs such as just-in-time delivery (JIT) and continuous replenishment (CRP) rely on the dissemination of scheduling, production, and shipment information between business partners (Tan et al. 2000; Vlosky et al. 2000). IICT adoption has the potential to improve market and customer knowledge through open and timely shared information, thus reducing the cost of market research (Anandarajan et al. 1998).

In a case study, Anadarajan et al. (1998) found that eBusiness technology implementation enables faster trading cycles, increases ability to win new customers and business relationships, as well as retain existing customer relationships leading to improvements in business efficiency. Implementing IICT in the customer interface can simplify workflows in ordering, management and business reporting, and managing customer service and support functions (Ling and Yen 2001). In another case study documented by Chan and Davis (2000), a large U.S. electronics distributor was able to increase productivity through customer interface extranet implementation. Their sales and profits doubled since extranet implementation, while the sales staff was reduced from 1,600 employees to 1,450 employees. Also, Anandarajan et al. (1998) found that extranet adoption led to significant reduction in costs related to purchasing and inventory management, material handling, order processing, production scheduling and sales promotion. eBusiness enables faster preparation, transferring, and processing of order management documents, such as invoices, resulting in reduction in average time for payment (Anandarajan et al. 1998). Further, sales representatives are able to move from routinized work to establishing closer customer relationships (Vlosky et al. 2000). Anandarajan et al. (1998) argue that employing IICT may also lead directly or indirectly to an enhanced corporate image. In support of this argument, Vlosky et al. (2000) conclude that extranet partners are perceived to be more “cutting edge”, customer orientated, and more committed to long-term relationships.

IICT applications can offer important marketing tools and platforms for providing value-added services, such as inventory visibility, reporting tools, on-line chats, delivery tracking, and customized user interfaces. Each purchase event can be customized and every sale standardized (mass customization) through IICT utilization. Embedded extranets can facilitate queries to another company's database and transmit the information transparently (Chan and Davis 2000). An example of an embedded extranet is a vendor's extranet which is able to display order-tracking information retrieved from a logistics provider's information system. In a case study by Anandarajan et al. (1998) extranet adoption enhanced customer service through improved access to information that customers need for decision making and planning; decreased lead times and improved operations planning resulted from the extranet launch and adoption. eBusiness can simplify also the physical supply chain by disintermediation, eliminating intermediaries in the supply chain (Anandarajan et al. 1998). It also offers significant savings in publication costs, as manuals and other publications can be distributed electronically.

2.6. IICT in Exchange Relationships

Since the 1980's, relational marketing exchange has evolved to be a dominant paradigm in the marketing literature. The move from short-term discrete exchange transactions to long-term interactions with relational value started with Arndt's 1979 seminal article on domesticated markets. Domesticated markets have evolved to a relational exchange paradigm which includes norms (Heide and John 1992), ethics and moral restrictions (Gundlach and Murphy 1993), and most importantly mutual benefit. Relational exchange develops over time; considers both history and future; is based on assumptions on expected behavior; builds on trust, commitment, and joint effort; and includes both economical and social satisfaction (Macneil 1978, 1980 in Dwyer et al. 1987). There is wide consensus that relationship strength is a driver to increase customer

satisfaction, erect market barriers, lower transaction and operation costs, and earn higher returns both for suppliers and buyers (Gundlach and Murphy 1993; Narayandas and Rangan 2004). According to Arndt (1979) reduced uncertainty and transaction costs, synergies of combining complementary operations, and opportunities in political economies of scale to shape and control the market motivate relational market structures. The value of a relational exchange hinges on ex ante coordination and information management.

These motives have given rise to the Network Economy, which is deeply rooted in the relational exchange paradigm. The 21st century business governance structure is increasingly a network model. A network can be characterized as a collection of dyadic relationships. The basic premise of a network system is that the profit per partner will increase as the profitability of the network system increases. Achrol and Kotler (1999) define network organization as "an interdependent coalition of task- or skill-specialized economic entities…that operate without hierarchical control but is embedded, by dense lateral connections, mutuality, and reciprocity, in a shared value system that defines membership roles and responsibilities." Thus, network structure is a transition from vertical integration to virtual integration as a control mechanism.

The benefits of network structure in the new global, knowledge rich, and turbulent markets include, according to Achrol and Kotler (1999), a network's ability to dampen market turbulence through efficient information transfer throughout the system, and dilute turbulence by dividing cost between the network participants, thus enabling superior adaptability. Consequently, the role of information and information processing capabilities has increased its importance.

In today's market environment, relationships can be significantly facilitated by IICT. It can be argued that IICT has become the infrastructure of the Network Economy (Figure 6). IICT

enables efficient and effective market monitoring, faster reaction time to market changes, and a proactive approach to change. Anandarajan et al. (1998) argue that IICT can deepen business partnerships and collaboration. In a study by Cannon and Homburg (2001), the authors hypothesized that open information sharing between supplier and customer in the B2B context would lead, via decreased acquisition and operation costs, to increased customer intention to expand purchases from the supplier, but did not find support for the hypothesis. They reasoned customers' inability to process the received information as a possible cause for the surprising results. However, a closer look at the questionnaire used reveals that the authors investigated sharing of strategic and confidential information instead of operative information, which is often the subject of sharing in terms of Internet based technologies.

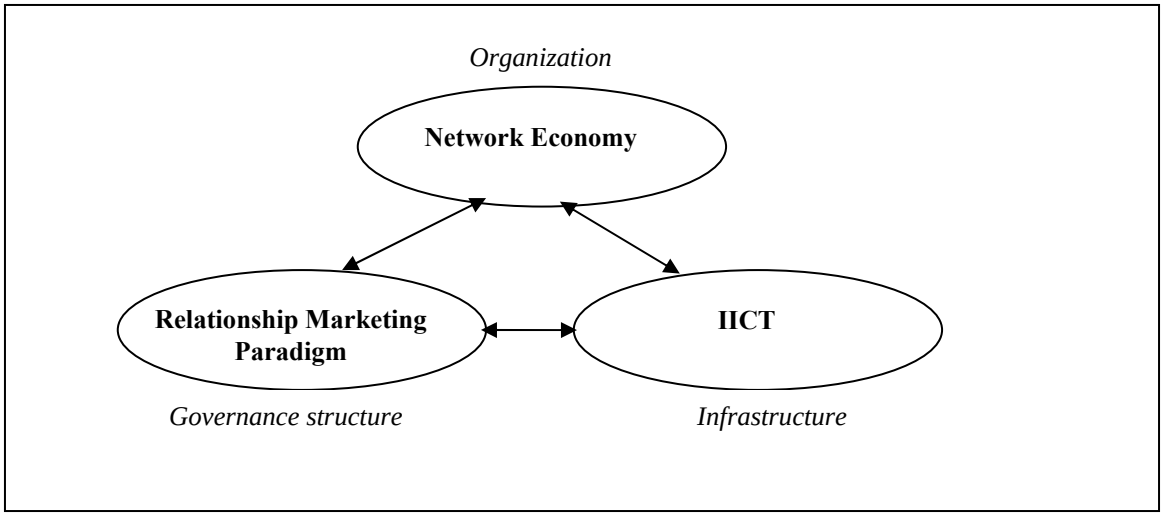


Figure 6. The 21st century organization, governance structure, and business facilitating infrastructure

Internet-based technologies provide excellent tools for the relationship management function to gather information about customers and their exchange behavior. This enables opportunities for targeting in terms of products, services, and prices. Internet-based technologies reduce customer costs (e.g. time, effort, transaction, operation, acquisition) and consequently

increase value and satisfaction from the exchange relationship. However, the relationship management functional managers need to be aware that they are facing a more "market educated" customer base than ever before, due to increased information availability and reduced information search costs. IICT diminishes this information asymmetry between suppliers and buyers.

2.7. Forest Products Industry in the United States

The forest industry can be divided into two main sectors: chemical forest industry, i.e. pulp and paper industry, and mechanical forest industry, which can be divided into primary (lumber, panels, engineered) wood products and secondary (furniture, cabinets etc.) wood products. Forest products industries can be identified by their Standard Industrial Classification (SIC) or North American Industrial Classification System (NAICS) codes:

- Paper and allied products manufacturing (NAICS 322; SIC 26)
- Wood products manufacturing: lumber, building materials (NAICS 321; SIC 24)

According to the American Forest & Paper Association (in Winistorfer 2005), the United States forest products industry contributes $243 billion each year to the nation's economy; represents 7 percent of the entire manufacturing base; is among the top 10 manufacturing industries in 46 states; and employs 1.1 million people. These figures highlight the often unrecognized importance of the forest industry to the U.S. economy. The U.S. has historically been and remains the world leader both in production and consumption of many forest products ranging from sawn wood to paper products (Juslin and Hansen 2002). For example, close to 90 million tons of paper were produced and 95 million tons were consumed in the United States in 1999, based on Pulp and Paper International (PPI) statistics (in Juslin and Hansen 2002), which translates into 765 pounds per capita per year. In comparison, annual paper consumption in

China is 74 pounds per capita and 8 pounds per capita in India, while the world average is 114 pounds (FAO 2004).

The U.S. forest products industry went through a major globalization and restructuring process in the 1990s including several mergers and acquisitions followed by mill shutdowns and overall reduced capacity. The loss of manufacturing infrastructure, combined with rapidly increased foreign competition and imports from lower manufacturing and operating cost markets of timber, furniture, and fiber products, have brought uncertainty and pressure to change in many sectors of the forest industry (Winistorfer 2005).

Innovation and value-added products and services may hold the key to competitive advantage when competing against global competitors with vast raw material supplies, low manufacturing wages, less overall regulations, less environmental regulations, state-of-the-art manufacturing capacity, and an increasingly educated manufacturing workforce (Winistorfer 2005). IICT may assist the forest industry to reduce costs in supply and value chains, enable value added and customer focus strategies, and help the industry to participate in the 21st century Network Economy. The U.S. forest industry can learn from other industries how to better utilize IICT in nurturing profitable customer relationships and fostering networks of suppliers, intermediaries, and buyers with an efficient flow of information which can lead to superior operational efficiency.

2.7.1. IICT Adoption

In 2004, the solid wood products industry was ranked 19th among the 21 manufacturing industry sectors surveyed for eCommerce utilization by the US Census Bureau (2005). The wood products industry employed eCommerce in 6 percent of total shipments, which represented only 0.7 percent of all manufacturing sector eCommerce shipments in 2004. The paper industry is

slightly more advanced in terms of eCommerce, ranking 11th. Twelve percent of paper industry shipments were conducted using eCommerce in 2004, representing 2 percent of total U.S. manufacturing sector eCommerce shipments.

The gamut of IICT sophistication in the U.S. forest industry is wide. The most advanced companies in the industry have established and executed eBusiness strategies for years. On the other hand, as the U.S. Census Bureau eCommerce statistics show, many companies are still hesitant to use the Internet and IICT for conducting transactions. Firm size has been found to have a positive correlation with IICT adoption in the forest industry (Vlosky 1999; Vlosky 2002). In a survey done in 2000, 20 percent of forest products industry respondents had already engaged in eCommerce capabilities, with an additional 20 percent planning to do so in the future (Vlosky 2002). In a survey conducted one year later also by Vlosky, 67 percent of North American pulp and paper companies surveyed stated that they are currently using Internet-based technologies to conduct business, confirming the pulp and paper industry's lead in eBusiness adoption relative to solid wood sector (Vlosky and Kallioranta 2003). Furthermore, Vlosky (2002) argues that the pulp and paper sector is ahead of composite manufacturers (e.g. medium-density fiberboard, particleboard), which are in turn ahead of the softwood lumber sector. The hardwood lumber sector is ranked last.

Vlosky and Kallioranta (2003) found that the most frequently used Internet business applications in the pulp and paper sector were corporate websites and Internet EDI. Approximately 60 percent of respondents handled customer contacts via the Internet, but only 37 percent sold products to customers on-line. Also a survey by PricewaterhouseCoopers found that paper industry websites are primarily informational rather than transactional (pponline.com 2000; Cubine and Smith 2001). They found that 82 percent of paper companies have an Internet

presence, but only 6 percent of corporate websites have product availability data online and 3 percent offer order status information. Product information and general company information on websites (Damery 1999), and order status, order tracking, and shipping notices via extranets (Vlosky and Kallioranta 2003; Vlosky and Punches 1999; Damery 1999) have been found to be the most frequently implemented IICT functionalities in the forest products sector, again confirming the lack of eCommerce in the sector. In another survey by PricewaterhouseCoopers, only 5 paper industry websites were considered to be "best in class" when judged on website functionality, overall strategy, and visual impact (Cambell 2001). One forest industry website success story comes from Europe where the global forest industry giant Stora Enso's website was ranked number one in a survey published in the Financial Times on November 26, 2003 (Stora Enso News 2003). However, the survey concentrated on availability of financial information and site technology, instead of effectiveness of customer communication and relationship tools.

The use of eMarketplaces, eAuctions, or other eIntermediary entities with different business models, in the forest sector has been low, leading to failure of many forest industry vertical start-up eIntermediary companies when the dot.com bubble burst in 2002. Forest industry consortium-based eMarketplaces were also unable to drive eBusiness adoption despite industry backing and significant financial support. For example, in 2001, North American forest industry giants Boise Cascade, Georgia-Pacific, International Paper, Mead Westvaco, and Weyerhaeuser jointly established ForestExpress. In 2004, ForestExpress changed its name to Liaison after overhauling its initial eMarketplace business model to become a value chain integrator and extending its scope to other industries beyond the forest sector. The forest sector's main concerns with eIntermediaries include: loss of contact with exchange partners, profitability

(eIntermediary pricing structure), resources, security of sensitive information, and need to restructure established business processes (Kallioranta 2003).

Despite the generally lagging in eCommerce adoption, the forest products industry has made great strides in some areas. For example, the industry has developed its own industry-specific standard formats for point-to-point (P2P) connectivity by EDI and XML. These industry-specific standards include the paper industry's EDIPAP for EDI and papiNet for XML, and the Nordic sawmilling industry's EDIsaw EDI standard (Juslin and Hansen 2002). Development of these standards is a result of industry and supply chain-wide cooperation. Dupuy and Vlosky (2000) found that in 1998, 16 percent of forest industry companies had EDI connections in place. They observed a strong correlation between EDI implementation and company size and that half of the surveyed companies using EDI had implemented it before 1993.

Research has found that the forest products industry expects such benefits from eBusiness as timeliness of information exchange, greater exposure to customers, improved customer service, ability to retain customers, enhanced corporate image, increased access to industry information, and achievement of competitive advantage (Pitis and Vlosky 2000; Vlosky et al. 2000; Vlosky 2000; Vlosky 2001; Vlosky and Kallioranta 2003). The following issues have been found to challenge IICT adoption and hence impede gaining the desired benefits: legacy system integration; business culture change management to allow close supplier and customer partnerships; hiring and retaining quality employees; establishing industry standards; and having an eBusiness strategy emphasizing that eBusiness is part of an overall business strategy and not simply a new technology (Cubine and Smith 2001; pponline.com 2000; Vlosky 2001).

The goal of this research is to investigate the organizational factors and capabilities that could support forest products industry in effective utilization of IICT in the customer interface. An applied objective is to explore differences between the forest industry and more IICT and eCommerce advanced manufacturing sectors and identify factors that contribute to variability in IICT effectiveness.

3. RESEARCH MODEL AND HYPOTHESES

3.1. Conceptual Research Model: Antecedents for Effective IICT Adoption

Ross and Weill (2002) found that most organizations do not generate the maximum value possible from IT investments. "The companies that manage their IT investments most successfully generate returns that are as much as 40 percent higher than those of their competitors", Ross and Weill (2002) conclude. 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), organization structure (Vlosky et al. 2000), control (Vlosky et al. 2000), management fear (Hamill 2000), process of integrating eBusiness into existing operating processes of the firm (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), technology implementation (Vlosky et al. 2000), and decision making (Vlosky et al. 2000).

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. This research views IICT effectiveness as a heterogeneously distributed firm capability, and hence investigates IICT embeddedness in non-IT related organizational resources and capabilities. Figure 7 shows the conceptual research model with the hypothesized antecedent firm capabilities influence on effective IICT adoption in the customer interface. The

influence of each variable and associated hypotheses are discussed in detail in the following sections.

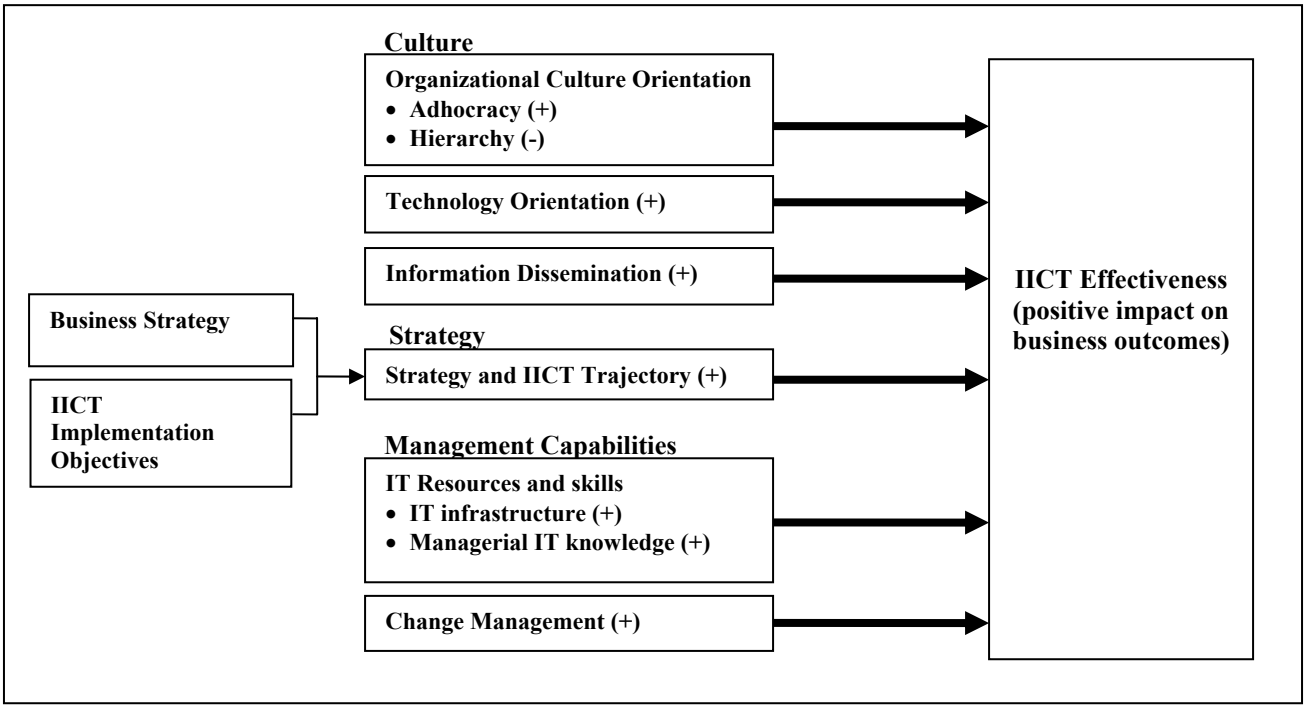


Figure 7. Proposed conceptual research model: Antecedents for effective IICT adoption

3.2. Corporate Culture

Is successful IICT implementation based on complex organizational routines that are based on tacit knowledge and fused into the corporate culture? Does a particular organizational culture support IICT adoption in the customer interface over another culture orientation?

Organizational or corporate culture was established as core theme in management theory in the late 20th century. Organizational culture can be seen either as something that an organization has or as something that an organization is (Berthon et al. 2001). Organizational culture can be defined as "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).

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). Conner (1991) argues that organizational culture affects behavior throughout the firm. 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.

3.2.1. Organizational Culture Orientation

Corporate culture archetypes defined by Cameron and Ettington in 1988 (in Berthon et al. 2001) are adhocracy culture, market culture, hierarchy culture, and clan culture. The resulting framework (Figure 8) is also known as the competing values of organizational effectiveness framework (in Deshpande et al. 1993). The two dimensions that delineate these four cultures in the Cameron and Ettington model are process and focus (Deshpande et al. 1993; Moorman 1995; Berthon et al. 2001). The process axis describes the continuum from organic to mechanistic processes. Organic processes emphasise flexibility, spontaneity, and individuality, whereas mechanistic processes foster control, stability, and order. The focus axis describes the relative organizational emphasis on internal maintenance (i.e., smoothing activities, integration) or on external positioning (i.e., market positioning, competitive differentiation). The adhocracy culture, with its organic organizational processes and external focus, emphasizes entrepreneurship, creativity, and adaptability. The opposite, hierarchy culture, has mechanistic organizational processes and an internal focus and emphasizes order, rules, and regulations. The market culture has mechanistic organizational processes with an external focus and stresses

competitiveness and goal achievement. The clan culture is typified by organic organizational processes and an internal focus, emphasizing cohesiveness, participation, and teamwork.

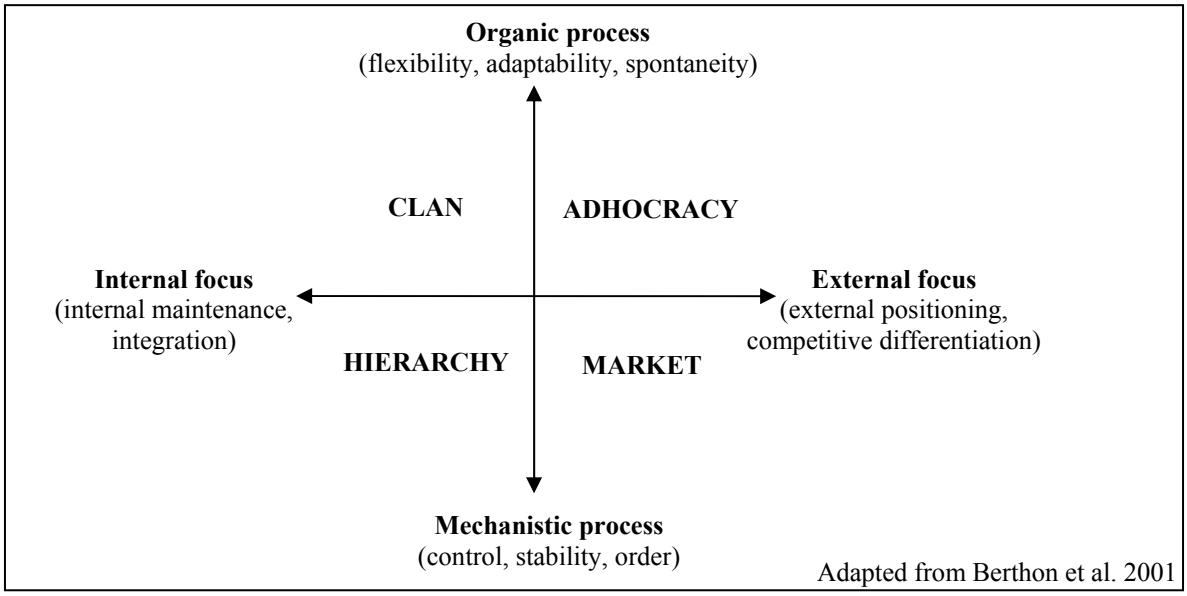


Figure 8. Organizational culture archetypes

Empirical research has found that cultures that harness entrepreneurship (adhocracy) and competitiveness (market) outperform those cultures reflecting organizational rules (hierarchy) and internal cohesiveness (clan) (Deshpande et al. 1993). Adhocracy culture has been argued to be the most effective culture in Western cultures (Webster 1994 in Berthon et al. 2001). Adhocracy culture resonates well with the market orientation concept with its market focus and internal responsiveness. Kohli and Jaworski (1990) define market orientation from organizational behavior perspective along three dimensions: generation of market intelligence, dissemination of the intelligence across departments, and organization wide responsiveness to it. Narver and Slater (1990) define market orientation from a cultural perspective, also along three dimensions: customer orientation, competitor orientation, and inter-functional coordination. Deshpande et al (1993) argue that market orientation is a subcomponent of culture.

Harper and Utley (2001) suggest that organizational culture should address human behavioral elements in order to lead to a successfully implemented IT strategy. They found that, as the human component is de-emphasized, IT success declines. Their analysis revealed that the following cultural attributes had a 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. Srinivasan et al. (2004) 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.

Given that the focus in an adhocracy culture is on innovation, entrepreneurship, flexibility, and adaptability, it can be hypothesised to have positive effect on IICT implementation effectiveness. Formal and centralized organization structures produce process uniformity and therefore reduce risk, but they tend to lead to slower decision making and reaction to new information or market situations (Matsuno et al. 2002). Hence, one would expect hierarchy culture, which is coupled with a focus on internal maintenance and rule orientation, to have a negative effect on IICT effectiveness. An organization with focus on internal maintenance might lack the "will for change" required for successful and innovative IICT adoption. Also, it could hinder attention to changing market needs and hence reduce a firm's capabilities to detect new IICT and institutional pressures (Srinivasan et al. 2004). Accordingly, the following hypotheses were formulated to test the hypothesized effects of the two opposite culture orientation archetypes on business outcomes:

H_{1a}: Adhocracy culture has a positive relationship with IICT effectiveness

H_{1b}: Hierarchy culture has a negative relationship with IICT effectiveness

3.2.2. Technology Opportunism

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 concept is similar to 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 limited to sensing new (radical) technologies and responding to them with a response ranging from new technology adoption to the decision to ignore the technology. The technology opportunism concept also finds common ground with innovation diffusion theory.

Srinivasan et al. (2002) found that though the firm's technology environment influences technological opportunism, firms can become more technologically opportunistic by 1) having a future focus, 2) having a top management that advocated the use of new technologies, and 3) developing an adhocracy culture within the firm. The following hypothesis was formulated to test the effect of technology opportunism on effective IICT implementation:

H_2: Technology opportunism (ability to sense trends in the technology environment) has a positive correlation with IICT effectiveness

3.2.3. 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 consequently its 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). A study by Vlosky et al. (2000) indicated that companies share more information with their extranet partners than with their non-extranet partners. Increased information sharing between trading partners results in lower total transaction costs, higher order fulfillment rates, shorter order cycle times, and more accurate demand forecasting. An organization's ability to disseminate business and IT knowledge throughout the organization is essential for superior IT adoption (Armstrong and Sambamurthy 1999). Accordingly, the following hypothesis is proposed:

> H_3: Cross functional information dissemination is positively correlated with IICT effectiveness

3.3. Business Strategy

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, and the coordination and integration of functional area strategies (Varadarajan and Jayachandran 1999). Barney (1996) defined strategy as a "pattern of resource allocation that enables firms to maintain or improve their performance" (in Varadarajan and Yadav 2002).

Porter (1985) argues that there are two basic types of competitive advantage a business can hold: cost leadership and differentiation. Cost leadership strategy stresses scale, low cost inputs, and improving efficiency in production and manufacturing processes (Grant 1991). This strategy is successfully implemented when the business develops, produces, markets, and distributes a standard product more efficiently than its competitors. Typically, businesses with a cost leader strategy avoid expenditures that are not directly associated with the production and distribution of a competitive product or service. In contrast, a differentiation strategy is effectively deployed when the business provides unique and superior value to the buyer. Sources of value may include product quality, special features, distribution, and service. Differentiation strategy emphasizes innovation, brands, marketing, and new product development (Grant 1991).

An alternative strategy framework (see Table 7) is provided by Miles and Snow (1978) (cited in Vorheis and Morgan 2003; McKee et al. 1989). The Miles and Snow typology identifies four strategy alternatives: prospector, analyzer, defender, and reactor. Prospector proactively seeks and exploits new market opportunities, competes on innovation and hunts for first-mover advantage. Borrowing from information diffusion theory, prospectors can be considered as pioneers in their market. Prospector's emphasis on innovation makes it similar to the differentiation strategy in the Porter's strategy framework. Analyzer emphasizes securing market position by introducing incremental innovation. Analyzer often competes by balancing differentiation and operation efficiency investments; hence analyzer is a combination of cost leader and differentiation strategy. Defender focuses on securing market position and often competes through efficiency related advantages (such as operations) thus placing it on the same level as Porter's cost leader. Reactor has no consistent clear strategy and hence is not a viable

strategy in the long run (McKee et al. 1989). Reactor is a type that Porter would call "stuck-in-the-middle".

Based on the RBV, firm resources are fundamental to strategy execution. For example, establishing a cost leader strategy requires specific resources (such as scale-efficient manufacturing technology and processes, access to low-cost raw materials or labor etc.) which differ from resources required for instituting a differentiation strategy (such as brand image, extensive sales and service network) (Grant 1991). Firm IICT resources are no exception. In order to create value to the firm, IICT resources need to support the overall business strategy and objectives.

Table 7. Congruent IICT adoption objectives by business strategy types

<table>
<tr><th colspan="2">Strategy Type</th><th>IICT adoption objective</th></tr>
<tr><td>Miles and Snow (1978)</td><td>Porter (1985)</td><td rowspan="3">• Value-added services
• Customized exchange experience
• Deepen customer relationships
• Improved service
• Enhanced image
• Joint product development</td></tr>
<tr><td>Prospector</td><td rowspan="2">Differentiation</td></tr>
<tr><td>Analyzer</td></tr>
<tr><td rowspan="2">Defender</td><td rowspan="2">Cost leader</td><td>• Improved operations efficiency
• Faster inventory turns
• Reduced employee count
• Reduced transaction costs
• Reduced sales cost
• Increase sales</td></tr>
<tr><td>Reactor</td><td>"Stuck-in-the-middle"</td><td>• Serve everybody with generic solution
• Imitate competitors</td></tr>
</table>

3.3.1. Business Strategy and IICT Congruency

The decision to implement IICT should be derived from the business strategy; how a company creates value and connects with its stakeholders (Chan and Davis 2000). Clegg et al. (1997) noted that many organizations have been struggling with successful integration of information technology into their business goals and strategies.

Based on the RBV, 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). Table 7 describes how IICT can support Porter's (1985) generic strategy types of cost leader and differentiation, as well as prospector, analyzer, defender strategy types proposed by Miles and Snow (1978). For example a low cost strategy would necessitate IICT resources that enhance operational efficiency and reduce transaction costs. Strategy based on differentiation and superior customer service would require a different IICT configuration. In this case the focus might be in deepening customer relationships, building barriers to exit, and creating responsive supply chain management. Accordingly, the following hypothesis was formulated:

H4: Alignment of business strategy and IICT objectives has a positive relationship with IICT effectiveness

3.4. Management Capabilities

The proposed research views IICT capability as a heterogeneously distributed firm capability and attempts to extend current IT capability constructs (e.g. Mata et al. 1995; Ross et al. 1996; Bharadwaj 2000; Boynton et al. 1994) by taking a more holistic view on the interplay of technology with non-IT related intangible organizational resources and capabilities. The management skill-related premise is that effective IICT implementation requires co-occurrence of tangible IT resources and intangible IT management capabilities. IICT management capabilities include IT infrastructure, IT investment, organization wide IICT knowledge and support, and employment of change management.

3.4.1. Tangible and Intangible IT Resources

Bharadwaj (2000) examined firm IT capability and ability to mobilize and deploy IT-based resources in combination with other resources and capabilities. He adopted Grant's (1991)

classification schema in classifying the IT-based resources in 1) tangible IT resources (physical IT infrastructure); 2) human IT resources (technical and managerial IT skills); 3) intangible IT resources (knowledge assets, synergy). The previously discussed IT capability frameworks all recognize IT capability that includes the tangible IT infrastructure resources and intangible IT managerial skills.

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. Also 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 and IICT implementation.

IT management 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). Technical resources are essential in IT application implementation, but 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). 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. 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. Boynton et al. (1994) found empirical support for their argument that a major component of IT capability is represented by possession and exchange of IT and business knowledge among IT managers, functional managers, and top management. They concluded that the overlapping IT and business knowledge structures in different managerial layers of a firm, as well as the connections and relationships between the IT, functional, and senior managers, are related to organization's ability to effectively utilize new technologies in their operations. Accordingly, the following hypotheses were formulated:

H_{5a}. Robust information technology infrastructure is positively correlated with IICT effectiveness

H_{5b}. Managerial (top management, functional management, IT management) IT knowledge is positively correlated with IICT effectiveness

3.4.2. Change Management

Organizational change is often caused by advances in IT. In many IT projects the technology itself functions, but the organization is not ready to use it effectively and efficiently. 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 the RBV, a firm's competitive position is based on a bundle of unique interconnected resources, and the task of firm management is to adjust and renew these resources and their configuration as time, competition, and change erode their value (Conner 1991). Grant

(1991) argued that employees' adaptability to organizational 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). Based on Moore's Law, IT capabilities need to be dynamic as IT is constantly evolving. 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).

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). 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. Based on the IT project management literature, effective change management includes the following elements: common vision, user buy-in, communication, revised work process, new performance metrics, and training. These principles are discussed in the following sections.

Table 8. Top 10 IT Management Challenges in 2002

Top IT management concern	% of respondents
1. Change management	17
2. Budget management	16
3. Motivating staff	16
4. Staff recruitment & retention	13
5. Influencing the board	9
6. Outsourcing	8
7. Managing the integration process	7
8. Team development	5
9. Security	5
10. Business / IT alignment	4

Source: Riley (2002) in Computer Weekly

3.4.2.1. Change Management Principles

The fundamental question that needs to be asked regarding any IT project: “How can I leverage technology to create value in my business?” (Kosch 2002). It is important to remember that technology itself should not be the starting point, but should result in the achievement of business goals. The appropriate and successful starting point is to first make the business case. In the “Internet world,” benefits are often stated as "better, faster, more," which indicates that the business case hasn't been adequately made. A better description and justification for an IT project should include measurable business benefits (Feldman 2002).

Holland and Skarke (2003) argue that achievement of common vision on implementation objectives and implications is needed for coherent project direction. They also stress the importance of all stakeholders being able to articulate what the vision means in terms of their jobs. If employees are unaware or unsure of the effects of an IT project on their job description or stability, there is a high risk of resistance or even outright sabotage. Ross and Weill (2002) found that the companies that had the most success with IT initiatives were those that had senior managers taking an active leadership role in key IT decisions. Management participation is needed for determining the broad objectives of a project and making sure that the project does not lose focus. Further, to improve dissemination of the new idea or project and ensure continued project support, it is important that a strong, visible champion or influence leader is chosen (Koch 2002; Holland and Skarke 2003).

Involving the users in the planning process improves user buy-in of the project. IT professionals are naturally responsible for recommending the right technology solution and ensuring that the organization has correct technical requirements, but the future users of the system are the ones who know the business processes that the new technology will address.

Managing change is really about understanding people. “It's about being sensitive or emotionally intelligent in your response to how people are feeling about the change you want to bring about,” said Garfoot (2001). Many projects fail because technology is the driver and real users are just merely observers.

Poor communication can lead to unreasonable expectations, completely wrong expectations, or loss of interest and support for the project (Koch 2002). 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 discussed in Papanastassiou (2004) after initial excitement wanes and realization of the required hard work sets in coupled with expected and unexpected problems (Figure 9). Thus, it is recommended to plan to deliver early tangible results and publicize successes to build momentum and support (Garfoot 2001).

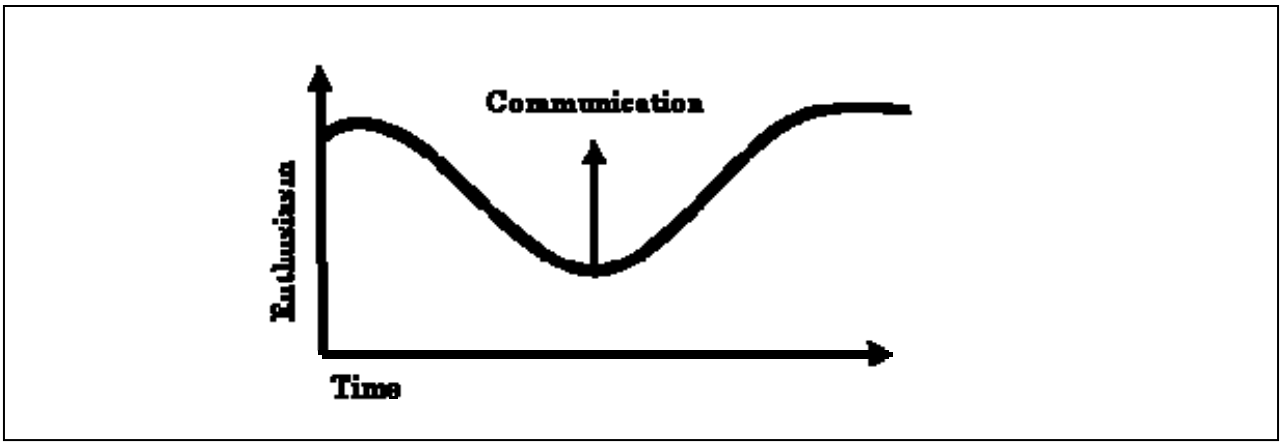


Figure 9. IT project enthusiasm curve

eBusiness-enabled business process workflows do not typically replicate old process workflows; hence, old ways of working will typically not yield optimal results (Holand and Skarke 2003). New metrics of successful performance need to be developed and agreed on and users should be rewarded for performing relative to the new metrics (Holland and Skarke 2003).

For example, if a company has implemented a Customer Relationship Management (CRM) system, the incentive system might no longer be based on the number of units sold but on the number of customers acquired and on customer profit margins (Rigby et al. 2002). If employees don't fully understand the changed work processes or performance metrics, they will generally attempt to continue to perform their old jobs to the old standards of performance (Holland and Skarke 2003). Thus, training for using the new system is an important part of a successful change management program.

In this study, the conceptual change management construct includes the following principles: common vision, user buy-in, communication, revised work process, new performance metrics, and training. Accordingly, the following hypothesis is proposed:

H_6: Employment of change management principles has a positive correlation with IICT effectiveness

3.5. Effect of IICT Implementation on Business Activity Outcomes

IICT can be regarded as a valuable resource because it enables firms to capture and implement customer interface strategies and operations that improve efficiency and effectiveness by either reducing firm costs or differentiating products, services, or relationships. Mizik and Jacobson (2003) argue that companies can achieve competitive advantage through value creation or value appropriation. IICT adoption can enhance value creation by enabling business process innovation and providing value-added services. IICT adoption may mitigate value appropriation by improving operational efficiency, deepening relationships, and erecting entry barriers through virtual integration with exchange partners. As business partners' information systems are integrated, it becomes more difficult and expensive to switch vendors as well as lose customer accounts. The potential impact of IICT on business outcomes can be approached through Porter's value chain activities. In today's market environment, relationships are so heavily facilitated by

IICT that it can be argued that IICT has become the infrastructure of the 21st century Network Economy, hence affecting supplier-customer relationships. This research investigates several different kinds of outcomes of customer interface IICT adoption from a supplier's perspective: impact on value chain activities; impact on inter-organizational information diffusion; impact on relational customer relationship variables; and general perceived success with IICT implementation. The business outcome variables of interest are summarized in Table 9.

The impact of IICT adoption in the customer interface is explored in terms of the following front-end value chain activity outcomes: sales revenue, number of customers, customer service quality, customer satisfaction, image, and overall company competitiveness. IICT applications can offer sales tools and marketing platforms for providing value-added services and customized user interfaces. In a case study by Anandarajan et al. (1998), IICT application adoption enhanced customer service through improved access to information. On-line technologies can drive down customer costs (e.g. time, effort, transaction, operation, acquisition) and consequently increase value and satisfaction from the exchange relationship. Anadarajan et al. (1998) also found that IICT application implementation enabled faster trading cycles and an ability to win new business or retain existing customers. Past research has also argued that suppliers with strong IICT application offerings enjoy enhanced "cutting edge" corporate image (Anandarajan et al. 1998; Vlosky et al. 2000). There is empirical evidence to indicate that firms with high IT capability tend to outperform rivals on a variety of profit and cost-based performance measures (Bharadwaj 2000).

Back-end value chain activities are also impacted by customer interface IICT and comprise of: inventory levels, fulfillment cycle length, production planning efficiency, order processing efficiency, on-time delivery, educed data errors, and timely reporting. Virtual

integration allows for the incorporation of timely and accurate data into the company's planning and control system (Anandarajan et al. 1998; Vlosky et al. 2000). Thus, IICT integration has potential to reduce the excess inventory building bullwhip effect caused by lack of accurate upstream demand information. By sharing manufacturing schedules, production capacity information, and consumer demand information, companies are better able to coordinate and streamline production and value chain activities via improved demand forecasting (Tan et al. 2000). Implementing IICT in the customer interface can also simplify workflows in inventory management, production scheduling, materials handling, order processing, and reporting (Ling and Yen 2001; Anandarajan et al. 1998).

Table 9. IICT impacted business outcomes

Business Outcomes			
Value chain		**Relationship**	
Front-end activities	**Back-end activities**	**Information**	**Relational**
Sales revenue	Inventory levels	Sharing	Satisfaction with relationship
Number of customers	Fulfilment cycle	Timeliness	Trust
Customer service quality	Production planning	Quality	Dependence
Customer satisfaction	Order processing	Knowledge of needs	Leverage
Image	On-time delivery		
Competitiveness	Data errors		
	Reporting		

Information has become the unit of exchange and source of competitive advantage (Vargo and Lusch 2004) and a primary wealth-creating asset (Achrol 1991). Information variables in this research include impact on: amount of information shared; quality of information shared; and understanding customer needs. IICT applications provide the tools to gather information about customers and their exchange behavior.

In the Network Economy, business relationships are often facilitated by IICT, hence IICT plays an important role in supplier-customer relationships. IICT adoption may mitigate value

appropriation by deepening relationships and erecting entry barriers through virtual integration with exchange partners. However, not all IICT-facilitated business relationship outcomes are positive. For example, as business partners' information systems are integrated, it becomes more difficult and expensive to lose customer accounts, consequently increasing dependence. In addition, IICT can diminish information asymmetry between suppliers and buyers, generally shifting power from suppliers to customers (Porter 2001). Suppliers are facing a more knowledgeable customer base than ever before due to increased information availability and reduced information search costs. Supplier satisfaction with customer relationships, trust in customers, dependence on customers, and supplier leverage in the relationship are the relationship variables investigated in this research.

Finally, subjective managerial perceptions of IICT adoption effectiveness are probed in terms of overall success and recommendations to continue customer interface IICT.

3.6. Customer Relationship Portfolio

One of the fundamental requirements for exchange to occur is both parties' ability to either accept or reject an offer (Kotler 1984 in Houston et al. 1987). Thus, development and evolution of a relationship depends on the ability and motivation of both exchange parties to enter into and grow the relationship (Johnson and Selnes 2004). Based on the relationship development process posited by Dwyer et al. (1987), relationships evolve through five phases: 1) awareness, 2) exploration, 3) expansion, 4) commitment, and 5) dissolution. The basic premise of the framework is gradual growth of interdependence. Johnson and Selnes (2004) take a customer classification approach based on customer portfolio management to describe different types of relationships as opposed to processes methodology taken by Dwyer et al. (1987). The Johnson and Selnes (2004) typology consists of following customer classes: 1) stranger, 2)

acquaintance, 3) friend, and 4) partner. As the customer moves from acquaintance class to friends, to partners, the developing trust and eventually commitment indicate a change in the value creation mechanism from pure economic value to include relationship value.

Both the process and typology methods of describing relationship stages are presented in Table 9. In both approaches, moving from initial stages, or a lower level customer class to a higher class, takes time, typically years, and is increasingly expensive because of increasing asset specificity (both tangible and intangible). The lower-order relationship stages (exploration and awareness) are discrete/transactional exchange relationship stages. As one moves forward in the process or typology frameworks, the relationship starts developing more relational aspects and the value creation shifts to encompass social values and future collaboration is supported by assumptions, i.e. norms, trust and planning. Formation of satisfaction, trust, commitment, and perceived value, influence the shift from discrete to relational exchange. Maintaining a portfolio of different types of customer relationships is important, as they can serve different strategic purposes.

Norms inhibit opportunistic exploitation of power (Heide and John 1992). Norms are shared expectations about behavior, and may apply at different levels, e.g. society, industry, firms, or group of individuals (Heide and John 1992). Relational norms can be operationalized across three dimensions based on Macneil (1980) (in Heide and John 1992): 1) Flexibility is bilateral expectations of willingness to make adaptations to respond the changes; 2) Information exchange refers to proactive dissemination of information that might affect exchange partners decision making; 3) Solidarity defines a mutual expectation that high value is placed on the relationship maintenance. Norm development takes place in the exploration phase of relationship development (Dwyer et al. 1987).

Table 10. Relationship evolution stages

	Transactional			Relational	
Process	**AWARENESS**	**EPLORATION**	**EXPANSION**	**COMMITMENT**	
Typology	**STRANGER**	**ACQUINTANCE**	**FRIEND**	**PARTNER**	
Time	→	→	→	→	
Cost to move up	→	→	→	→	
Recognition	Established (Awareness) Pre-recognition (Stranger)	Established	Established	Established	**DISSOLUTION**
Communication	Unilateral (Awareness)	Bilateral	Bilateral	Bilateral open	
Attraction	Initiates move to higher stage ->	Value potential	Value	Commitment	
Negotiations	-	Bargaining	Negotiations	Norms	
Power	-	"Just" power required to move to higher phase ->	Balance	Balance	
Relational norms	Environmental social context	Low	Medium	High	
Trust	-	Trustworthiness evaluation	Medium	High	
Actual risk	-	Low	Medium	High	
Perceived risk	-	High	Medium	Low	
Interdependence	-	Low	Medium	High	
Commitment	-	-	Low	High	
Product offering	Market	Standard	Differentiated	Customized	
Perceived value	-	Increase potential	Satisfying	High	
Control	-	Low	Medium	High	
Transaction cost	-	High	Medium	Low	
Asset specificity	-	Not established	Medium	High	
Barriers to exit	-	Not established	Low	High	
Source of competitive advantage	-	Satisfaction	Satisfaction+Trust	Satisfaction+Trust +Commitment	
Sustainability of competitive advantage	-	Low	Medium	High	
Knowledge	-	General knowledge of customer	Knowledge of segment	Specific knowledge	
Market info. Balance	Asymmetric	Asymmetric	Asymmetric	Less asymmetric	

Source: Dwyer et al., 1987; Johnson and Selnes, 2004

Dwyer et al. (1987) state that the possibility of dissolution is present throughout the relationship development process. Dissolution takes place when the (long-term) cost of relationship maintenance exceeds the benefit received, or does not fulfill the both parties' expectations. Relationship dissolution is very easy in the initial stages (exploration and

expansion) of relationship development. On the other hand, when the exchange partners have moved to the commitment stage and have established virtual integration through system-to-system connectivity, a strong bond is formed between exchange partners and it can become very expensive and difficult for businesses to dissolve the relationship.

3.6.1. IICT Value across Customer Relationship Stages

This research attempts to take the first step in developing a framework for integrating the customer relationship portfolio and IICT application portfolio management. In other words, this research approaches the question of "Which IICT application should be implemented with customers in which relationship stage?" Companies should make cogent systematic managerial decisions with regard to building electronic communication linkages, instead of simply reacting to customer wants or needs. Expected changes in supplier-perceived value from IICT by customer relationship type is shown in Figure 10 and discussed in the following sections. In this research context, the following definition of value is used:

> Value = (Economic benefit + Attitudinal benefit) – (Economic cost + Non-economic cost; effort, risk).

Angeles (2001) found it to be common that companies establish electronic integration with trading partners with whom they have had the longest relationship and who have the highest level of sales. The value of direct point-to-point (P2P) or system-to-system connections, such as EDI or XML, with customers in the "stranger" and "acquaintance" phase is posited to be very low, or actually negative, due to high implementation costs in terms of money, resources, and effort. Value increases when the relationship moves to the "friend" phase and is highest with "partner" customers. The proposed value function shape is derived from the high complexity, cost, and risk of establishing system-to-system connections, and associated high transaction costs

if transaction volume is low. Thus, P2P integration is posited to be best suited for long-term customer relationships with high transaction volumes.

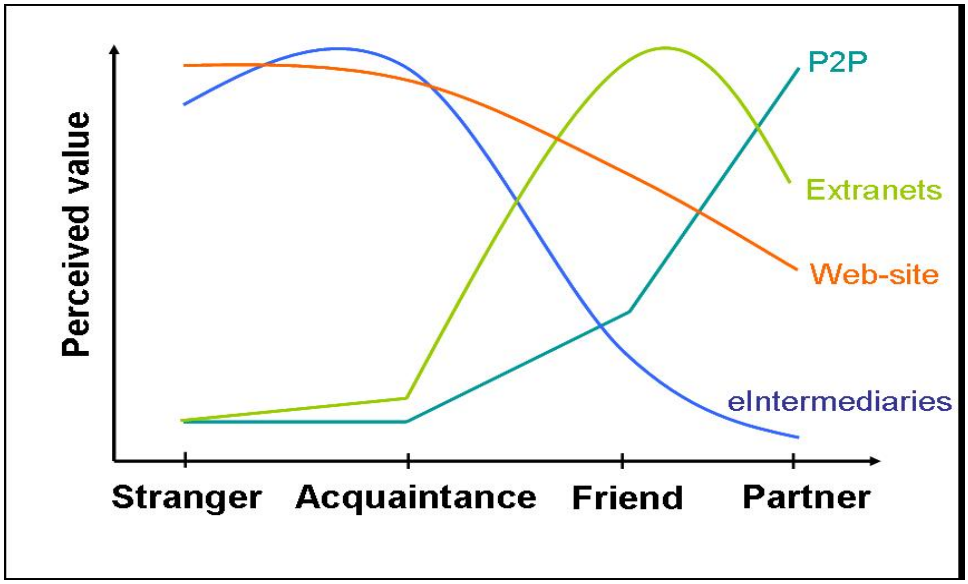


Figure 10. Expected IICT value functions across customer relationship types

Extranet connections are an economical alternative to creating and maintaining one-to-one proprietary networks. Chan and Davis (2000) estimated that establishing a supply chain link via an extranet is $1,000 per partner compared to $50,000 using EDI. With extranets, supplier-perceived value is expected to be lowest with "stranger", increasing when moving to "acquaintance," peaking with "friend," and turning downward with "partner" customers. This downward turn in an otherwise increasing value trend is due to the desire to further integrate via P2P technologies. The goal of deepening the business relationship and becoming a strategic "partner" may be seen as an incentive for virtual integration via P2P technologies (Chan and Davis 2000). Firms might prefer system-to-system integration with "partners" because it may allow "partner" customers the convenience of transmitting business documents and transactions directly from their own procurement systems and increase value they perceive.

eMarketplace, eExchange, and eAuction value is expected to be highest when offered to customers in the "stranger" or "acquaintance" phases, but quickly decline as the relationship moves in a relational direction. The reason for the expected decline is that, as eIntermediaries are not supplier-specific, they offer products and services from competing suppliers side-by-side and hence have an opportunity to direct price and attribute comparisons, thus negatively affecting switching barriers and loyalty. It is generally not in a firm's best interest to promote customers to view product offerings next to competitors' offerings in a generic on-line environment controlled by a 3rd party eIntermediary. On-line auctions may be effective bargaining tools but their effect on relationship development is posited to be negative, as the main focus is on price, ignoring continuity and other relational attributes of exchange relationships. As a result, eAuctions are most effective when offering spot purchases to transactional customers.

Corporate websites are posited to have the most value with potential customers who are searching for potential suppliers. The value of an information-oriented or non-transaction-oriented corporate website remains relatively high across the relationship continuum because it offers a source of general information. Website tools can improve problem-solving capabilities by offering interactive problem analysis tools and frequently asked questions (FAQ) on-line.

Accordingly, following is the proposed order of perceived value by IICT application across customer relationship stages:

Proposition 1_a: P2P connection value with partner > with friend > with acquaintance or stranger

Proposition 1_b: Extranet connection value with friend > with partner > with acquaintance > with stranger

Proposition 1_c: eIntermediary connection value with stranger and acquaintance > with friend > with partner

Proposition 1_d: Corporate website value with stranger or acquaintance > with friend or partner

4. RESEARCH METHODOLOGY

4.1. Sample Characteristics

The conceptual research model is tested on a 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 the manufacturing industry sectors listed below (a total of 1,000 companies):

- Paper Manufacturing (NAICS 322; SIC 26)
- Wood Products Manufacturing (NAICS 321; SIC 24)
- Chemical Manufacturing (NAICS 325; SIC 28)
- Food Manufacturing (NAICS 311; SIC 20)

In addition to wood products and paper manufacturing companies, the other industry sectors were chosen because of their close relationship to the forest industry and because they are ranked among the top sectors in the U.S. with regard to percent of gross sales in 2004 generated using eCommerce (U.S. Census Bureau 2005). Specifically, the percentages for the chemical and food manufacturing industry were 18 percent and 12 percent, respectively. Chemical industry eCommerce shipments represent 10 percent and food industry 7 percent of total eCommerce shipments in the U.S. manufacturing sector. The paper industry was ranked 11th and wood products industry was ranked 19th among the 21 industry sectors surveyed (with 2 percent and 0.7 percent of total eCommerce, and 12 percent and 6 percent of industry shipments, respectively).

Marketing executives were identified in Srinivasan et al. (2004) as frequently being responsible for eBusiness implementation decisions. Accordingly, Marketing executives were selected as the informants. Mailings lists from these industries were purchased from Best Lists Inc., a national list provider.

4.2. Research Design

The research was conducted using a mail survey methodology for primary data gathering. In general, sampling, survey procedures and, follow up efforts were conducted in accordance with the Tailored Design method developed by Dillman (2000). Mail questionnaires were chosen as the most cost effective method of data collection. It also affords a high degree of anonymity and is less limited by rigid time constraints that can impede the effectiveness of other survey methods.

In order to ensure that the questionnaire was appropriately designed to collect the information desired and in accordance to the research objectives, it was pre-tested on a selected convenience sample of 20 marketing research academic experts and forest industry experts. During the pre-test, attention was paid to understandability, wording, phrasing, and length of the survey. 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. Face validity is content oriented validity estimation. The questionnaire was amended accordingly to reflect the comments and feedback received.

The survey process included sending a pre-notification postcard one week prior to the first mailing to inform the recipients of the survey; mailing the initial survey accompanied by a postage-paid pre-addressed return envelope and a personally signed cover letter promising free summary research results if the questionnaire was completed and returned; sending a follow-up reminder postcard one week after the initial questionnaire mailing; and mailing a second survey to companies that did not respond to the first mailing three weeks after the initial questionnaire mailing.

4.3. Survey and Measures

The questionnaire (see Appendix) was developed based on existing constructs from the literature when available. If constructs were not available for the construct of interest, new constructs were built based on theories and items found from existing literature. Before hypothesis testing, all constructs were checked for validity and reliability, and modified as necessary, through factor analysis. The term "eBusiness" was used instead of IICT in the questionnaire because it was assumed to be conceptually more familiar to respondents, reducing potential confusion. To collect data on the various resource and capability constructs, Likert-type scales were used when applicable, anchored by 1= strongly disagree, 3= somewhat agree, 5= strongly agree. The questionnaire was distributed in booklet format, which was divided into the following sections: I) Company Background, II) eBusiness with Customers, III) eBusiness Value. Following is a discussion of each section.

Section I. Company Background

- Industry sector
- Revenue
- IT spending
- Culture orientation (8 items)
- Propensity for open functional information dissemination (4 items)
- Technology opportunism (8 items)
- IT infrastructure (3 items)
- Managerial IT skills (4 items)
- Business strategy
- eBusiness applications (i.e. IICT) implemented in the customer interface
- Perception of industry eBusiness adoption rate

After asking of basic company information, culture orientation was measured using the scale developed by Moorman (1995) for adhocracy and hierarchy culture orientations. Three potential scales were identified for measuring the propensity for open information dissemination: "Information Sharing (Functional)" by Fisher, Malz, and Jaworski (1997); "Information

Transmission Process" by Moorman (1995); and "Corporate Culture (Communication Openness)" by Kitchell (1995). Among the three scales, the Fisher, Malz, and Jaworksi (1997) scale, which assesses perceptions of the extent to which organizational guidelines and expectations foster the free exchange of information between functional areas, is preferred due to its conceptual fit and the highest reliability (.79). 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).

The respondent firm's business strategy was identified using the Miles and Snow strategy type descriptions developed by McKee, Varadarajan, and Pride (1989). The descriptions, written in paragraph format, were transferred into a table format to ensure easier readability and faster comprehension and comparison. The McKee et al. (1989) descriptions were supplemented by additional characteristics from business strategy literature.

Section II. eBusiness with Customers

- Dependent variables: Impact of eBusiness adoption in business outcomes
  - Front-end value chain activities (6 items)
  - Back-end value chain activities (8 items)
  - Inter-organizational information exchange (4 items)
  - Customer relationship (5 items)
- Dependent variable: Perception of company's success with eBusiness (3 items)
- Change management (8 items)
- Customer interface eBusiness objective
- Age of eBusiness adoption
- Champion department
- Percentage of business functions conducted with eBusiness

A new dependent variable construct of IICT adoption impact on business outcomes was developed. "IICT effectiveness" was measured both on an aggregate level, and separately for each business impact component: value chain activities, inter-organizational information

exchange, and customer relationship outcomes. In addition, the overall satisfaction of IICT adoption in the customer interface was measured through the delighted-terrible scale developed by Westbrook (1980) and two additional items relating to recommendation and encouragement of continued eBusiness usage.

Existing scales were not found for change management in the IT context. As a result, new eight-item scale was developed based on change management principles found in the literature. Two items for common vision were included from "Consensus on appropriation" scale developed by Salisbury et al. (2002). For capturing the fit between business strategy and IICT objectives, respondents were asked to indicate their objectives for customer interface eBusiness implementation among five cost leader strategy (improve operational efficiency, reach new customers, reduce transaction costs, reduce employee count, enable faster inventory turns) and five differentiation strategy (improve customer service, deepen existing customer relationships, cut out middlemen in distribution channel, enable joint product development, improve brand image) related objectives (Table 11). eBusiness objectives were compared to business strategy type. The resulting match/no-match yields the independent (dummy) variable for business strategy - IICT objective fit (Table 12).

Table 11. Business strategy and IICT objective variables

Cost reduction objectives	Differentiation objective
Improve operational efficiency (e.g. better forecast, production planning)	Deepen existing customer relationships
Reduce employee count	Improve customer service
Faster inventory turns	Joint product development
Reach new customers	Improved brand image
Reduce transaction cost (e.g. sales, service, negotiation cost)	Cut out middlemen in the distribution channel

Table 12. Business strategy and IICT objective trajectory independent variable values

Strategy Type	Objective association	Business strategy match (dummy)
Prospector	All differentiation	Match (1)
Prospector	All cost leader or mix of cost leader and differentiation	No-match (0)
Defender	All cost leader	Match (1)
Defender	All differentiation or mix of cost leader and differentiation	No-match (0)
Analyzer	Mix of cost leader and differentiation	Match (1)
Analyzer	All cost leader or differentiation	No-match (0)

Section III. eBusiness value

- Perceived value of customer interface eBusiness per IICT application (company website, extranet, eMarketplace, direct electronic integration) and customer relationship stage (prospect, transactional, key, partner)
- Percentage of customers transacting via eBusiness
- Share of customer segments (partner, key, transactional, prospect)

The final section, Section III on eBusiness value, was optional for the respondents, but continuing through this section was encouraged by promising a more comprehensive set of free summary results upon completion. The decision to make this section optional was based on the growing length of the survey and fear of a high non-response rate. In addition, it was concluded that due to a lack of an existing research framework in the literature and measures for integrated customer portfolio and IICT portfolio management, this research should approach the research problem of mapping IICT/eBusiness value by IICT application and customer relationship type from an exploratory perspective.

Value of IICT application (company website, extranet, eMarketplace, direct electronic integration) by customer relationship type (prospect, transactional, key, partner) was measured through direct judgment. After providing the key characteristics of each customer relationship type, definitions of the value concept, and each IICT application, a scale for each IICT application was presented to respondents to capture the perceived value of the IICT application

by customer relationship type. The scales were anchored by 1=no value and 7=very high value for each IICT application in each customer relationship stage. Two-way factorial design with 16 groups (cells) is used to test differences in IICT perceived value by customer relationship phase (Table 13).

Table 13. Two-way factorial design: IICT value by customer relationship phase

IICT	Customer Relationship Phase			
	Prospect	**Transactional**	**Key**	**Partner**
P2P	Perceived value of transacting with Strangers by P2P	Perceived value of transacting with Acquaintances by P2P	Perceived value of transacting with Friends by P2P	Perceived value of transacting with Partners by P2P
Extranet	Perceived value of transacting with Strangers by extranets	Perceived value of transacting with Acquaintances by extranets	Perceived value of transacting with Friends by extranets	Perceived value of transacting with Partners by extranets
eIntermediary	Perceived value of transacting with Strangers by eIntermediaries	Perceived value of transacting with Acquaintances by eIntermediaries	Perceived value of transacting with Friends by eIntermediaries	Perceived value of transacting with Partners by eIntermediaries
Corporate website	Perceived value of transacting with Strangers by corporate website	Perceived value of transacting with Acquaintances by corporate website	Perceived value of transacting with Friends by corporate website	Perceived value of transacting with Partners by corporate website

4.4. Data Analysis

The data from the questionnaires was coded and entered using Microsoft Excel® and the Statistical Package for the Social Sciences® (SPSS) for data analysis and interpretation. The data were categorized and analyzed in a number of ways including:

- Descriptive analysis and graphical representation of the data
- Factor analysis for construct confirmation and data reduction (summated scales are used in subsequent regression analysis)
- Regression and correlation analyses to test antecedents for effective IICT implementation
- *t*-tests to test for differences in IICT effectiveness between forest products and non-forest products industry sectors

- Plots of perceived value functions for IICT applications by customer relationship phase
- General linear models for repeated measures to test for differences in value perception by customer relationship phase and IICT application (4 by 4 factorial design)

5. RESULTS

5.1. Survey Response Rate

One thousand questionnaires were mailed to companies in the selected manufacturing industry sectors (wood products, pulp and paper, food, chemicals). Of the 1,000 surveys mailed, 108 were either undeliverable or the receiver indicated that their company did not want to participate. A total of 113 questionnaires were returned, however, six were blank. Thus, the adjusted sample size was 886, resulting in a 12 percent adjusted response rate (Table 14). 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 deemed acceptable considering the often lower response rates in studies investigating eBusiness in the business-to-business context (e.g. Chuang and Shaw 2005; O'Leary 2003; Kallioranta 2003; Vlosky and Pitis 1999).

Table 14. Response rate

	Initial sample size	Undeliverable, take off list, empty	Adjusted sample size	Useable responses	Adjusted response rate
Total	1,000	114	886	107	12%
Forest Products	500	36	464	52	11%
Other Industries	500	78	422	55	13%

5.1.1. Analysis of Missing Data

In survey research, missing data is often common. Missing data might affect the generalizability of the results through its potential "hidden" biases (Hair et al. 1998). Missing data may also impact the sample size available for analysis if remedies for missing data are not applied (Hair et al. 1998). The main reasons for missing data are respondents' refusal to respond and data entry errors.

One respondent with 66 percent of responses with missing data in the first section[2] (Section I. Company background) of the questionnaire was omitted from the data analysis. Among the remaining cases, missing data varied from 0 to 2 percent per case. Missing data by variable in the first section of the questionnaire ranged from 0 to 4 percent. Overall, missing data was infrequent and random throughout the questionnaire. For multivariate analysis, mean replacement was chosen as the most suitable imputation option for the infrequent and random missing data as list-wise or pair-wise exclusion of data would decrease the already scarce sample size (Hair et al. 1998). Missing data for univariate analyses (descriptives, *t*-tests) was remedied through pair-wise exclusion of missing data, in other words; all available data was used in the analyses.

However, one exception to the infrequent missing data was found in the question inquiring the respondent company's business strategy. This variable had a missing value rate of 10 percent. Systematic patterns of missing data in the "business strategy" variable were tested through group comparisons of observations with missing versus valid data for the remaining variables in this section. First, Levene's test statistic was calculated to confirm equality of variance between respondent groups. No significant differences were found in group means due to missing data in the "business strategy" variable among the other variables in the first section of the questionnaire. Because this question was the only question exploring business strategy and because business strategy has an important role in the conceptual research model, this variable was retained in the data set "as is", however its interpretation in testing the conceptual model "antecedents for effective IICT adoption" need to be considered in this context.

[2] The questionnaire was divided in three (I, II, III) sections. All respondents were asked to answer the questions in the Section I. Company Background. Only the respondents who had implemented customer interface IICT were asked to continue with the Section II. eBusiness with Customers. Section III. eBusiness Value was presented as an additional voluntary section to all respondents.

5.1.2. Analysis of Non-Response Bias

Non-response bias was assessed by independent samples two-tailed *t*-tests and Pearson's Chi-Square tests between respondents from the first and second mailings. Since the respondents from the second mailing required prompting to respond and therefore can be perceived to be less eager to respond, they are likely to be similar to non-respondents (Adams 1986; Donald 1960). If respondents from the first and second mailings significantly differ, research results might not be generalizable to the sample frame.

To investigate non-response bias, these two groups were compared on company background data (industry sector, revenue, and IT spending), eBusiness adoption characteristics (industry sector eBusiness adoption perception, and age of IICT implementation), eBusiness effectiveness (IICT impact on sales revenue, IICT impact on production planning efficiency, and attitude towards implementation success), and organizational characteristics (information sharing, IT infrastructure, and tendency to seek information on technology change in the business environment).

Levene's test statistics were calculated to check for equal variance between the respondent groups. If the significance value of the Levene's test was not significant ($p>0.05$), then *t*-test results that assume equal variances were used. If the test statistic was significant ($p<0.05$), *t*-test results not assuming equal variance were used.

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 15). Hence, no evidence of non-response bias was found and the research results are considered to be generalizable to the sample frames.

Table 15. Assessment of non-response bias

	Response received	n	Pearson Chi-Square		d.f.	Sig.[+]
Background						
Industry sector (forest/other)	1st	82	.011		1	.916
	2nd	24				
Corporate sales revenue (1-4)	1st	80	1.850		3	.604
	2nd	24				
IT spending (0-4)	1st	79	3.622		4	.460
	2nd	24				
	Response received	**n**	**Mean**	***t*-value**	**d.f.**	**Sig.[+]**
eBusiness adoption characteristics						
Industry sector eBusiness adoption rate perception (1-5)	1st	80	3.6	-1.889	102	.062
	2nd	24	4.0			
Customer interface eBusiness first implemented (0-11)	1st	68	5.3	-.575	86	.567
	2nd	20	5.7			
eBusiness effectiveness						
eBusiness adoption success perception (1-7)	1st	70	4.3	-.988	89	.326
	2nd	21	4.6			
Sales revenue (1-5)[++]	1st	70	3.4	1.213	78	.229
	2nd	20	3.2			
Production planning efficiency (1-5)	1st	67	3.4	.543	86	.588
	2nd	21	3.4			
Organizational characteristics						
Everyone believes that sharing information is important (1-5)	1st	82	3.6	-.656	104	.513
	2nd	24	3.8			
IT infrastructure is adequate for implementing eBusiness (1-5)	1st	82	2.7	-.559	103	.578
	2nd	23	2.9			
Actively seeks intelligence on technological changes in the environment (1-5)[++]	1st	81	2.8	-.899	27	.377
	2nd	22	3.1			

Possible scale values in parenthesis
[+] p-value of 2-tail *t*-test/chi-square
[++] equal variances not assumed

5.2. Sample Characteristics

Of the 106 respondents, 49 percent are in forest products manufacturing businesses (e.g., lumber, plywood, cabinetry, millwork, furniture, pulp, paper, paperboard, and packaging manufacturing). The remaining 51 percent of respondents were combined under a non-forest products industry sectors category. Several industry sector comparisons between these two

categories (forest product industry sector and non-forest products industry sectors) are reported later in Section 5.5. “Forest Industry/Non-Forest Industry Comparisons”. Results up to Section 5.5. report both forest products industry and non-forest products industry sector respondents combined.

A majority of respondent companies are medium-size companies with 2005 corporate sales revenue between ten and five-hundred million dollars (Figure 11). Smaller companies with 2005 revenue less than $10 million (16 percent) and large corporations with corporate revenue more than $500 million (19 percent) are also represented.

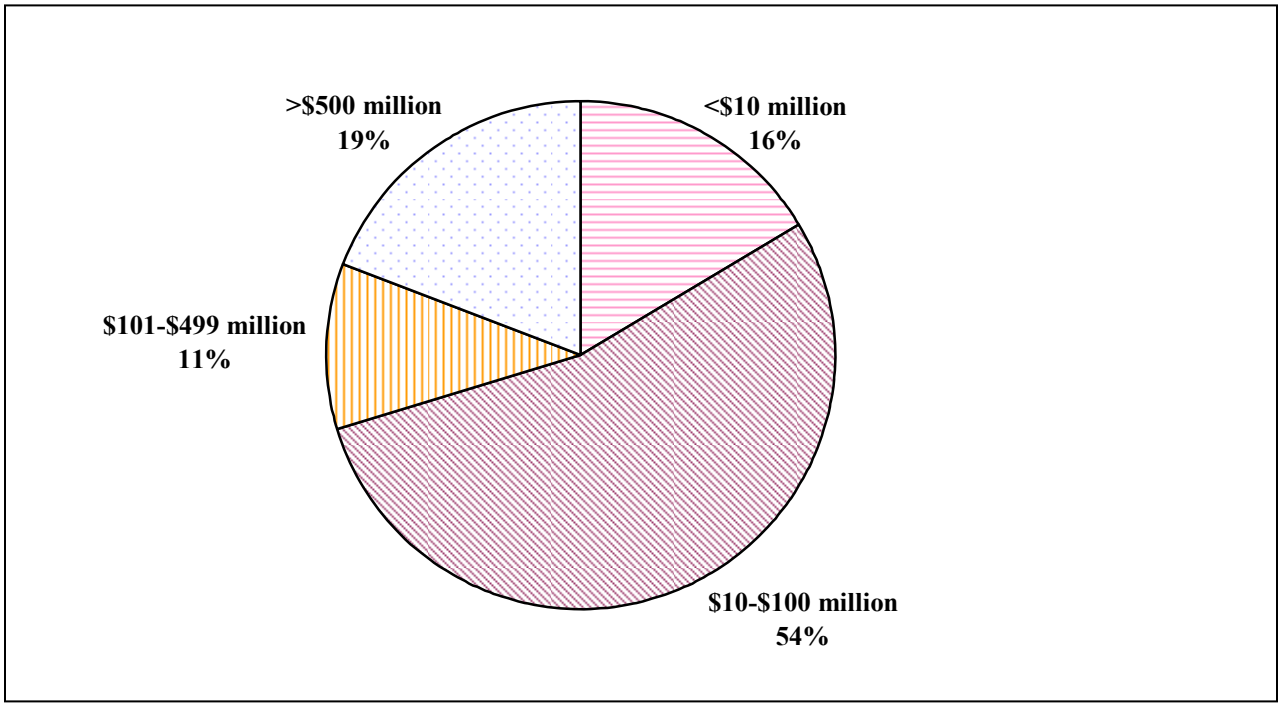


Figure 11. Corporate sales revenue in 2005 (n=104)

Almost 40 percent of the respondents had an IT budget in 2005 less than $50,000 and majority (67 percent) had IT spending of $250,000 or less (Figure 12). Eleven percent of the respondents indicated that their annual IT budget was more than $1.1 million. Also, 11 percent of respondents reported that they are unaware of the magnitude of their company IT budget.

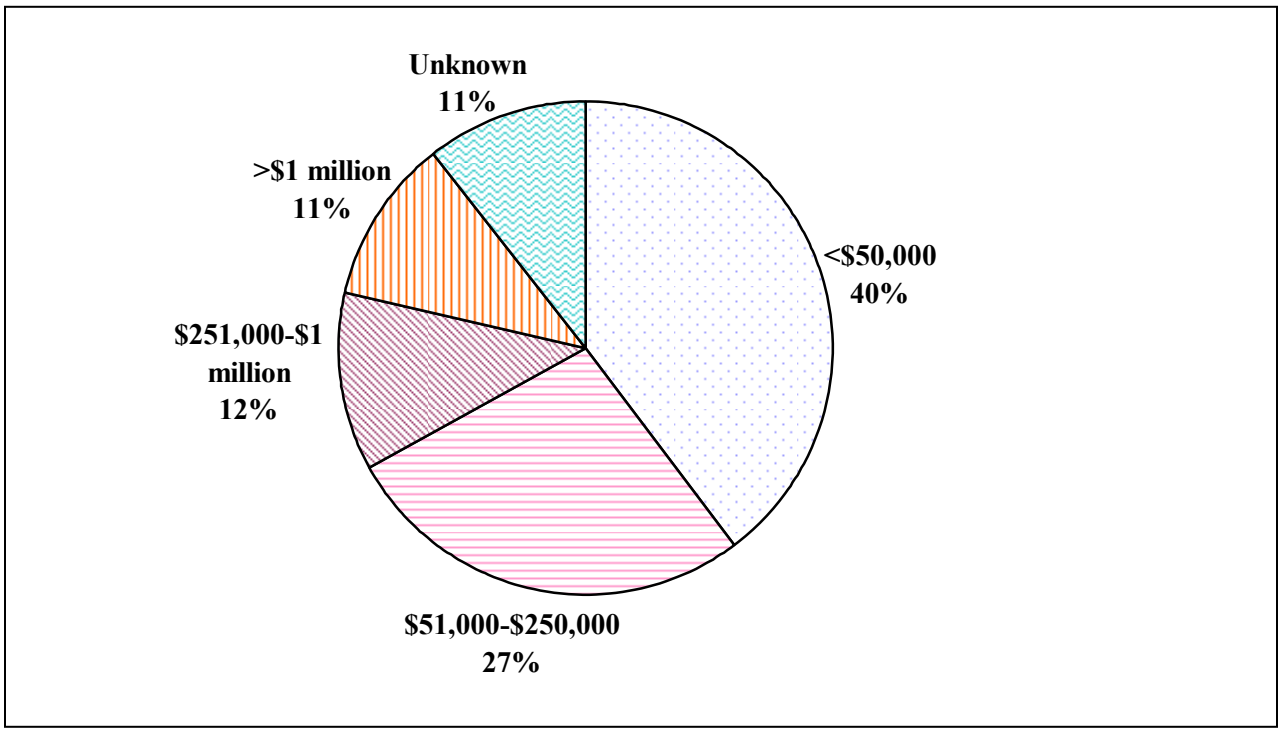


Figure 12. Information Technology (IT) spending in 2005 (n=103)

A majority of respondents (55 percent) who were able to identify their business strategy from the provided list of characteristics describing different business strategies indicated that their business strategy most resembles the characteristics typical for the "analyzer" business strategy described by Miles and Snow (1978) (Figure 13). Characteristics typical for the analyzer business strategy are: sales and financial management core competencies; emphasize on securing market position by incremental innovation; high product price, quality, and service levels; moderate levels of business process formalization and employee autonomy. Just over one quarter (28 percent) of respondents indicated that the company has a "prospector" business strategy (Miles and Snow 1978). Prospectors proactively seek and exploit new market opportunities, compete on innovation, and search for first-mover advantage. In addition, companies with a prospector business strategy typically have a broad, technically sophisticated, high priced product portfolio, which is complimented by high customer service standards. Typical for this

strategy type are high employee autonomy and low level of business process formalization. The remaining 17 percent of respondents identified their company's business strategy most with the "defender" (Miles and Snow 1978) strategy type characterized by: process engineering and production core competencies; emphasis on securing market position; low price and low service offering; high level of business process formalization; and low level of employee autonomy. Ten percent (11 respondents) were either unable to identify or chose not to indicate their business strategy.

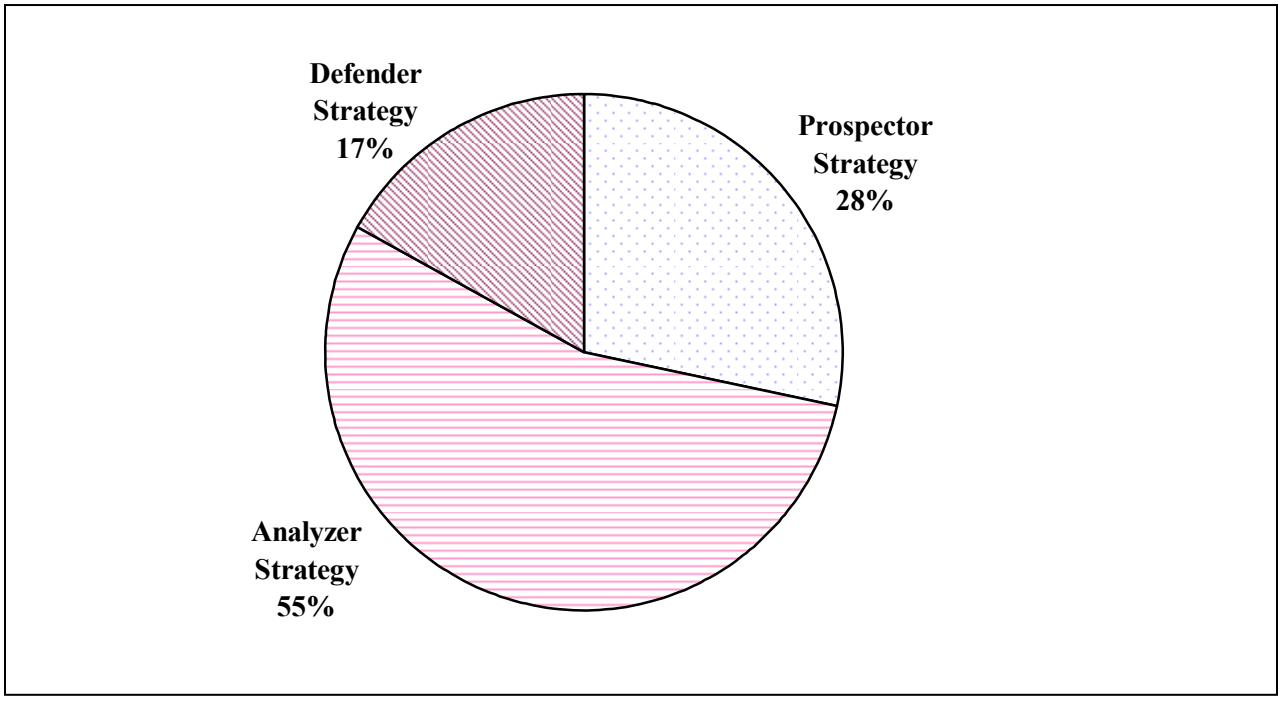


Figure 13. Business strategy types based on Miles and Snow typology (n=95)

5.2.1. IICT Adoption

Respondents were asked about their perception of the overall eBusiness adoption rate of the industry sector they operate in relative to other industry sectors. Most respondents (42 percent) indicated that they perceived their industry sector to be a late adopter relative to other industry sectors. Only one respondent perceived their industry sector to be an eBusiness adoption

leader. Overall, a majority of respondents perceived their industry sector to be a follower rather than on the cutting edge of eBusiness adoption.

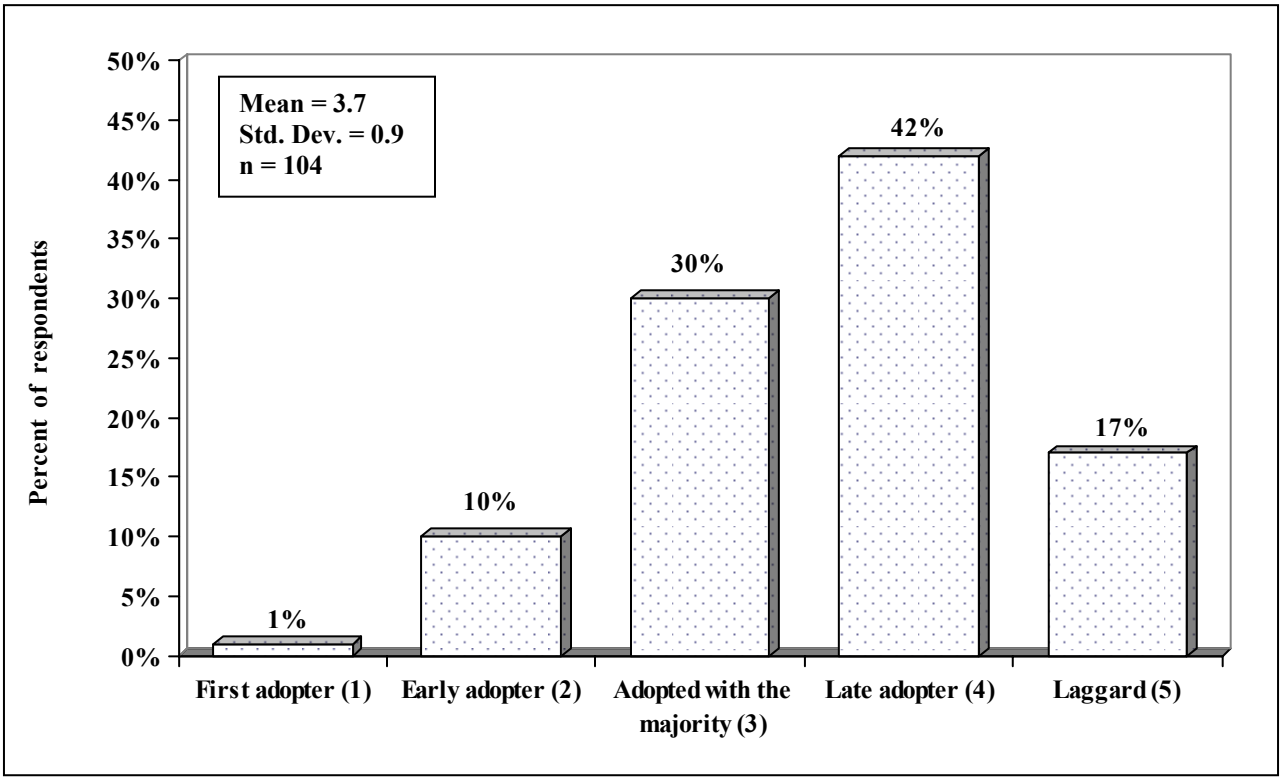


Figure 14. Perception on the industry sector eBusiness adoption rate (n=104)

Overall, 90 percent of respondents said they have implemented IICT in customer interface (Figure 15). Only 11 respondents (10 percent) indicated that their company is not using any IICT application (website, extranets, eMarketplaces or eExchanges, or direct virtual integration) in the customer interface. The most widely used IICT application is company website, which was implemented by 85 percent of respondents. Forty-three percent of respondents use extranets to provide customers with customer-specific and customized content. Direct system-to-system integration with customers' information systems was established by 35 percent of the respondents. Fifteen percent of respondents have used third party eIntermediaries to transact with customers.

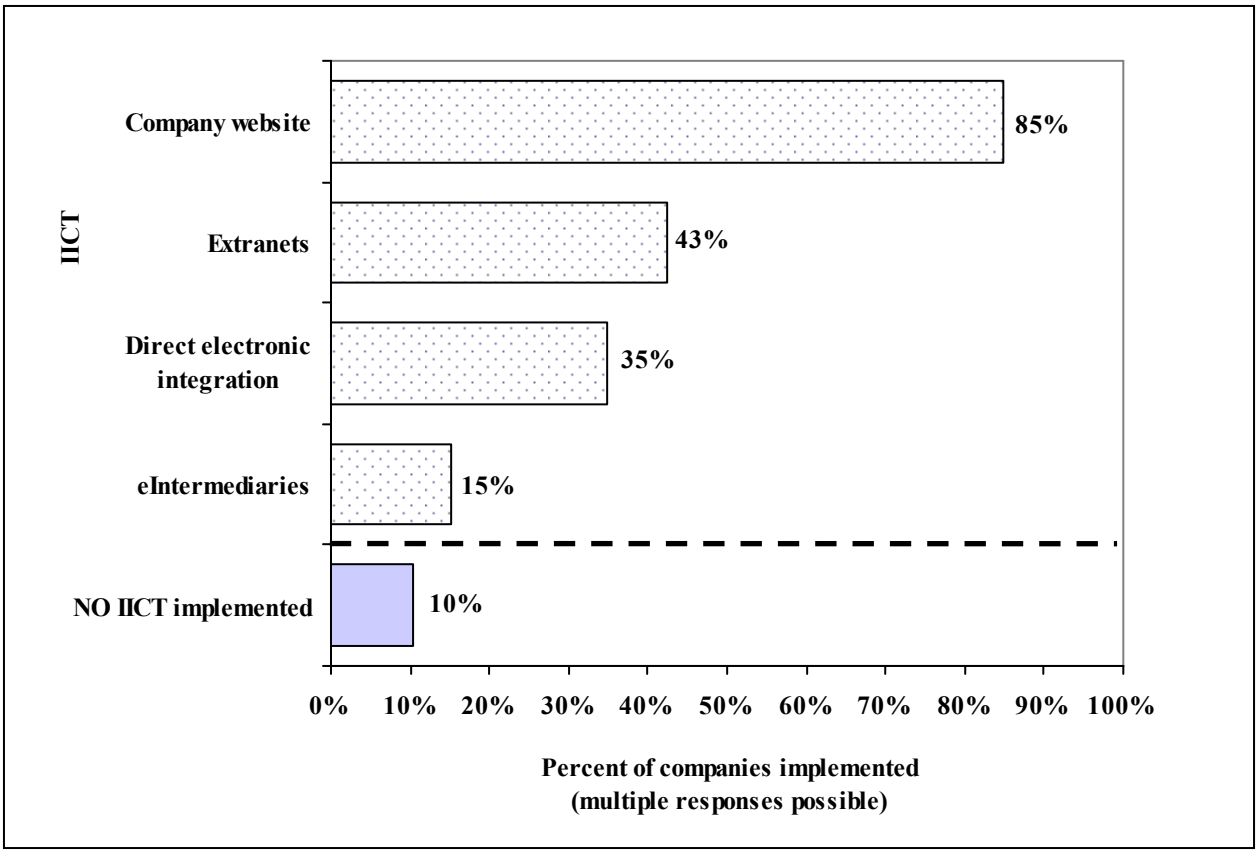


Figure 15. IICT applications implemented in the customer interface (n=106)

Respondents were asked about the "champion" department driving customer interface eBusiness adoption in their organization. Marketing (29 percent) and Sales (28 percent) departments were identified as the business functional areas most responsible for leading customer interface eBusiness. For 22 percent of respondents, champion was the IT department, followed by Top Management (13 percent). The remaining companies indicated either an internal push from another department or an external pull from customers as the driver to adopt eBusiness in the customer interface.

Of respondents who have implemented IICT in the customer interface, on average, eBusiness applications were first implemented five years ago (Figure 16). Eight percent of the respondents established customer interface eBusiness more than ten years ago. Fourteen percent of respondents adopted customer interface IICT two or fewer years ago.

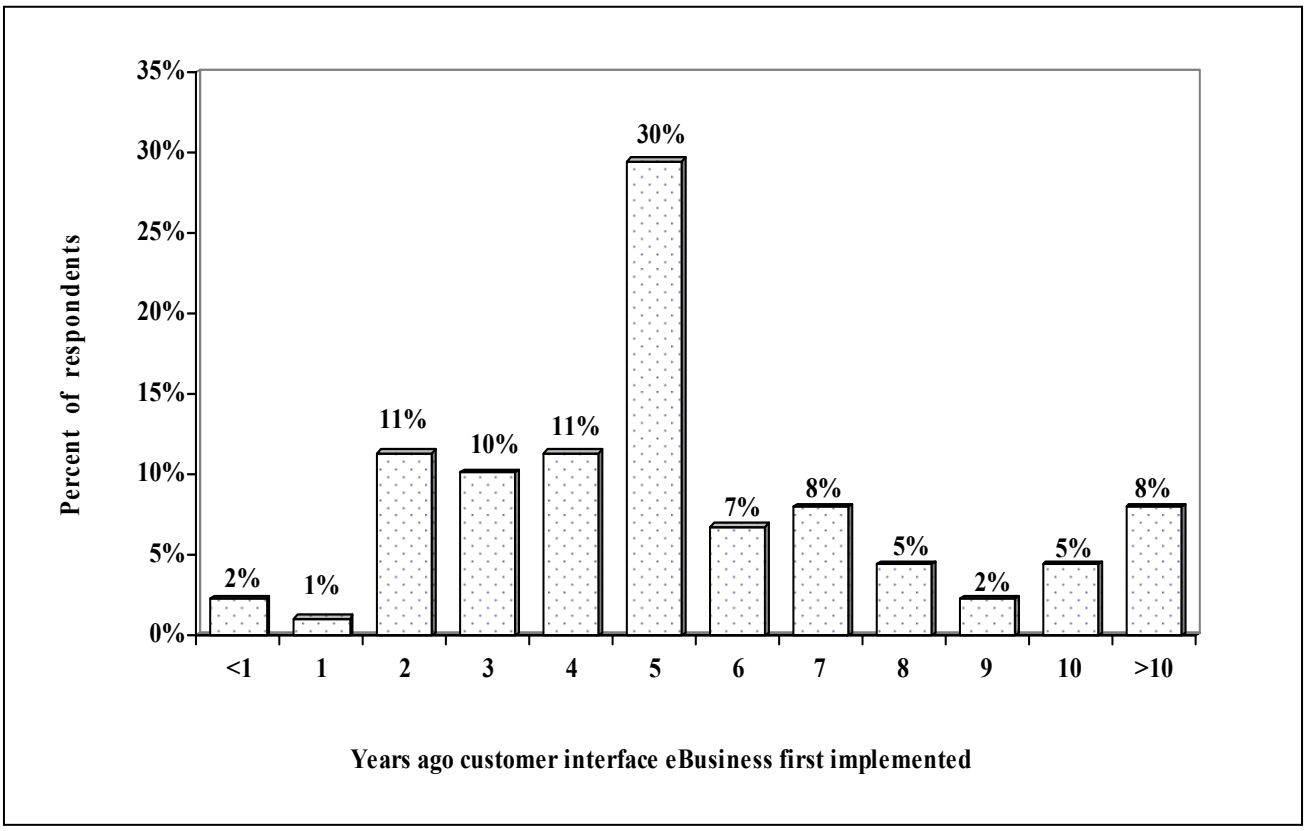


Figure 16. Customer interface eBusiness implementation age (n=88)

Respondents were asked to indicate the extent to which certain business functions and operations were conducted using eBusiness. Figure 17 displays the extent of IICT utilization in order fulfillment process. Roughly 40 percent of respondents indicated that IICT are not used at all (0 percent) in pre-sales support (e.g. inventory visibility), order management (e.g. order status, tracking, changes), customer support (e.g. on-line help, instant messaging with customer service representative), and complaint reporting. Overall Figure 17 shows that eBusiness still plays only a small to moderate role in order fulfillment management and execution. Traditional ways of conducting business transactions using phone, fax, or face-to-face prevail. Sixty-four percent of respondents indicated that 1-20 percent of their sales revenue was attributed to eCommerce in 2005 and none of the respondents had 80-100 percent of 2005 revenue from

eCommerce. Order management and receivables are the order fulfillment processes in which eBusiness applications are most utilized. Eight percent of respondents indicated that 81-100 percent of accounts receivable payments were received through electronic payment. Nine percent responded that 81-100 percent of order management activities were accomplished using eBusiness.

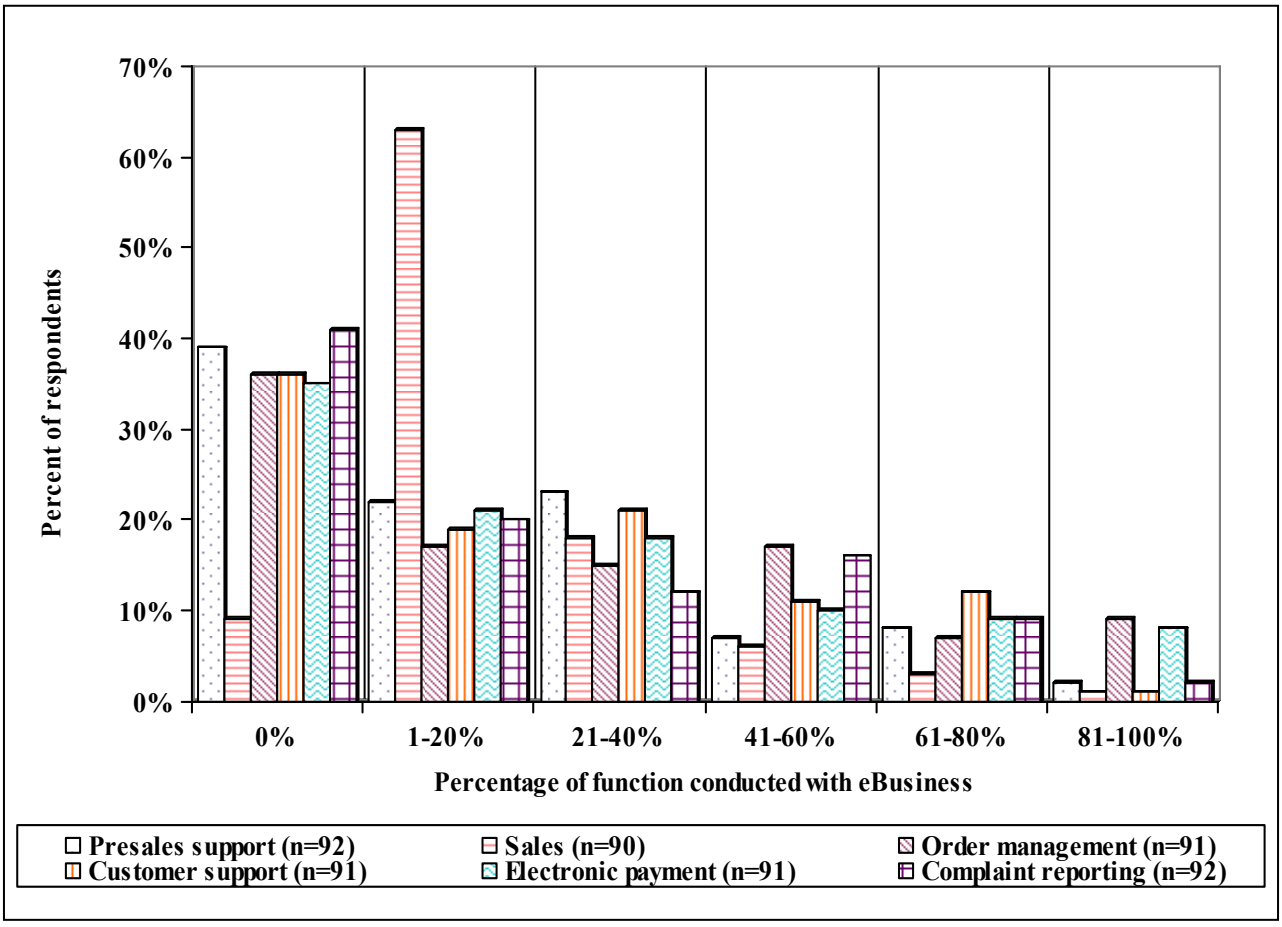


Figure 17. Share of order fulfillment process conducted by eBusiness applications

Figure 18 shows how eBusiness is used in advertising and promotion, product information dissemination, sales lead generation, and co-operative product development with customers. Results indicate that virtual-joint-product-development platforms have not gained vast success. Forty percent of the respondents do 1-20 percent of their advertising and promotion

on-line, and approximately thirty percent of the respondents generate 1-20 percent of sales leads using eBusiness applications. Of all business functions and processes, eBusiness is used most for disseminating product information and least used for joint product development (Table 16).

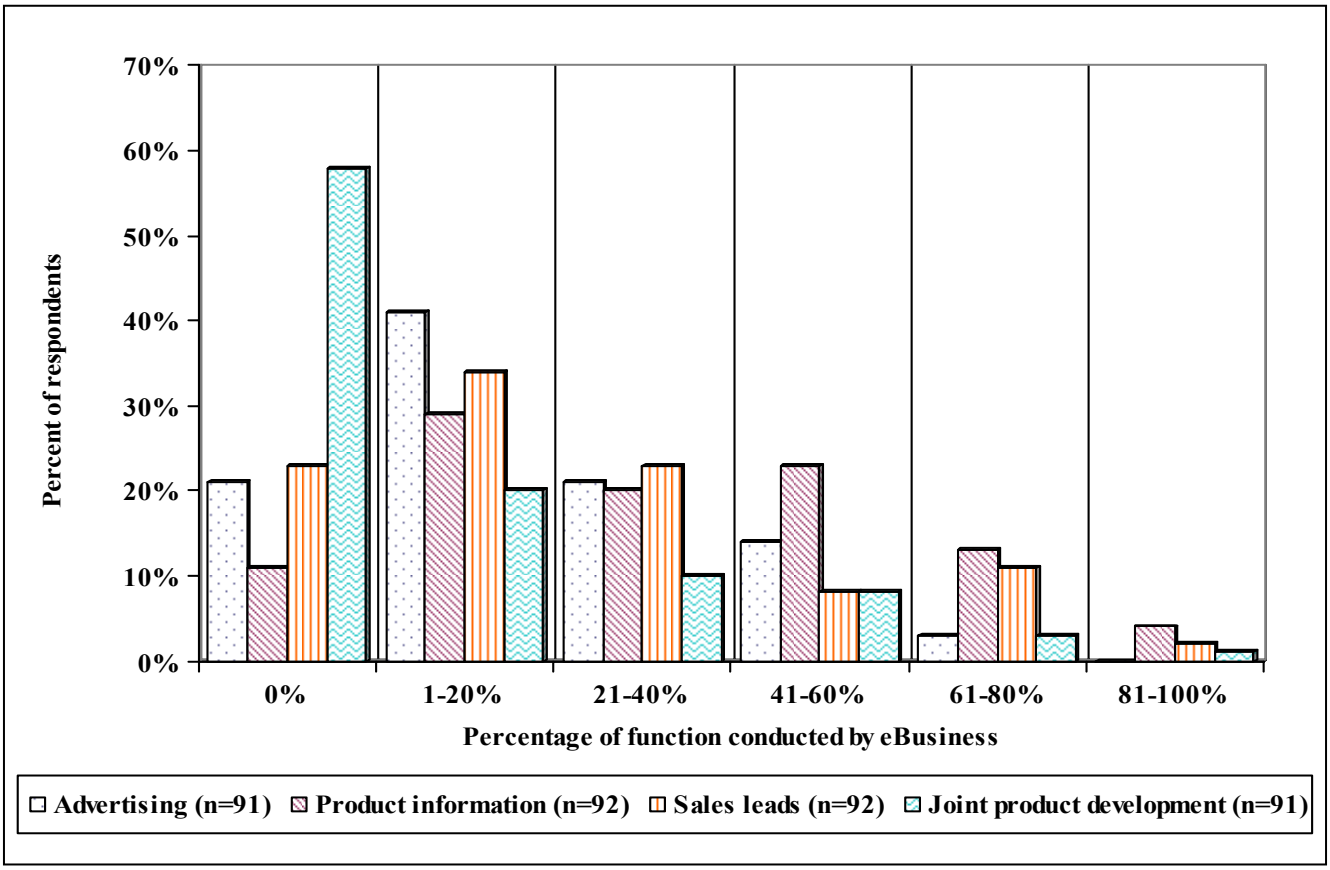


Figure 18. Share of business process conducted by eBusiness applications

Table 16. Rank of business process share by eBusiness

Business process/function	Mean	Std.Dev.	Mode	n
Product information dissemination	2.1	1.4	1	92
Order management	1.7	1.7	0	91
Electronic payment	1.6	1.6	0	91
Sales lead generation	1.6	1.3	1	92
Customer support	1.5	1.4	0	91
Advertising and promotion	1.4	1.1	1	91
Complaint reporting	1.4	1.5	0	92
Sales revenue	1.3	0.9	1	90
Presales support	1.3	1.4	0	92
Product development collaboration	0.8	1.2	0	91
Scale: 0=none, 1=1-20%, 2=21-40%, 3=41-60%, 4=61-80%, 5=81-10% of business process conducted by eBusiness				

In the final section of the questionnaire, respondents were asked to indicate the percentage of customers that they transact with through eIntermediaries, extranets, and direct point-to-point virtual integration between their and customer's information systems. Forty-two percent of respondents indicated that extranets are not utilized to transact with customers (Figure 19). Thirty-eight percent of respondents responded that extranets are used to transact with 1-20 percent of their customer base. Eleven percent specified that eIntermediaries are used to communicate with a significant 41-80 percent of their customers. None of the respondents indicated that eIntermediaries were used to transact with 81-100 percent of their customer base. Point-to-point virtual integration was used to transact with customers by 59 percent of respondents.

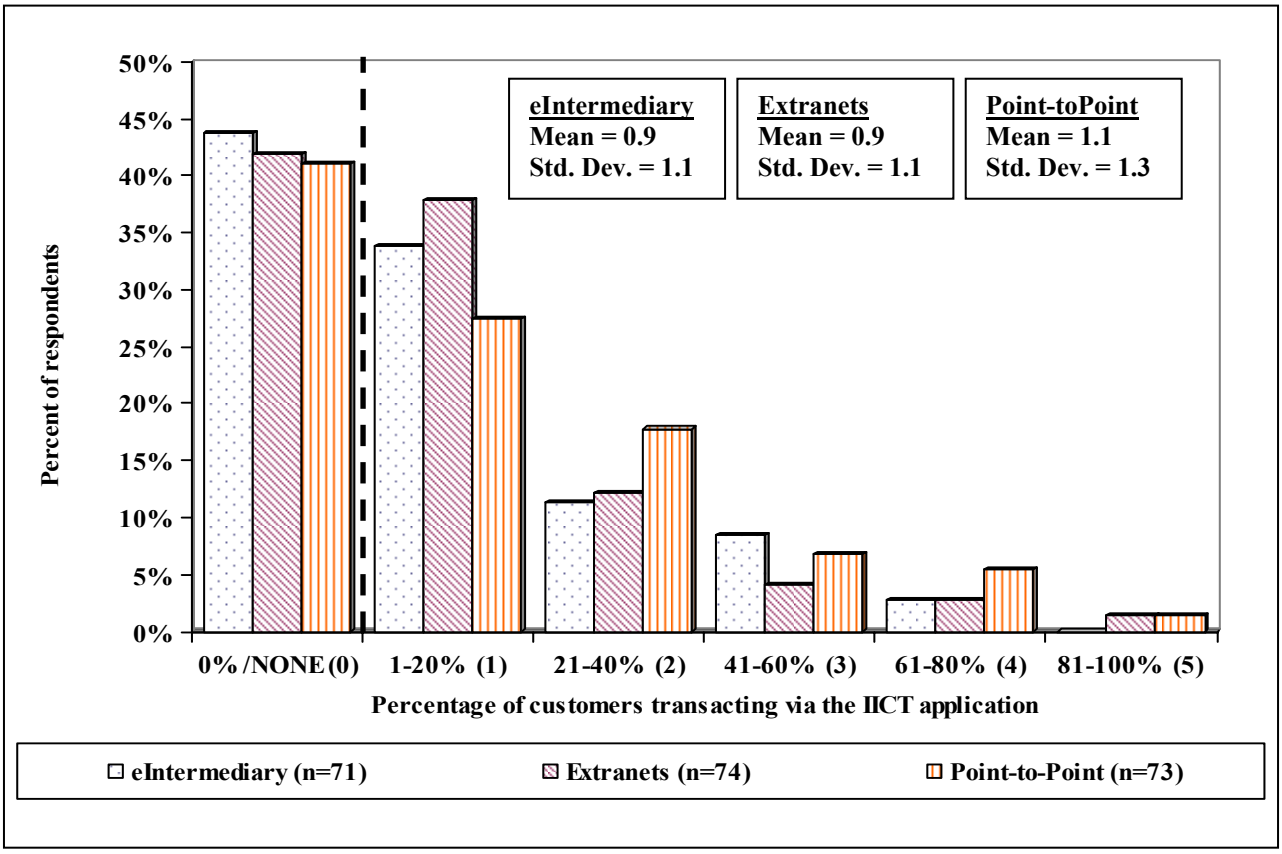


Figure 19. Share of customers transacting via IICT per application

5.2.2. IICT Implementation Objectives

Respondents were asked which business objectives were the primary motivators for customer interface IICT implementation (among the companies who had adopted IICT in the customer interface). Improvement in customer service (78 percent of respondents) was the most cited motivator for customer interface IICT adoption, followed by deepening existing customer relationships (60 percent) (Table 17). Both of these objectives are aligned with the general objective of Porter's (1985) differentiation business strategy to provide unique and superior value to customers.

The next three most cited IICT adoption objectives; reach new customers (54 percent), reduce transaction cost (38 percent), and improve operational efficiency (38 percent), are closely aligned with the criteria of Porter's (1985) cost leader strategy. Cost leadership stresses scale, low cost inputs, and improving efficiency in the production process (Grant 1991). Typically, businesses with a cost leader strategy avoid expenditures that are not directly associated with the production and distribution of a competitive product or service.

Only 7 percent of respondents had adopted IICT with the objective to cut out middlemen from their existing distribution channels. The desire to reduce employee count was mentioned as a motivator for IICT utilization for 15 percent of respondents and five percent of respondents said that no clear objectives were established for IICT adoption or that they were not aware of them.

Overall, results indicate that IICT adoption is strongly driven by the desire to strengthen companies' customer orientation. Customers, as opposed to manufacturing processes, are the focus of all top three IICT objectives (improve customer service, deepen relationships, reach new customers).

Table 17. IICT implementation objectives and associated strategy type (n=95)

IICT implementation objective	% of respondents [mr]	Strategy type association
Improve customer service	78%	Differentiation
Deepen existing customer relationships	60%	Differentiation
Reach new customers	54%	Cost leader
Reduce transaction costs with customers (e.g. sales, service, negotiation cost)	38%	Cost leader
Improve operational efficiency (e.g. better forecasting, production planning)	38%	Cost leader
Improve brand image	37%	Differentiation
Faster inventory turns	16%	Cost leader
Reduce employee count	15%	Cost leader
Joint product development	14%	Differentiation
Cut out middlemen	7%	Differentiation
No objectives were set or I don't know	5%	"Stuck in the middle"
[mr] Multiple responses possible		

5.3. IICT Adoption Effectiveness

IICT adoption may mitigate value appropriation by improving operational efficiency, deepening relationships, and erecting entry barriers through virtual integration with exchange partners. This research investigates several different kinds of outcomes of customer interface IICT adoption from the supplier's perspective: impact on value chain activities; impact on inter-organizational information dissemination; impact on relational customer relationship variables; and general perceived success with IICT implementation.

5.3.1. IICT Implementation Satisfaction

Respondents were probed on their general satisfaction in using eBusiness with customers. They were asked would they overall 1) recommend continuing eBusiness with customers, and 2) encourage use of eBusiness in the customer interface if they were to develop new markets/business opportunities. On a Likert-type scale ranging from 1= strongly disagree to 3= somewhat agree to 5= strongly agree, respondents indicated both a willingness to continue using eBusiness (mean=3.8) and expand (mean=4.0) eBusiness with customers (Figure 20). Only a

small amount of respondents (2 percent) indicated that they strongly would not recommend continuing and strongly would not encourage further use (1 percent) of eBusiness with customers. On average, respondents demonstrate satisfaction with adopting IICT in the customer interface.

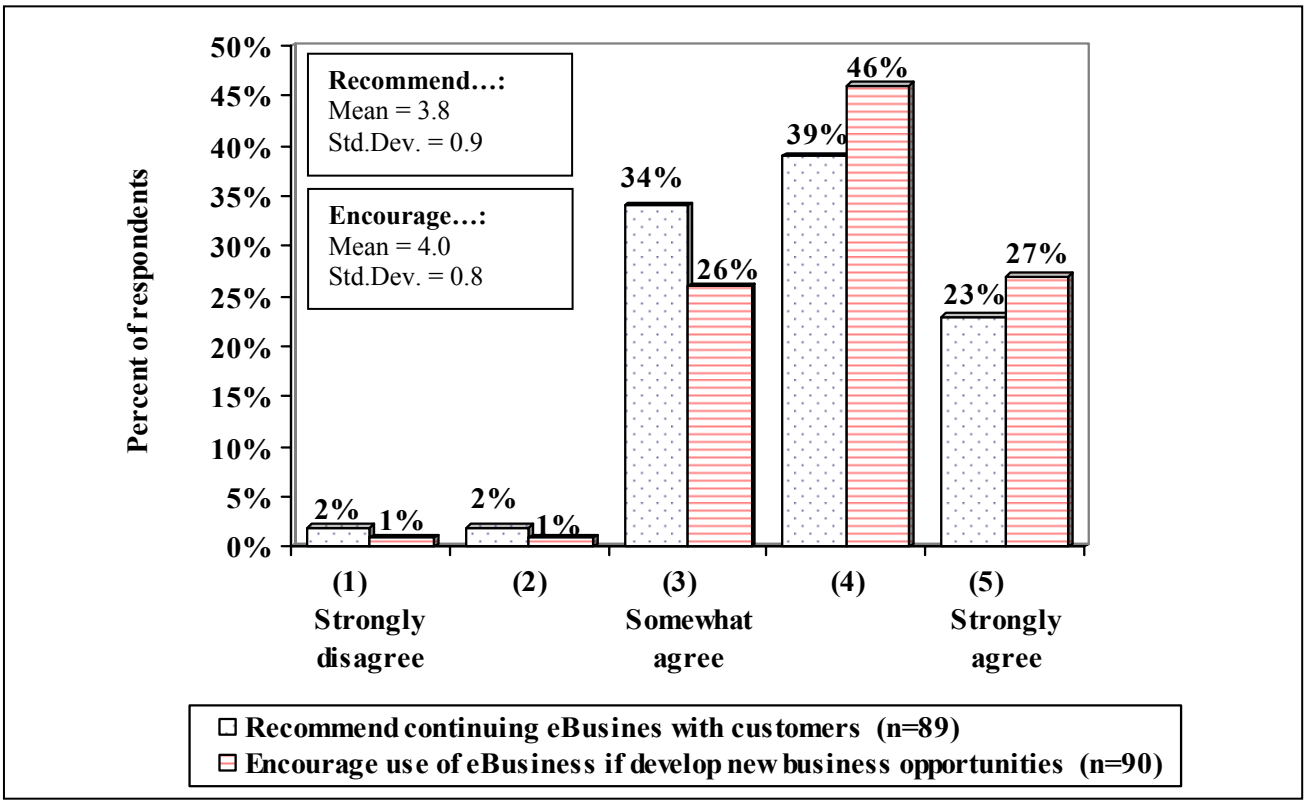


Figure 20. IICT implementation satisfaction

Overall satisfaction of IICT adoption in the customer interface was measured through the "Delighted-Terrible" scale by Westbrook (1980) anchored by 1 = terrible, 4= mixed (about equally satisfied and dissatisfied), 7 = delighted. Respondents were asked to state overall, how they feel about their company's success from using eBusiness with customers. Forty-nine percent of respondents leaned toward being "mostly satisfied" to "delighted" with their company's customer interface eBusiness success (Figure 21). Thirty-seven percent of respondents had mixed feelings, and 14 percent indicated dissatisfaction. None of the

respondents indicated that they felt "terrible" about their company's customer interface eBusiness adoption. On average, respondents seemed to have a rather positive (mean = 4.4) perception about their company's success from using eBusiness with customers. A summated scale of these three items (recommend continuing eBusiness with customers, encourage use of eBusiness if develop new business opportunities, and how do you feel about your company's success from using eBusiness with customers) is used in subsequent analyses to further investigate factors affecting IICT implementation satisfaction. The summated scale is labeled "IICT implementation satisfaction".

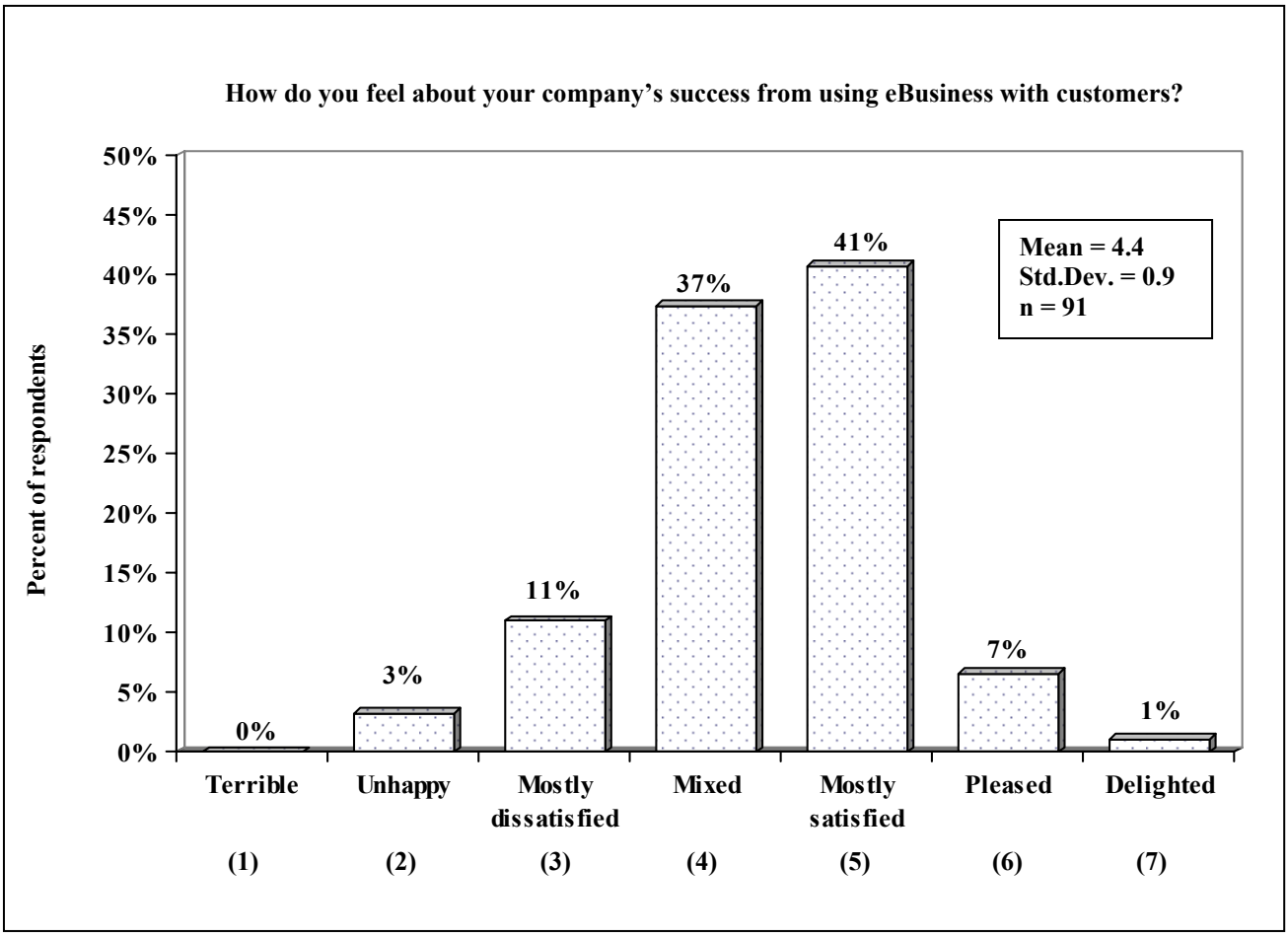


Figure 21. Perception of eBusiness implementation success (n=91)

5.3.2. IICT Impact on Business Activity Outcomes

"By reducing a data set from a group of interrelated variables into a smaller set of uncorrelated factors, factor analysis achieves parsimony by explaining the maximum amount of common variance in a correlation matrix using the smallest number of exploratory concepts" (Field 2000). Principal component factor analysis and varimax rotation was conducted to identify underlying dimensions of IICT impact on business activity outcomes and for data reduction for hypotheses testing.

Table 18 lists the business activity outcome variables presented in the questionnaire and the mean impact of IICT implementation for each variable. The response scale was anchored by 1= highly decreased, 2= somewhat decreased, 3= no effect, 4= somewhat increased, 5= highly increased. Respondents who indicted that no IICT applications were adopted were omitted from the analysis resulting in a sample size of 95. Missing data were substituted with variable means to preserve an adequate sample size (Hair et al. 1998)

Based on previously discussed observed positive feelings about customer interface eBusiness success among respondents and their perceived high satisfaction with eBusiness, effects of IICT adoption on specific business activity outcomes were examined. One-sample two tailed *t*-tests were conducted to investigate IICT adoption effects on business outcomes by comparing the variable mean to the scale midpoint value (3= no effect). Except for four variables (data errors, inventory levels, order fulfillment cycle, sales force size), all other variables were significantly ($\alpha < 0.01$) different from the midpoint scale test value. It is worth noting that all of the four variables with no significant impact were the only reverse scale items, in which a positive impact on the business outcome would require a negative value response, which varies from the general direction of the other items on the measure. As such, the conclusion that IICT

adoption had no impact on these four outcomes should not be made as the reason for a non-significant result may be due to respondents' inability to correctly reflect the IICT impact on the measurement scale.

Table 18. Descriptive statistics: IICT impact on business outcomes (n=95)

Business Outcome Variable		Mean IICT impact	Std. Dev.
1	Information sharing with customers	4.0 ***	0.6
2	Timeliness of information supplied to customers	4.0 ***	0.7
3	Company image	3.8 ***	0.5
4	Quality of information supplied to customers	3.8 ***	0.7
5	Quality of customer service	3.7 ***	0.6
6	Customer satisfaction	3.5 ***	0.5
7	Order processing efficiency	3.5 ***	0.6
8	Sales revenue	3.5 ***	0.6
9	Company competitiveness	3.5 ***	0.5
10	Timely reporting to management	3.4 ***	0.6
11	Number of customers	3.4 ***	0.5
12	Production planning efficiency	3.4 ***	0.6
13	Ability to meet on-time delivery commitments	3.4 ***	0.5
14	Understanding of customer needs	3.3 ***	0.5
15	Our reliance on long-term customer relationships	3.3 ***	0.5
16	Our satisfaction with long-term customer relationships	3.2 ***	0.5
17	Our trust of our customers	3.1 **	0.4
18	Our leverage over customers	3.1 **	0.4
19	Our dependence on customers	3.1 **	0.4
20	Data errors (r)	3.1	0.7
21	Inventory levels (r)	3.0	0.7
22	Order fulfillment cycle time (r)	2.9	0.7
23	Sales force size (r)	2.9	0.5
** Significant at α=0.01; *** Significant at α=0.001;			

5.3.2.1. Adherence to Assumptions in Factor Analysis: IICT Impact on Business Activity Outcomes

Based on observations made in exploring the data set, the following items: "Data errors", "Inventory levels", "Order fulfillment cycle", and "Sales force size"; were omitted due to their questioned validity to measure the intended construct. Several preliminary factor analysis solutions were examined before a final factor analysis solution was found. Four variables were

withdrawn from the final factor solution: "number of customers" was omitted due to low (<.50) sampling adequacy (.434); "sales revenue" and "understanding of customer needs" were omitted due to low communalities (0.299 and 0.352 respectively); and "customer satisfaction" was omitted due to low (<.50) factor loading.

The sample size (n=95) for the remaining 15 variables exceeds the minimum required number of 5 observations (6.3) per variable required for factor analysis (Hair et al. 1998). Partial correlations, Bartlett test of sphericity, and measure of sampling adequacy all indicate that the data set is suitable for factor analysis after conducting the previously described procedures. In addition, the following statistics indicate that factor analysis is an appropriate method for analyzing the data set:

- The Kaiser-Meyer-Olkin overall Measure of Sampling Adequacy[3] is .793, which is higher than the acceptable threshold of .50
- Overall significance of the correlation matrix with the Bartlett test[4] is .000 (non-zero correlations)
- Anti-image correlation matrix shows that all individual Measures of Sampling Adequacy are above the .50 threshold (ranging from .729 to .879) and all partial correlations are small.

5.3.2.2. Factor Analysis Results: IICT Impact of Business Activity Outcomes

The principal component factor analysis identified strong intercorrelations among the business outcome items. The factor analysis identified four unique dimensions that could be used to address different facets of customer interface IICT adoption impact on business activity

[3] Indicates the proportion of variance that might be caused by the underlying factors; Guidelines for interpretation: .90 or above is marvelous, .80 is meritorious, .70 is middling, .60 is mediocre, .50 is unacceptable (Hair et al. 1998)
[4] Test for the presence of correlations among at least some of the variables in the correlation matrix (Hair et al. 1998)

outcomes. The latent root criterion (eigenvalue ≥1) was used in extracting the factors. The result from the latent root criterion was confirmed by investigating the scree-plot, which confirmed the appropriateness of the four factor solution.

The four factors explain 67.7 percent of the total variance of the 15 variables (Table 19). Table 19 shows the eigenvalues, variance explained by the factor, and cumulative variance explained by the 4 factor solution. Orthogonal varimax rotation was used to disperse the factor loadings[5] within the factors to achieve a more interpretable solution (Field 2000).

Table 19. Variance explained by the factor solution

Total Variance Explained						
	Extraction Sum of Squared Loadings			Rotation Sums of Squared Loadings		
Factor	Eigenvalue	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	4.55	30.31	30.31	2.99	19.93	19.93
2	2.53	16.85	47.16	2.97	19.81	39.74
3	1.99	13.24	60.40	2.49	16.58	56.32
4	1.10	7.31	67.70	1.71	11.39	**67.70**
Extraction Method: Principal Component Analysis. (n=95)						

For a sample of 100 respondents, factor loadings should be .55 or higher to be considered significant (Hair et al. 1998; Field 200); hence, the cut-off point for interpretation of the loadings was ±.60. In naming the four factors, all significant factor loadings were used in the process, but variables with higher loadings had greater influence on the factor name (Table 20).

- Factor 1 has four significantly high loadings (.803-.850), which are all related to IICT impact on fulfillment or internal process efficiency in the value chain, thus the factor was named "Internal Business Process Efficiency".
- Factor 2 loads the highest on variables associated with the depth and satisfaction with customer relationships. Accordingly, the factor was named "Customer Relationship".
- Factor 3 has significantly high loadings on variables linked with sharing information with customers. Hence, the factor was named "Information Diffusion".

[5] Correlation between the original variable and the factor; the squared loading is the amount of the variable's total variance accounted for by the factor (Hair et al. 1998).

- Factor 4 has two significant loadings "Company competitiveness" (.786) and "Company image" (.694). Both items describe competitive position of the company, thus the factor was named "Competitive Position".

Table 20. Factor analysis solution matrix for IICT impact on business activity outcomes

	"Internal Business Process Efficiency"	"Customer Relationship"	"Information Diffusion"	"Competitive Position"	Communality
Ability to meet on-time delivery commitments	0.850				0.565
Order processing efficiency	0.841				0.586
Production planning efficiency	0.832				0.674
Timely reporting to management	0.803				0.651
Our reliance on long-term customer relationships		0.833			0.670
Our dependence on customers		0.777			0.644
Our satisfaction with long-term customer relationships		0.763			0.709
Our trust of our customers		0.711			0.603
Our leverage over customers		0.674			0.622
Timeliness of information supplied to customers			0.759		0.740
Information sharing with customers			0.753		0.653
Quality of customer service			0.711		0.728
Quality of information supplied to customers			0.645	0.453	0.774
Company competitiveness				0.786	0.794
Company image				0.694	0.742
Extraction Method: Principal Component Analysis Rotation Method: Varimax with Kaiser Normalization Loadings <.40 not shown (n=95)					

Validity refers to the extent the measures correctly represent the concept or construct intended and how well the construct is defined by the measures (Hair et al. 1998). The factor solution demonstrated good convergent validity, where items measure their intended constructs and no other, by having the items load strongly (≥.60) on one factor. With respect to discriminant validity, which refers to does a construct differ from other constructs, the items loaded high on their corresponding factor construct than on their cross-loadings.

Reliability refers to a measure's ability to yield consistent values if multiple measurements are taken over time (Hair et al. 1998). Cronbach's α is a measure of reliability that ranges from 0 to 1, with value of .60 generally deemed the lower limit of acceptability (Hair et al. 1998). All the internal consistency (Cronbach's α) measures (Table 21) are above the recommended level of .60 for the identified factors and hence were satisfactory. Accordingly, high (≥.60) Cronbach's alphas indicate that the measures are reliable and would yield consistent values in multiple measurements.

Table 21. IICT impact composite scale reliability analysis (Cronbach's α)

	Internal Business Process Efficiency	Customer Relationship	Information Diffusion	Competitive Position
Cronbach's α	**0.88**	**0.82**	**0.79**	**0.60**
n	88	89	89	89
Number of variables	4	5	4	2
Scale min/max	4/20	5/25	4/20	2/8
Scale mean	13.7	15.9	15.4	7.3
Scale std.dev.	2.1	1.8	2.1	0.9
Item mean	3.4	3.2	3.8	3.7

5.3.2.3. Discussion: IICT Impact on Business Activity Outcomes

The factor analysis revealed four different facets of impact that adopting customer interface IICT has on respondents' business: 1) impact on internal business process efficiency, 2) impact on customer relationships, 3) impact on information diffusion with customers, and 4) impact on competitive position. In order to determine the business activity outcome most likely to benefit from IICT adoption and the order of relative impact on outcomes, paired sample one-way *t*-tests were performed between the different impact factors (Table 22). IICT adoption had the greatest impact on information dissemination (scale item mean 3.8) on a scale anchored by 1= highly decreased, 2= somewhat decreased, 3= no effect, 4= somewhat increased, 5= highly increased. Respondents indicated that their ability to provide customers with up-to-date and

accurate information had improved since IICT adoption. They also perceived an increase in the amount of information shared with customers. Respondents perceived the second highest impact from IICT adoption on their company's competitive position (scale item mean 3.7). Respondents felt that company image had improved from IICT adoption and enabled them to be more competitive. IICT adoption also had a positive effect on respondents' business process efficiency (scale item mean 3.4). Respondents indicated that their ability to meet on-time delivery commitments improved with IICT adoption, as had order processing and production planning efficiency and provided better opportunities for timely management reporting. IICT implementation in the customer interface had the least effect on customer relationships (scale item mean 3.2). Overall, respondents found only small positive change in their perceived trust and satisfaction with customers after IICT adoption and did not see that their reliance or dependence on customers had changed to any great extent.

Table 22. Paired samples *t*-test results for differences between IICT impact constructs

				Paired differences			
Scale		**Mean**	**Std.Dev.**	**Mean difference**	***t*-value**	**d.f.**	**Sig.[+]**
1	Information diffusion	3.8	0.5	0.2	3.40	87	0.001***
	Competitive position	3.7	0.5				
2	Competitive position	3.7	0.5	0.2	3.24	87	0.002**
	Internal business process efficiency	3.4	0.5				
3	Internal business process efficiency	3.4	0.5	0.3	4.21	87	0.000***
	Customer relationship	3.2	0.4				

** Significant at α=0.01; *** Significant at α=0.001
[+] p-value of 1-tail *t*-test

The four facets of IICT impact on 1) information diffusion with customers, 2) competitive position, 3) internal business process efficiency, and 4) customer relationship were

tested aggregately and separately against hypothesized organizational antecedents for effective customer interface IICT adoption. The aggregate measure is termed “IICT total effectiveness”.

5.4. Antecedents for Effective IICT Adoption

5.4.1. Validity of Organizational Capability Constructs

Before testing the hypothesized antecedents for effective IICT implementation, the validity of the organizational capability constructs in the conceptual research model (culture orientation, technology opportunism, information dissemination, IT resources, managerial IT knowledge, and change management) needed to be confirmed. A principal component factor analysis with varimax rotation was conducted in order to confirm the validity of the constructs using SPSS. To assess the reliability of the constructs, reliability analysis was also conducted using SPSS. Table 23 lists the constructs and their associated items presented in the questionnaire.

Because the questionnaire was divided in two main sections: “Section I. Company Background” (for all respondents) and “Section II. eBusiness with Customers” (for respondents with customer interface IICT implemented); not all constructs have the same sample size. In order to preserve sample size and assure best possible generalizability and stability of the results, validity of the change management construct will be assessed separately from the other constructs included in the questionnaire with the smaller sample size. Colinearity between the change management factor and the other organizational resource and capability construct factors identified in factor analysis will be examined in the subsequent multiple regression analysis to make sure there is sufficient discrimination between the change management and other organizational resource and capability factors.

Table 23. Descriptive statistics: Organizational capability constructs and items

		Mean	Std. Dev.	n
Adhocracy Culture[1]				
1	My company is dynamic and entrepreneurial. Employees are willing to stick their necks out and take risks.	2.7	1.1	106
2	The head of my company is generally considered to be an entrepreneur, an innovator, or a risk taker.	3.2	1.2	106
3	The glue that holds my company together is a commitment to innovation and development. There is an emphasis on being first.	2.8	1.2	106
4	My company emphasizes growth and acquiring new resource. Readiness to meet new challenge is important.	3.1	1.0	106
Hierarchy Culture[1]				
5	My company is chain of command oriented.	3.4	0.9	106
6	The head of my company is generally considered to be a coordinator, an organizator, or an administrator.	3.1	1.0	106
7	The glue that holds my company together is a set of formal rules and policies. Maintaining a smooth-running institution is important.	3.3	1.0	106
8	My company emphasizes permanence and stability. Efficient, smooth operations are important.	3.6	1.0	106
In my company/My company…				
Information Dissemination[1]				
9	everyone believes that sharing information is important	3.6	1.0	106
10	there is a tradition of inter-functional communication	3.0	0.9	106
11	information sharing between functions is strongly encouraged	3.6	1.0	106
12	managers of different functions are expected to share information	3.7	0.9	106
Technology Opportunism (Sensing) [1]				
13	is often one of the first in our industry to detect technological developments that might affect our business	2.5	1.2	106
14	actively seeks intelligence on technological changes in the environment	2.9	1.1	106
15	is often slow to detect changes in technologies that might affect our business (r)	3.1	1.1	106
16	periodically reviews the likely effect of changes in technology on our business	3.1	1.0	106
IT Resources[1]				
17	IT infrastructure is adequate for implementing eBusiness	2.8	1.0	106
18	level of internal IS integration is adequate for implementing eBusiness	2.7	1.0	106
19	the IT budget is adequate for meeting business objectives	2.9	1.1	106
Managerial IT Knowledge[1]				
20	top management supports eBusiness implementation	3.2	1.1	106
21	functional management believes eBusiness has potential to improve their business processes	3.3	1.1	106
22	IT management is capable of aligning IT projects with our business operations	3.0	1.0	106
23	IT management is capable of developing IT solutions that match our strategies	3.0	1.1	106

Table cont.

Change Management[2]				
24	the different functional managers easily reached consensus on how to implement eBusiness	2.7	0.8	95
25	the different functional mangers agree on current eBusiness objectives	2.9	0.8	95
26	customer service and sales representatives are involved with developing customer oriented eBusiness projects	2.9	1.0	95
27	the eBusiness strategy has been effectively communicated internally	2.5	0.9	95
28	the eBusiness strategy has been effectively communicated to customers	2.5	1.0	95
29	business processes have been reorganized due to eBusiness implementation	2.3	0.9	95
30	performance metrics have been formally adjusted to match changes due to eBusiness implementation	2.1	0.9	95
31	sufficient internal training on eBusiness system has been provided	2.4	0.9	95

Scale: 1= strongly disagree, 2= disagree, 3= somewhat agree, 4= agree, 5= strongly agree
[1] Sample: All respondents
[2] Sample: Respondents with IICT implemented
For each variable missing values are replaced with the variable mean
(r) Reversed scale

5.4.1.1. Adherence to Assumptions in Factor Analysis: Organizational Capability Constructs

The sample size of n=106 using 23 variables (Table 23) to measure organizational capabilities and resources does not exceed the factor analysis "rule of thumb" minimum requirement of a 5:1 ratio of observations per variable. The observation per variable ratio is 4.6:1. Field (2000), in summarizing several research findings, concludes that changes in the observations per variable ratio make little difference in factor solution stability. Guadagnoli and Velicer (1988) (in Field 2000) argue that the absolute sample size and the absolute magnitude of factor loadings have the most effect. They conclude that if a factor has four or more loadings above .60 then it is reliable regardless of sample size. McCallum et al. (1999) (in Field 2000) argue that if all communalities are above .60, sample sizes even less than 100 may be perfectly adequate, provided there are relatively few factors each with only a small number of indicator variables. Based on these findings it is argued that the sample size in this research is adequate for factor analysis.

The Kaiser-Meyer-Olkin overall Measure of Sampling Adequacy (.800), Bartlett test of sphericity (<.0001), and high (>.50) measures of sampling adequacy (range from .634 to .875) in the anti-image correlation matrix all indicate that the data set is suitable for factor analysis.

5.4.1.2. Factor Analysis Results: Organizational Capability Constructs

Principal component factor analysis identified strong intercorrelations among the organizational capability items. The analysis identified 6 dimensions. The latent root criterion (eigenvalue ≥1) was used in extracting the factors. The result from the latent root criterion for the six factor solution was confirmed by investigating the scree-plot. The 6 factors explain 71.5 percent of the total variance of the 23 variables (Table 24).

Table 24. Variance explained by the factor solution

Total Variance Explained						
	Extraction Sum of Squared Loadings			Rotation Sums of Squared Loadings		
Factor	Eigenvalue	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	6.98	30.3	30.3	3.24	14.1	14.1
2	3.31	14.4	44.7	2.94	12.8	26.9
3	2.01	8.8	53.5	2.93	12.7	39.6
4	1.71	7.5	60.9	2.71	11.8	51.4
5	1.35	5.9	66.8	2.48	10.8	62.2
6	1.08	4.7	71.5	2.15	9.3	**71.5**
Extraction Method: Principal Component Analysis. (n=95)						

The cut-off point for interpretation of the loadings was ±.55 (Table 25). All the factors had high factor loadings (>.58) only on the specific factor, which in all cases were equal to the scales as they were found in literature (information dissemination by Fisher et al. in 1997, technology opportunism by Srinivasan et al. 2004, adhocracy culture by Moorman in 1995, hierarchy culture by Moorman in 1995) or how they were modified from the existing scale in the literature (managerial IT knowledge by Boynton et al. 1994) or how they were developed based on theory (IT resources). 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. The constructs can be concluded to measure their intended organizational capability concept.

Cronbach's α was used to measure reliability (internal consistency) of the constructs. High (≥.70) Cronbach's alphas indicate that the measures are reliable and summated scales for each construct can be used in subsequent hypothesis testing (Table 26).

Table 25. Factor analysis solution matrix for organizational capability constructs

	"Information Dissemination"	"Technology Opportunism (sense)"	"Adhocracy Culture"	"IT Resources"	"Managerial IT Resources"	"Hierarchy Culture"	Communality
My company / In my company…							
information sharing between functions is strongly encouraged	0.847						0.628
managers of different functions are expected to share information	0.797						0.707
there is a tradition of inter-functional communication	0.751						0.807
everyone believes that sharing information is important	0.717						0.709
actively seeks intelligence on technological changes in the environment		0.807					0.798
is often slow to detect changes in technologies that might affect our business		0.798					0.808
is often one of the first in our industry to detect technological developments that might affect our business		0.780					0.715
periodically reviews the likely effect of changes in technology on our business		0.668					0.665
the head of my company is generally considered to be an entrepreneur, an innovator, or a risk taker.			0.868				0.706
emphasizes growth and acquiring new resource. Readiness to meet new challenge is important.			0.763				0.804
is dynamic and entrepreneurial. Employees are willing to stick their necks out and take risks.			0.688				0.794
the glue that holds my company together is a commitment to innovation and development. There is an emphasis on being first.		0.401	0.636				0.745
the head of my company is generally considered to be a coordinator, an organizator, or an administrator.			-0.535				0.783

Table cont.

IT infrastructure is adequate for implementing eBusiness				0.835			0.722
level of internal IS integration is adequate for implementing eBusiness				0.808			0.675
the IT budget is adequate for meeting business objectives				0.774			0.643
functional management believes eBusiness has potential to improve their business processes					0.736		0.685
IT management is capable of aligning IT projects with our business operations				0.430	0.714		0.770
IT management is capable of developing IT solutions that match our strategies					0.712		0.603
top management supports eBusiness implementation					0.586		0.664
is chain of command oriented.						0.805	0.659
emphasizes permanence and stability. Efficient, smooth operations are important.						0.726	0.734
the glue that holds my company together is a set of formal rules and policies. Maintaining a smooth-running institution is important.			-0.420			0.662	0.624
Extraction Method: Principal Component Analysis Rotation Method: Varimax with Kaiser Normalization Loadings <.40 not shown (n=95)							

Table 26. Organizational capability composite scale reliability analysis (Cronbach's α)

	Information Dissemination	Technology Opportunism (sense)	Adhocracy Culture	IT Resources	Managerial IT Resources	Hierarchy Culture
Cronbach's α	**0.86**	**0.84**	**0.85**	**0.85**	**0.83**	**0.72**
n	106	103	101	101	102	101
Number of items	4	4	4	3	4	3
Scale min/max	4/20	4/20	4/20	3/15	4/20	3/12
Scale mean	14.0	11.5	11.8	8.4	12.5	10.2
Scale std.dev.	3.1	3.6	3.8	2.8	3.5	2.4
Item mean	3.5	2.9	2.9	2.8	3.1	3.4

5.4.1.3. Adherence to Assumptions in Factor Analysis: Change Management

Existing scales were not found for IT-related change management from the IT or management literature. As a result, a new eight-item scale (Table 23) was composed to reflect IT related change management principles in the literature. The sample size (n=95) with 8 variables

exceeds the minimum required number of five observations per variable for factor analysis (Hair et al. 1998). The Kaiser-Meyer-Olkin overall Measure of Sampling Adequacy (.760), Bartlett test of sphericity (<.0001), and the high (>.50) measures of sampling adequacy (range from .704 to .867) in the anti-image correlation matrix all indicate that the data set is suitable for factor analysis. Exploration of the communalities found that one item, "Customer and sales representative involvement with developing customer oriented eBusiness projects," had an unacceptably low communality (.371). This item was eliminated from further analysis.

5.4.1.4. Factor Analysis Results: Change Management

A two-factor solution resulted from the principal component analysis with varimax rotation. The latent root criterion (eigenvalue ≥1) was used in extracting the factors. The result from the latent root criterion was confirmed by investigating the scree-plot. The two factors explain 68.6 percent of the total variance in the seven remaining variables. The first factor alone explains 41.0 percent of the total variance in the variables.

The cut-off point for interpretation of the loadings was ±.60 (Table 27). The first factor had high loadings for four items related to internal and external project communication (.780 and .858 respectively), reorganization of business processes (.822), and restructuring of performance metrics (.747) (Table 27; Analysis I). The second factor had high loadings for the two consensus items borrowed from the Salisbury et al. (2002) "Consensus on appropriation" scale. The sufficiency of internal training item had only a moderate loading on each of the factors.

Based on these results, the decision was made to separate the two "Consensus on appropriation" items and run the analysis again to see if the "internal training" item could have a stronger loading on the "Change Management" factor. The resulting analysis had a one factor

solution. As expected, all the loadings on the "Change Management" factor strengthened with the "internal training" item factor loading increasing from .466 to .659 (Table 27; Analysis II).

Table 27. Factor analysis solution matrix for Change Management

Analysis I				Analysis II (Consensus on appropriation separated)	
	"Change Management"	"Consensus on appropriation"	Communality	"Change Management"	Communality
the eBusiness strategy has been effectively communicated to customers	0.858		0.776	0.865	0.629
business processes have been reorganized due to eBusiness implementation	0.822		0.763	0.833	0.694
the eBusiness strategy has been effectively communicated internally	0.780		0.650	0.793	0.748
performance metrics have been formally adjusted to match changes due to eBusiness implementation	0.747		0.749	0.777	0.603
sufficient internal training on eBusiness system has been provided	0.466	0.546	0.516	0.659	0.434
the different functional mangers agree on current eBusiness objectives		0.870	0.751		
the different functional managers easily reached consensus on how to implement eBusiness		0.841	0.598		
Extraction Method: Principal Component Analysis Rotation Method: Varimax with Kaiser Normalization Loadings < .40 not shown					

The "Change Management" factor had four items with strong loadings (≥.75). Based on the theoretical reasoning to include the "internal training" item on the "Change Management" construct, Cronbach's α measures of reliability (internal consistency) were calculated with and without the "internal training" item for the "Change Management" factor (Table 28). As Table 28 shows, the omission of the "internal training" item did not have an effect on "Change Management" scale reliability. Cronbach's α remained at .85 for both measures indicating strong reliability.

Based on theoretical reasoning and empirical support, in this research, "Change Management" was established as a new five-item scale to include items for "internal project communication", "external project communication", "reorganization of business processes", "restructuring of performance metrics", and "internal training". A summated scale for the "Change Management" construct will be used in subsequent hypotheses testing.

Table 28. Change management composite scale reliability analysis (Cronbach's α)

	Change Management with internal training	Change Management without internal training
Cronbach's α	**0.85**	**0.85**
n	87	89
Number of items	5	4
Scale min/max	5/25	5/20
Scale mean	11.7	9.3
Scale std.dev.	3.6	3.0
Item mean	2.5	2.3

5.4.1.5. Discussion: Organizational Capabilities

Based on the organizational capability factor analysis, an overall respondent profile can be described by investigating the construct item means. The measurement scales used were anchored by 1=strongly disagree, 3=somewhat agree, 5=strongly agree. Overall, respondents seemed to agree that inter-functional information dissemination is encouraged in their organization (construct item mean 3.5). Respondents indicated that they had higher level of agreement that their organization represents a hierarchy culture (construct item mean 3.4) than an adhocracy culture (construct item mean 2.9). Also, respondents believed that their organization has adequate managerial IT resources (construct item mean 3.1), in which functional management understands eBusiness and IT management understand business. However, in general, respondents were not completely convinced that their organization had strong tradition in sensing technological change (technology opportunism) in their respective business arena

(construct item mean 2.9). Also, respondents seemed to doubt whether their organization has adequate tangible IT resources to adopt customer interface eBusiness (construct item mean 2.8), in terms of IT infrastructure, system integration, IT budget, and management support. Respondents did not agree that their organization follows the change management principles (construct item mean 2.5) while adopting IICT in their organization's customer interface. All the constructs were tested by one-sample two tailed *t*-test to investigate are the construct item means significantly different from the scale midpoint of 3=somewhat agree (Table 29). Information dissemination, hierarchy culture, and managerial IT knowledge constructs were significantly above the scale mid-point, where as change management was significantly below.

Table 29. Organizational capability construct item means

Construct	Construct item mean[+]	d.f.	Sig.
Information dissemination	3.5	94	.001***
Hierarchy culture	3.4	94	.001***
Managerial IT resources	3.1	94	.027*
Technology opportunism	2.9	94	.349
Adhocracy culture	2.9	94	.983
IT resources	2.8	94	.170
Change management	2.5	94	.001***

[+] Construct sum divided by number of items, calculated for each respondent with IICT
* Significantly different from 3 at $\alpha < 0.05$;
*** Significantly different from 3 at $\alpha < 0.001$

5.4.2. Hypothesis Testing: Antecedents for Effective IICT Adoption

In the following sections, statistical tests that were performed to test the conceptual research model and hypotheses are discussed and the results obtained from these tests are presented. First, organizational resource and capability antecedents for aggregate level IICT effectiveness are explored through bivariate correlation coefficients, after which multiple regression analysis is conducted. Second, organizational capability construct relationships to constituent IICT adoption impact on 1) information diffusion with customers, 2) internal

business process efficiency, and 3) customer relationship are separately assessed, and results from bivariate correlation coefficients tests and multiple regression analysis are reported. Finally, hypothesis test results are summarized and discussed.

"IICT total effectiveness" is an aggregate measure of overall IICT success that sums the four identified underlying dimensions of IICT impact (internal business process efficiency, information diffusion with customers, customer relationship, and competitive position). Summated scales of organizational capability constructs (information dissemination, adhocracy culture, hierarchy culture, technology opportunism, IT resources, managerial IT knowledge, and change management) were used to test the hypothesized relationships between organizational capabilities and IICT adoption effectiveness. In addition, the relationship between "IICT total effectiveness" and "business strategy fit with IICT objectives", "revenue in 2005", "annual IT spending", and "industry" sector were investigated.

Respondents who indicted that no IICT applications were adopted in their company's customer interface were omitted from the analysis resulting in a sample size of 95. Scatter plots of organizational capability constructs and "IICT total effectiveness" did not indicate non-linear relationships. Normal Q-Q probability plots for individual variables did not demonstrate any obvious departures from normality. Scatter plots suggested that two observations were outliers. These two observations were removed from data analysis as outliers (n=93). Missing data was substituted with variable means (Hair et al. 1998).

A correlation is a measure of linear relationship between variables. A correlation coefficient of zero indicates no linear relationship exists. Person's correlation coefficients measure the strength of association between two variables measured at an interval or ratio level. Person's correlation requires parametric data because it is based upon the average deviation form

the mean (Field 2000). When data is not measured at interval or ratio level and hence do not follow normal frequency distribution, they are said to be non-parametric and Pearson's correlation is not appropriate (Field 2000). Therefore, the Spearman correlation coefficients were used to investigate the association between "IICT effectiveness" and two variables measured on ordinal level: "revenue" (1=<$10million; 2=$10-100million; 3=$101-$499million; 4=>$500million) and "IT spending" (1=<$51,000; 2=$51,000-$250,000; 3=$251,000-$1million; 4=>$1.1million). Both "revenue" and "IT spending" categories can be ordered in a meaningful way hence justifying the use of Spearman correlation coefficients.

Point-biserial correlation coefficient is used to estimate relationship between naturally occurring dichotomous nominal variable ("industry", "business strategy fit with IICT objectives") and an interval scale ("IICT effectiveness") (Field 2000). To calculate the point-biserial correlation coeffcients, forest products industry respondents were coded as 0 and non-forest products industry respondents as 1 for "industry" variable. "Business strategy fit with IICT objectives" was calculated based on the match between the business strategy and IICT implementation objectives as described in Section 4.3. Match between the business strategy and IICT objectives was coded as 1 and no match as 0.

Table 30 presents results of Pearson correlation coefficients for "IICT total effectiveness" versus organizational capability constructs (information dissemination, IT resources, managerial IT knowledge, technology opportunism, adhocracy culture, hierarchy culture, change management), Spearman correlation coefficients for "IICT total effectiveness" versus "revenue" and "IT spending", and point-biserial correlation coefficients for "IICT effectiveness" versus "business strategy fit with IICT objectives" and "industry sector." One-tailed correlation

coefficient tests were selected because of the directional hypotheses of organizational capabilities' relationships with "IICT total effectiveness".

A Bonferoni adjustment is necessary to test the true level of significance of the analysis as a whole relative to what is specified for each individual significance test (Freund and Wilson 2003). To control the family level of significance at α .05 for the eleven simultaneous tests of correlation coefficients (b_1=0…b_{11}=0), Bonferoni adjustment method requires that each of the tests is conducted with level of significance 0.005 (0.05/11=0.0045) (Neter et al. 1996).

Table 30. 1-tail correlation tests between "IICT total effectiveness" and organizational capability constructs and control variables

IICT total effectiveness related to…	Organizational capability constructs							Respondent characteristics			
	Information dissemination	IT resources	Managerial IT knowledge	Technology opportunism (sense)	Adhocracy	Hierarchy	Change management	Revenue	IT spending	Business strategy fit with IICT objectives	Industry
Correlation coefficient	0.319	.316	.348	.396	.233	.039	.408	.130	.089	-.118	.297
Sig.	**.001***	**.001***	**.000***	**.000***	.012	.354	**.000***	.109	.218	.147	**.002***
R^2	.102	.100	.121	.157	.054	.002	.167	.017	.008	.014	.009
N	93	93	93	93	93	93	93	91	79	81	93
	Pearson							**Spearman**		**Point-Biserial**	
	Type of correlation coefficient										
*Significant at family level α=0.05 (α=0.0045 Bonferoni adjustment)											

Based on the Bonferoni adjusted family significance level of α=0.05 (individual test significant at α=0.005) (Table 30), results of Pearson's bivariate correlation coefficients indicate significant positive correlation (α<0.05) between all organizational capability constructs and "IICT total effectiveness", except for adhocracy culture and hierarchy culture. Based on the

coefficient of determination (R^2), employment of "change management" principles explains 16.7 percent (R^2=.167; p<.001) of the variability in "IICT effectiveness". "Technology opportunism" has the second largest positive correlation with "IICT total effectiveness" (R^2=.157; p<.001)). Approximately 16 percent of the variation in "IICT total effectiveness" can be attributed to the linear relationship with organizational "technology opportunism" tendency. Also "managerial IT knowledge" (R^2=.121; p<.001), "information dissemination" (R^2=.102; p=.001), and "IT resources" (R^2=.100; p=.001) had positive correlations with "IICT total effectiveness." Both organizational culture archetypes of "adhocracy" (p=.012) and "hierarchy" (p=.354) were not found to have statistically significant association with "IICT total effectiveness. The Spearman's bivariate correlation coefficients do not indicate significant correlation (α<0.05) between "IICT total effectiveness" and "revenue" (p=.109) and "IT spending" (p=.218). The point-biserial correlation coefficients indicate significant difference between the "industry" (R^2=.009; p=.002) sectors in "IICT effectiveness" but did not find significant relationship with "business strategy and IICT objective fit" (p=.147) and "IICT effectiveness".

The correlation coefficient in a bivariate test not only measures the effect of the specified variable in the test, but also indirectly measures the effect of other related variables. Accordingly, in addition to Pearson, Spearman, and point-biserial bivariate correlation coefficients, partial correlation coefficients were calculated to capture the variance uniquely explained by each variable. The partial regression correlation coefficients were calculated to measure the change in the average value of "IICT total effectiveness" associated with a change in a specific organizational capability variable, holding all other variables in the conceptual model constant. The partial regression correlation results are discussed in the following section.

5.4.2.1. Regression Analysis

Partial regression correlation coefficients measure the correlation of an independent and dependent variable when the effects of other independent variables have been removed from both the dependent and independent variables (Hair et al. 1998). Regression analysis was performed to examine the variance in the "IICT total effectiveness" dependent variable uniquely explained by organizational capability constructs and control variables, or in other words the unique contribution of a variable while holding all other variables constant. Summated scales of the seven organizational capability constructs (information dissemination, adhocracy culture, hierarchy culture, technology opportunism, IT resources, managerial IT knowledge, and change management) were used as independent variables in the regression analysis. Using seven factors rather than the initial 31 items allows for reduction in multicollinearity and achievement of greater parsimony. In addition to the summated scales, four nominal (dummy) variables (industry sector, revenue, IT spending, and business strategy fit with IICT objectives) were introduced into the model[6]. Resulting in eleven independent variables.

The backward multiple regression method was used to test the study hypotheses. The backward elimination process for variable selection identifies the set of variables that most explain the variability in the dependent variable. 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).

[6] The "industry" sector dummy variable was coded: 0=forest industry sector, 1=non-forest industry sector. The "revenue" dummy variable was coded: 0=revenue less than $100 million, 1=revenue more than $100 million in 2005. The "IT spending" dummy variable was coded: 0=IT spending less than $50,000, 1=IT spending more than $50,000 per year. "Business strategy fit with IICT objectives" was coded: 0=no fit, 1=fit.

Respondents who indicted that no IICT applications were adopted in their organization were omitted from the analysis resulting in a sample size of n=95, which was further reduced to n=88 after eliminating outliers and influential cases. Missing data were substituted with variable means (Hair et al. 1998).

To achieve sufficient statistical power for multiple regression with eleven independent variables, a minimum of 59 observation are required to attain 80 percent power for large effects (Faul and Erdfelder 1992). The sample size of 88 usable observations meets this requirement. The backward variable selection resulted in a model with four independent variables. With a sample size of 88 and five parameters with significant beta 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).

"Change management", "industry", "technology opportunism", and "IT resources" were found to be significant determinants of customer interface IICT adoption effectiveness (Table 31), whereas "hierarchy" and "adhocracy" corporate culture, "information dissemination", "managerial IT knowledge", "business strategy and IICT objective fit", "revenue", and "IT spending" were statistically excluded from the model (Table 32). Regression results (in Table 31) show that there is a relationship between the dependent variable ("IICT total effectiveness") and the four independent variables ($F(4,83)=18.01$, $p<.001$). The estimated model retaining the four significant variables explains approximately 46 percent of variance in the dependent variable.

Hence, the predictive equation for "IICT total effectiveness" measure is:

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

Table 31. ANOVA and regression model summaries for IICT total effectiveness antecedents

	Sum of Squares	d.f.	Mean Square	F	Sig.	R^2	Adjusted R^2	Std. Error of the Estimate	Durbin-Watson Statistic
Regression	728.9	4	182.2	18.01	0.000*	0.46	0.44	3.18	1.61
Residual	839.8	83	10.1						
Total	1568.8	87							

* Significant at α=0.001 level
Dependent Variable: IICT total effectiveness
Dependent variable scale min-max (mean): 15-75 (52.2)
Predictors: (Constant), Technology opportunism, IT resources, Industry dummy, Change management

Table 32. Excluded variables from IICT total effectiveness antecedents

	Beta In	*t*-value	Sig.	Partial Correlation	Colinearity Statistics	
					Tolerance	VIF
Hierarchy	0.050	0.615	0.540	0.068	0.980	1.020
Business strategy fit with eBusiness implementation objectives	-0.017	-0.201	0.841	-0.022	0.896	1.116
Managerial IT knowledge	0.062	0.587	0.559	0.065	0.581	1.720
Adhocracy	-0.064	-0.689	0.493	-0.076	0.761	1.315
IT spending	-0.047	-0.512	0.610	-0.056	0.786	1.272
Revenue	0.061	0.758	0.450	0.083	0.988	1.012
Information dissemination	0.140	1.506	0.136	0.164	0.730	1.369

Beta in: Standardized regression coefficient (β) when the variable was removed from the model (variables are in the order of removal)

Table 33 provides coefficients for all significant independent variables. Standaridzed beta coefficients allow for direct comparison among independent variables in terms of their contribution to the regression variate. "Change management" (β =.362, p<.001) made the greatest positive contribution to the variate, followed by "Industry" (β =.256, p=.003), "Technology opportunism" (β =.198, p=.038), and "IT resources" (β =.195, p=.031).

Table 33. Regression results explaining IICT total effectiveness

	Unstandardized Coefficients		Standardized Coefficients			Colinearity Statistics	
	b	**Std. Error**	**β**	***t*-value**	**Sig.**	**Tolerance**	**VIF**
(Constant)	39.974	1.554		25.729	0.000		
Change management	0.461	0.121	**0.362**	3.806	**0.000*****	0.712	1.405
Industry sector	2.159	0.694	**0.256**	3.113	**0.003****	0.956	1.046
Technology opportunism	0.243	0.115	**0.198**	2.111	**0.038***	0.733	1.365
IT resources	0.321	0.146	**0.195**	2.191	**0.031***	0.816	1.226

* Significant at α=0.05; ** Significant at α=0.005; *** Significant at α=0.001
Dependent Variable: Total effectiveness
(n=88)

Finally, adherence to the assumptions underlying regression analysis needs to be addressed. As mentioned, seven observations were eliminated from the data set as unrepresentative of the general population leaving (n=88) for the analysis. Examination of standardized, studentized, and studentized deleted residuals indicate (value larger than 95 percent confidence interval threshold value of 1.96) that six observations were outliers. In addition, SDFBETAs for independent variables [2/√n] (0.21) and Cook's distance [4/n-k-1] (0.01) thresholds were exceeded by one observation. These observations were deleted form the data set.

Visual examination of the normal probability plot of the residuals (Hair et al. 1998; Field 2003) revealed no systematic or substantial departures from normality. The residual plot closely adhered to the diagonal normal distribution line. Thus, the regression variate was found to meet the normality assumption. The partial regression plots for each independent variable retained in the model do not exhibit nonlinear patterns. Examination of the scatter plot of studentized residuals by studentized predicted values (Hair et al. 1998; Field 2003), revealed no pattern of increasing or decreasing residuals suspect of heteroscedasticity. Hence, the assumption of equal variance around the regression line for all values of the independent variables was met.

Examination of the partial plots for each independent variable (Hair et al. 1998; Field 2003) in the model did not indicate nonlinear patterns. The Durbin-Watson statistic (Table 31) between 1 and 2 (1.62) indicates independence of the residuals (Field 2003). All tolerance values are close to 1 (smallest 0.712), all Variance Inflation Factor (VIF) values are significantly lower than 10 (highest 1.405) (Table 31), and none of the condition indices exceeded 30, indicating no evidence of multicolinearity (Hair et al. 1998; Field 2003). Multicolinearity refers to correlation among three or more independent variables, which reduces a single independent variable's predictive power (Hair et al. 1998).

5.4.2.2. Results of Hypotheses Tests and Empirical Research Model: Antecedents for Effective IICT Adoption

Hypotheses H_{1a} and H_{1b} examined the effects of organizational culture orientation on IICT adoption effectiveness in the customer interface. Specifically, the hypotheses suggested that an adhocracy corporate culture would have a positive effect and a hierarchy corporate culture would have a negative effect on IICT adoption effectiveness, respectively. The analysis did not yield a bivariate correlation coefficient (b) or regression coefficient (β) that was significantly different than 0 for adhocracy culture ($p=.493>.05$) or hierarchy culture ($p=.540>.05$) and eliminated these variables from the multiple regression model. The correlation coefficient for adhocracy was positive ($b=.233$) as directionally hypothesized, but the regression coefficient was negative ($\beta=-.064$) as opposed to what was hypothesized. Also, the coefficients for hierarchy culture ($b=.039$, $\beta=.050$) were not negative and not as directionally hypothesized. Therefore, the results obtained from the bivariate correlation tests and multiple regression did not support these hypotheses.

Hypothesis H_2 examined the effect of organizations' capability to detect changes in their technical environment on customer interface IICT adoption effectiveness. Specifically, the

hypothesis suggested that an organization's technology opportunism would have a positive effect on IICT adoption effectiveness. The analysis revealed a bivariate correlation coefficient (b=.396) and a regression coefficient (β=.243) that were significantly different than 0 (p=.000<Bonferoni adjustment for α=0.01 and p=.038<.05, respectively for b and β) and in the hypothesized direction. Therefore the results obtained from the bivariate correlation tests and multiple regression test supported the hypothesis.

Hypothesis H_3 examined the effect of cross-functional information sharing inside an organization on customer interface IICT adoption effectiveness. Specifically, the hypothesis suggested that cross-functional information dissemination would have a positive effect on IICT adoption effectiveness. The analysis revealed a bivariate correlation coefficient (b=.319) that was significantly different than 0 (p=.001<Bonferoni adjustment for α=0.01). However, the multiple regression analysis did not find a regression coefficient (β=.140) that was significantly different than 0 (p=.136>.05) and eliminated the variable from the multiple regression model. The correlation and regression coefficients were positive as directionally hypothesized. Therefore the results obtained lend partial support for the hypothesis.

Hypothesis H_4 examined the effect of aligning the business objective with IICT implementation objectives on IICT adoption effectiveness. Specifically, the hypothesis suggested that business strategy fit with IICT implementation objectives has a positive effect on IICT adoption effectiveness. The analysis did not yield a bivariate correlation coefficient (b=-.130) or a regression coefficient (β=-.017) that was significantly different than 0 (p=.096>Bonferoni adjustment for α=0.05 and p=.841>.05, respectively for b and β). The variable was eliminated from the multiple regression model. In addition the coefficient was not as directionally

hypothesized. Therefore the results obtained from the bivariate correlation tests and multiple regression test did not support the hypothesis.

Hypotheses H_{5a} and H_{5b} 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 bivariate correlation coefficient (b=.316) and a regression coefficient (β=.321) that were significantly different than 0 (p=.001<Bonferoni adjustment for α=0.01 and p=.031<.05 respectively for b and β) and in the hypothesized direction. For managerial IT knowledge the analysis revealed a bivariate correlation coefficient (b=.348) that was significantly different than 0 (p=.000<Bonferoni adjustment for α=0.01). However, the multiple regression analysis did not find a regression coefficient (β=.062) that was significantly different than 0 (p=.559>.05) and eliminated the variable from the backward elimination multiple regression model. Both correlation coefficients and both regression coefficients were positive as directionally hypothesized. Therefore the results obtained lend full support for the IT infrastructure hypothesis but only partial support for the managerial IT knowledge hypothesis.

Hypothesis H_6 examined the effect of employment of IT-related change management principles in customer interface IICT implementation on IICT implementation effectiveness. Specifically, the hypothesis suggested that employment of change management principles would have a positive effect on IICT adoption effectiveness. The analysis revealed a bivariate correlation coefficient (b=.408) and a regression coefficient (β=.461) that were significantly different than 0 (p=.000<Bonferoni adjustment for α=0.01 and p=.000<.001, respectively for b and β) and in the hypothesized direction. Therefore the results obtained from the bivariate

correlation and multiple regression tests supported the hypothesis. Table 34 summarizes the results from hypotheses tests.

Table 34. Summary of hypotheses test results

	Hypotheses	Bivariate correlation	Multiple regression	Directionally as hypothesized
H_{1a}	Adhocracy culture has a positive relationship with IICT adoption effectiveness	Not supported	Not supported	Inconclusive
H_{1b}	Hierarchy culture has a negative relationship with IICT adoption effectiveness	Not supported	Not supported	No
H_2	Technology opportunism has a positive relationship with IICT effectiveness	Supported	Supported	Yes
H_3	Cross functional information dissemination has a positive relationship with IICT effectiveness	Supported	Not supported	Yes
H_4	Alignment of business strategy and IIT objectives has a positive relationship with IICT effectiveness	Not supported	Not supported	No
H_{5a}	Robust information technology infrastructure has a positive relationship with IICT effectiveness	Supported	Supported	Yes
H_{5b}	Managerial IT knowledge has a positive relationship with IICT effectiveness	Supported	Not supported	Yes
H_6	Employment of change management principles has a positive relationship with IICT effectiveness	Supported	Supported	Yes

Figure 22 presents the empirically tested research model of organizational resource and capability antecedents for "effective IICT adoption" in the customer interface with a summary of the bivariate and multiple regression results for the six organizational resources and capabilities (technology opportunism, information dissemination, IT resources, managerial IT knowledge, change management, industry sector) that were found to have a significant association with customer interface "IICT effectiveness". Figure 23 concludes the empirical holistic framework for IICT capability.

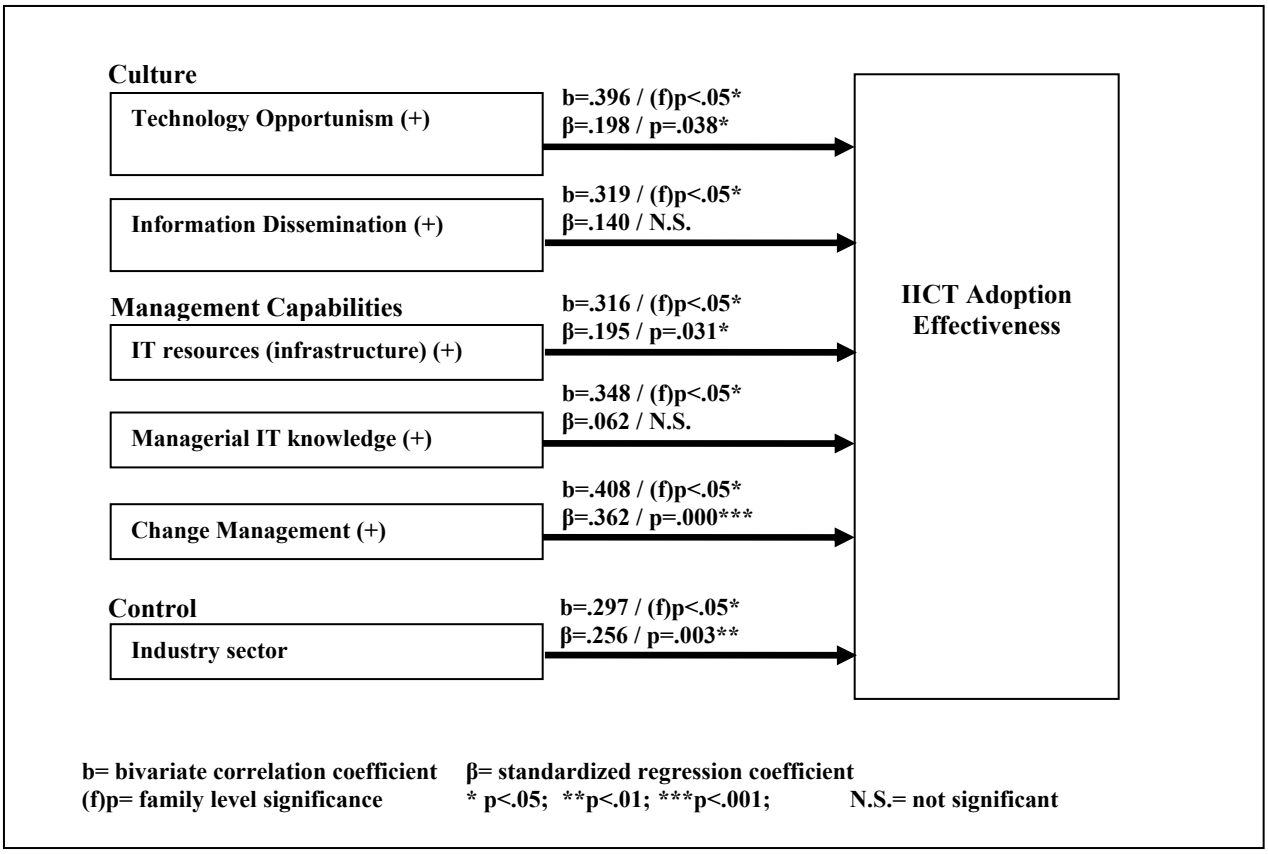


Figure 22. Empirical research model: Antecedents for effective customer interface IICT implementation

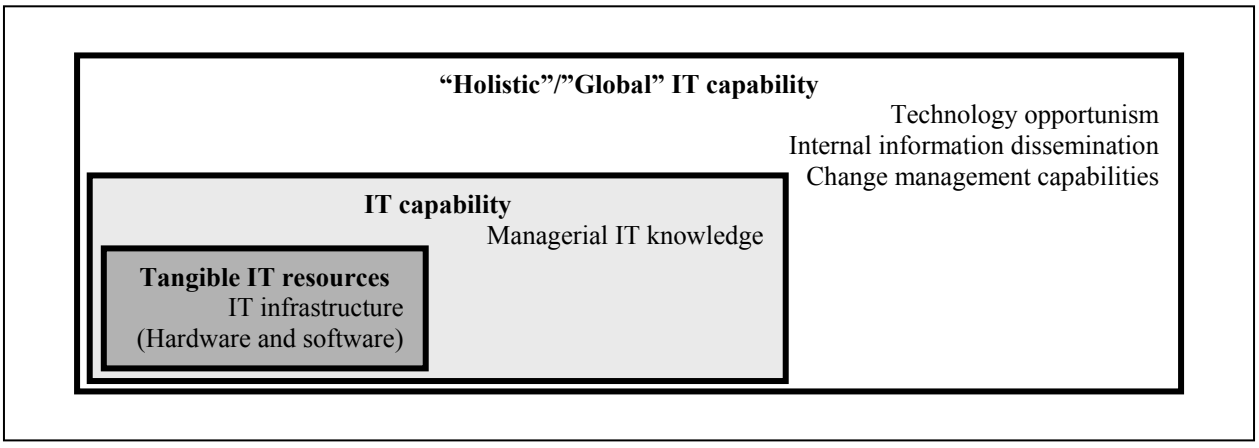


Figure 23. Empirical holistic framework for IT capability

5.4.3. Antecedents for IICT Business Activity Impacts

In addition to the aggregate level IICT adoption effectiveness model, organizational drivers for the constituent IICT business activity impacts (information diffusion with customers, internal business process efficiency, customer relationship) resulting from the IICT impact factor analysis, were tested.

As was the case with the aggregate IICT effectiveness model, the respondents who indicted that no IICT applications were adopted in their company were omitted from the analysis of business activity impacts (n=95). Outlier observations in the data set were removed after examination of scatter plots and missing data were substituted with variable means (Hair et al. 1998).

Similar to the investigation of association between the aggregate level IICT adoption effectiveness and organizational capabilities, Table 35 presents 1-tailed correlation coefficients from Pearson's, Spearman's and point-biserial correlations for the three IICT business activity impacts (information diffusion with customers, internal business process efficiency, and customer relationship) versus the organizational capability constructs (information dissemination, IT resources, managerial IT knowledge, technology opportunism, adhocracy, hierarchy, change management) and other variables in interest (business strategy fit with IICT objectives, industry, revenue, IT spending). Three different methods of correlation coefficient estimation were used because the constructs and variables were measured at three different levels: interval, ordinal, and dichotomous. The fourth observed IICT impact factor, "competitive position", was omitted due to its low Cronbach's α (.60) and absence in the theoretical framework for IICT impact.

Table 35. 1-tail correlation coefficient tests for IICT business activity impacts and organizational capability constructs

		Information diffusion with customers (n=93)	R^2	Internal business process efficiency (n=94)	R^2	Customer relationship (n=94)	R^2
Information dissemination	Pearson Correlation	0.230	0.053	0.130	0.017	0.113	0.013
	Sig.	0.013		0.106		0.139	
IT resources	Pearson Correlation	0.180	0.032	0.229	0.052	0.298	0.089
	Sig.	0.042		0.013		**0.002***	
Managerial IT knowledge	Pearson Correlation	0.232	0.054	0.283	0.080	0.215	0.046
	Sig.	0.012		**0.003***		0.019	
Technology opportunism	Pearson Correlation	0.259	0.067	0.233	0.054	0.155	0.024
	Sig.	**0.006[m]**		0.012		0.068	
Adhocracy	Pearson Correlation	0.036	0.001	0.128	0.016	0.287	0.082
	Sig.	0.366		0.110		**0.003***	
Hierarchy	Pearson Correlation	0.193	0.037	0.021	0.000	0.066	0.004
	Sig.	0.032		0.422		0.263	
Change management	Pearson Correlation	0.340	0.116	0.284	0.081	0.212	0.045
	Sig.	**0.000***		**0.003***		0.020	
Business strategy fit with IICT objectives	Point-biserial Correlation	-0.097	0.009	-0.133	0.018	-0.108	0.012
	Sig.	0.193		0.116		0.167	
Industry	Point-biserial Correlation	0.164	0.027	0.312	0.097	0.183	0.033
	Sig.	0.059		**0.001***		0.039	
Revenue	Spearman Correlation	0.091	0.008	0.216	0.047	0.011	0.000
	Sig.	0.196		0.019		0.459	
IT spending	Spearman Correlation	0.036	0.001	0.137	0.019	0.051	0.003
	Sig.	0.376		0.113		0.326	

* Significant at family level α=0.05 (α=0.0045 Bonferoni adjustment)
[m] Marginally significant at family level α=0.05

The Pearson's bivariate correlation coefficients indicate significant family level correlation after Bonferoni adjustment ($\alpha<0.05$) between IICT implementation's effect on "information diffusion with customers" and "change management" as well as marginally with "technology opportunism". Other organizational capability and resource constructs or variables were not found to have a significant relationship with "information diffusion with customers." IICT implementation's impact on "internal business process efficiency" has positive significant family level association ($\alpha<0.05$) with "change management" and "managerial IT knowledge." Also "industry" sector was found to have a significant relationship with "internal business process efficiency." Surprisingly, the "customer relationship" impact did not demonstrate significant positive relationship with "change management", which had been found to have the strongest association in all previous tests. Instead, the Pearson's correlation indicated positive significant family level association ($\alpha<0.05$) between "customer relationship" impacts and "IT resources" and "adhocracy" corporate culture.

The results provide further support that an organization's "change management" capability has the strongest positive association with successful IICT adoption in the customer interface. Based on the coefficient of determination (R^2), approximately 12 percent of the variation in "information dissemination with customers" and 8 percent of the variation in "internal operations efficiency" can be attributed to the linear relationship with deployment of "change management" principles in IICT project implementation. Organizational "technology opportunism" (R^2=.067) had a marginal positive relationship with IICT impact on "information diffusion with customers". "Managerial IT knowledge" (R^2=.080) had a positive but small association with "internal process efficiency". "IT resources" (R^2=.089) and "adhocracy" (R^2=.082) corporate culture showed to advance improvements in "customer relationships" after

IICT implementation in the customer interface. Results from the point-biserial correlation indicate that industry sector (R^2=.097) has an effect on the rate of success what comes to impact of IICT implementation on "internal operations efficiency." Based on the Pearson's correlation coefficients, "internal information dissemination" and "hierarchy" corporate culture did not have relationship with any of the IICT business activity outcomes. Finally, "revenue", "IT spending", or "business strategy fit with IICT objectives" do not have statistically significant association with any IICT business activity outcomes.

5.4.3.1. Regression Analysis

Regression analysis was performed to examine the variance in the IICT business activity outcomes (information diffusion with customers, internal operations efficiency, and customer relationship) uniquely explained by the organizational capability constructs (adhocracy and hierarchy corporate culture, internal information dissemination, technology opportunism, IT resources, managerial IT knowledge, and change management) and the control variables (industry sector, revenue, IT spending, and business strategy fit with IICT objectives). Hence, there are eleven independent variables in the following regression models.

Respondents who indicted that no IICT applications were adopted in their organization were omitted from the analysis (n=95). Five outliers were eliminated based on high standardized, studentized, and studentized deleted residuals from both the regression analysis on "information diffusion with customers" and the regression analysis on "internal business process efficiency". Missing data were substituted with variable means (Hair et al. 1998).

For the dependent variable "information diffusion with customers" the backward regression variable selection resulted in a model with three independent variables. "Change management", "industry", and "technology opportunism" were found to be significant and

positive determinants of customer interface IICT adoption effect on "information diffusion with customers" (Table 36). Regression results (in Table 36) show that there is a relationship between the dependent variable ("information diffusion with customers") and the set of three independent variables ($F=(3,86)11.98$, $p<.001$). The estimated model explains approximately 30 percent of variance in the dependent variable. The other independent variables were statistically excluded from the model (Table 37).

For the dependent variable "internal business process efficiency" backward regression variable selection resulted in a model also with three independent variables. "Change management", "industry", and "revenue" were found to have a positive relationship with "internal business process efficiency" achieved by IICT adoption (Table 36). The backward regression method excluded the other independent variables from the model (Table 37). Regression results show that there is a relationship between the dependent variable ("internal business process efficiency") and the set of three independent variables ($F(3,86)=10.87$, $p<.001$). The estimated model explains approximately 28 percent of variance in the dependent variable.

Table 36. ANOVA and regression summary for IICT business activity outcome antecedents

	Sum of Squares	d.f.	Mean Square	F	Sig.	R^2	Adjusted R^2	Std. Error of the Estimate	Durbin-Watson Statistic
Dependent Variable: Information diffusion with customers									
Regression	93.2	3	31.1	11.98	0.000*	0.295	0.270	1.610	1.925
Residual	223.0	86	2.6						
Total	316.3	89							
* Significant at α=0.001 level; Predictors: (Constant), Technology opportunism, Industry, Change management; (n=90)									
Dependent Variable: Internal business process efficiency									
Regression	69.2	3	23.1	10.87	0.000*	0.275	0.250	1.457	1.975
Residual	182.7	86	2.1						
Total	251.9	89							
* Significant at α=0.001 level; Predictors: (Constant), Change management, Revenue, Industry; (n=90)									

Table 37. Excluded variables from IICT business activity outcome antecedent models

	Beta In	*t*-value	Sig.	Partial Correlation	Collinearity Statistics	
					Tolerance	VIF
Dependent Variable: Information diffusion with customers						
Managerial IT knowledge	0.078	0.735	0.464	0.079	0.732	1.365
Business strategy fit with eBusiness implementation objectives	-0.049	-0.519	0.605	-0.056	0.931	1.075
IT spending dummy	0.011	0.111	0.912	0.012	0.778	1.286
Adhocracy	-0.069	-0.674	0.502	-0.073	0.793	1.261
Information dissemination	0.062	0.585	0.560	0.063	0.729	1.372
Revenue dummy	0.087	0.955	0.342	0.103	0.991	1.009
IT resources	0.091	0.889	0.377	0.096	0.777	1.288
Hierarchy	0.098	1.072	0.287	0.116	0.987	1.014
Predictors in the Model: (Constant), Technology opportunism, Industry, Change management						
Dependent Variable: Internal business process efficiency						
Hierarchy	0.014	0.154	0.878	0.017	0.972	1.029
Managerial IT knowledge	0.061	0.574	0.567	0.062	0.760	1.315
Information dissemination	0.059	0.581	0.563	0.063	0.825	1.213
Technology opportunism	0.074	0.695	0.489	0.075	0.751	1.332
IT spending dummy	-0.081	-0.695	0.489	-0.075	0.626	1.597
Adhocracy	-0.049	-0.506	0.614	-0.055	0.894	1.119
Business strategy fit with eBusiness implementation objectives	-0.113	-1.173	0.244	-0.126	0.910	1.099
IT resources	0.150	1.481	0.142	0.159	0.810	1.234
Beta in: Standardized regression coefficient (β) when the variable was removed from the model (variables are in the order of removal) Predictors in the Model: (Constant), Change management, Revenue, Industry						

Backward regression analysis was also run for the dependent variable "customer relationship". However, the analysis was unable to conclude with a regression model with acceptable properties. The main problem encountered was a strongly non-normal distribution of the residuals. Several transformations were tried, including square root, log, inverse, and square transformations of the dependent variable and independent variables, to remedy the problem. However, the transformations were unable to rectify the non-normality problem. In addition, R^2 values of the attempted regression models were all well under 20 percent, which is approaching

the data set's threshold for ability to detect significant relationships at a power of .80 and .05 significance level. As a result, a multiple regression model between the IICT impact on "customer relationship" and any set of independent variables could not be constructed.

Table 38 provides coefficients for all significant independent variables in both successful backward regression models (IICT impact on "information diffusion with customers" and "internal business process efficiency"). According to the estimated models, the predictive equations for these IICT impact models are:

> IICT impact on information diffusion with customers = 11.636 + .175(Change management) + .881(Industry) + .108(Technology opportunism)
>
> IICT impact on internal business process efficiency = 10.911 + .166(Change management) + .956(Industry) + .847(Revenue)

Standaridzed beta coefficients allow for direct comparison among independent variables in terms of their contribution to the regression variate. According to Table 38, "Change management" (β =.321, $p<.005$; β =.336, $p<.001$) made the greatest positive contribution to both "information diffusion with customers" and "internal business process efficiency" followed by effect of "industry" sector (β =.235, $p<.05$; β =.286, $p<.05$) and "change management" for both models. Organizational "technology opportunism" (β =.202, $p=.056$) had a marginal positive contribution to "information diffusion with customers", but no relationship was found with "internal business process efficiency". "Revenue" had a positive relationship with "internal business process efficiency" (β =.233, $p<.05$) impact of IICT adoption in the customer interface.

Finally, adherence to the assumptions underlying regression analysis was addressed. Visual inspection of normal probability plots of the residuals (Hair et al. 1998; Field 2003) revealed no systematic or substantial departures from normality for the regression models. The partial regression plots for the independent variables in the models did not exhibit nonlinear

patterns. Examination of the scatter plots of studentized residuals by studentized predicted values (Hair et al. 1998), revealed no pattern of increasing or decreasing residuals, eliminating concerns about heteroscedasticity. Examination of the partial plots for model independent variables (Hair et al. 1998; Field 2003) did not indicate nonlinear patterns. The Durbin-Watson statistics indicate independence of the residuals (1.925 and 1.975, respectively for information diffusion and internal efficiency models) (Table 36). All tolerance values were close to 1 (smallest 0.753) and all Variance Inflation Factor (VIF) values were significantly lower than 10 (highest 1.328) (Table 37), indicating no evidence of multicolinearity (Hair et al. 1998; Field 2003).

Table 38. Regression results explaining IICT impact on business activity outcomes

	Unstandardized Coefficients		**Standardized Coefficients**			**Colinearity Statistics**	
	b	**Std. Error**	**β**	***t*-value**	**Sig.**	**Tolerance**	**VIF**
Dependent Variable: Information diffusion with customers							
(Constant)	11.636	0.688		16.903	0.000		
Change management	0.175	0.057	**0.321**	3.085	**0.003****	0.758	1.319
Industry	0.881	0.344	**0.235**	2.561	**0.012***	0.975	1.026
Technology opportunism	0.108	0.056	**0.202**	1.939	**0.056** [m]	0.753	1.328
Dependent Variable: Internal business process efficiency							
(Constant)	10.911	0.573		19.048	0.000		
Change management	0.166	0.046	**0.336**	3.637	**0.000*****	0.985	1.015
Industry	0.956	0.310	**0.286**	3.087	**0.003****	0.984	1.017
Revenue	0.847	0.334	**0.233**	2.536	**0.013***	0.997	1.003

* Significant at α=0.05; ** Significant at α=0.01; *** Significant at α=0.001;
[m] Marginally significant at α=0.05; (n=90)

5.4.3.2. Empirical Research Model: Antecedents for Business Activity Effectiveness by IICT Adoption

Figure 24 shows the three empirical models for organizational capability antecedents for IICT implementation impact on 1) information dissemination with customers, 2) internal business process efficiency, and 3) customer relationships. It provides a summary of the bivariate

and multiple regression results for the organizational capabilities that were found to have a significant relationship with IICT adoption outcomes.

The results confirm that organizational change management capability and industry sector have the strongest association with IICT implementation success at both the aggregate level of IICT effectiveness and on the constituent level of IICT business activity impacts in terms of information diffusion with customers and internal business process efficiency. Overall, findings show that forest industry respondents are lagging non-forest products industry respondents in appropriating value from customer interface IICT implementation.

Interestingly, the results indicate that corporate revenue, which in previous research has been associated with organization's likelihood to use IICT (Vlosky 1999; Vlosky 2002), had a positive effect only on IICT implementation impact on internal business process efficiency. This finding might be attributed to larger organizations having the ability to achieve more significant cost savings in internal business processes due to a larger volume of automated business transactions due to eBusiness utilization. Management comprehension of IT as a business tool and business efficiency enabler had a positive bivariate correlation coefficient with organizational ability to improve operational efficiency through customer interface IICT adoption.

Also, interestingly, adhocracy business culture, which was not a significant indicator of total IICT effectiveness, is positively related to improving IICT-enabled customer relationships. An explanation for this finding may be found in adhocracy culture's close relationship with a market orientation; companies with an adhocracy culture are more likely to emphasize customers and customer relationships than cultures with an emphasis on internal operations.

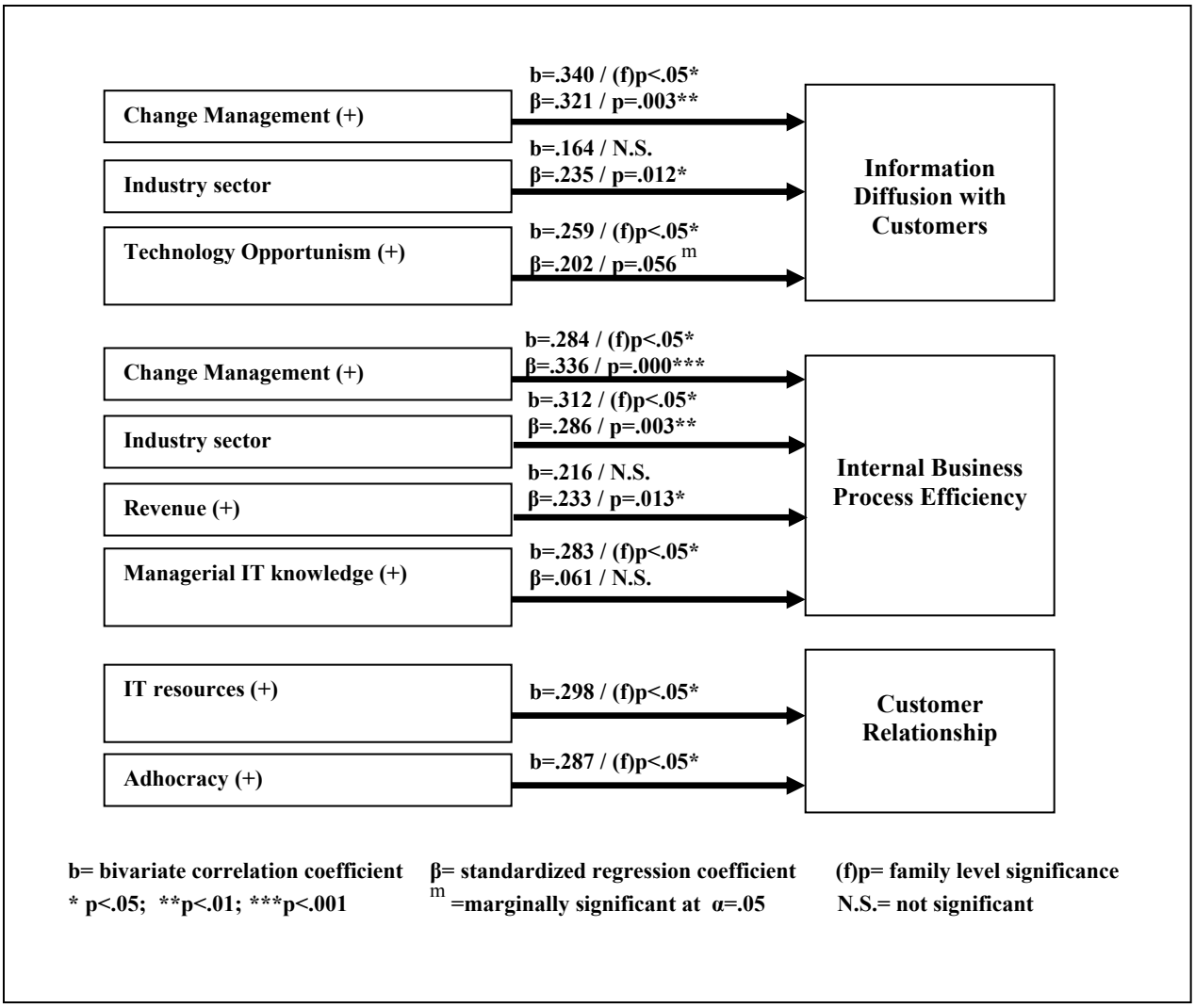


Figure 24. Empirical research sub-models: Antecedents for IICT adoption business activity outcomes

5.5. Forest Industry/Non-Forest Industry Comparisons

One of the objectives of this research is to compare the United States forest and paper products industries to other industrial sectors in terms of level of IICT implementation, implementation success, and related organizational capabilities. The goal is to identify organizational factors and capabilities that could aid the forest products industry to effectively utilize IICT in the customer interface.

5.5.1. IICT Adoption

Independent samples *t*-tests were conducted to explore differences between the forest products and non-forest products sector respondents in term of IICT adoption (perception of industry adoption rate, time of eBusiness adoption, implemented IICT applications, business functions aided by IICT, and IICT implementation objectives). First, Levene's test statistics were calculated to compare variances between respondent groups. If the significance value of a Levene's test statistic was not significant ($p>0.05$), then *t*-test results that assume equal variances were used. Conversely, if the test statistic was significant ($p<0.05$), *t*-test results assuming unequal variances were used.

Respondents were asked about their perception of the overall rate of eBusiness adoption in their industry sector relative to "other" industry sectors on a scale: 1=first adopter, 2=early adopter, 3=adopted with the majority, 4=late adopter, 5=laggard. Overall, forest products sector respondents perceived their industry to be a late eBusiness adopter (mean 4.0) (Figure 25). Non-forest industry respondents viewed their industry sector as having adopted eBusiness with the majority (mean 3.4). Based on the independent samples *t*-test, forest industry respondents had a more negative perception of their industry sector adoption rate than non-forest products sector respondents ($p=.001<.05$).

Respondents were asked when customer interface eBusiness was first implemented in their organization. The age of eBusiness adoption scale was coded 0=<1 year ago, 1=1 year ago…10=10 years ago, 11=>10 years ago. On average, forest products sector respondents first implemented customer interface eBusiness applications almost five years ago (Figure 26), whereas non-forest products respondents first established customer interface eBusiness on average six years ago, a statistically significant difference at $\alpha=.05$ ($p=.036<0.05$). Results

support previous findings in the literature (Bakker 1999 in Karuranga et al. 2005; Vlosky and Pitis 1999) and trade statistics (U.S. Census Bureau 2005) that the forest industry follows other industry sectors in eBusiness adoption.

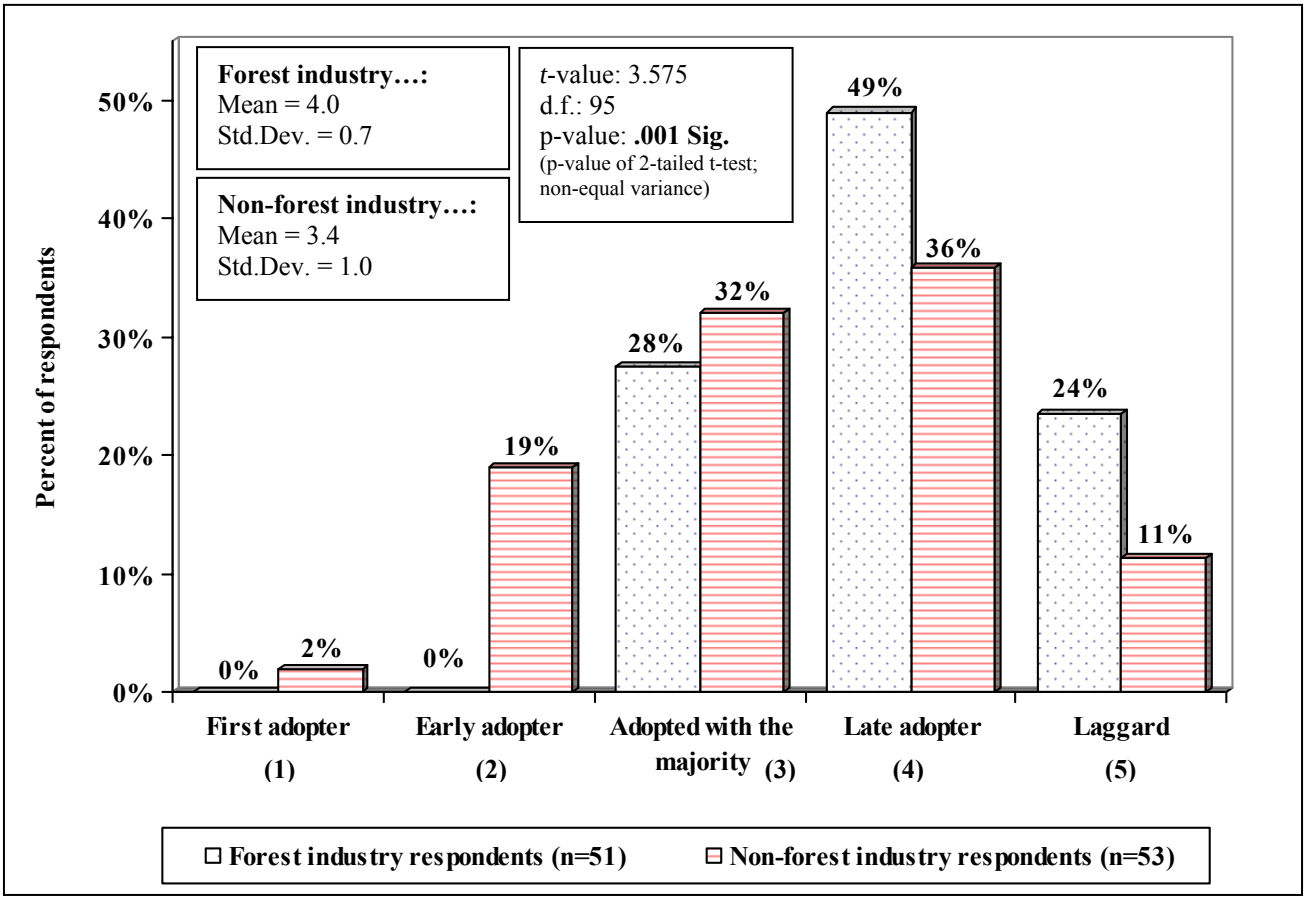


Figure 25. Industry eBusiness adoption rate: comparison between forest products industry and non-forest products industry respondents

IICT application adoption rates were compared for forest products industry and non-forest products industry sector respondents by specific IICT application. Eighty-one percent of forest industry respondents and 89 percent of non-forest industry respondents indicated that their organization had a website (Table 39). A Chi-Square test did not indicate a significant difference between the two industry sectors in website adoption rate ($p=.243>.05$). However, a Chi-Square test shows that non-forest products industry sector respondents had a higher adoption rate of

extranets than forest industry respondents (p=.017<.05). Specifically, extranets were implemented by 31 percent and 54 percent of forest products industry and non-forest products industry respondents, respectively. In addition, electronic point-to-point (P2P) integration with customers was established by 21 percent of forest products industry respondents as opposed to 48 percent of non-forest products industry respondents (p=.004<.01). Overall, the least adopted IICT application was an eIntermediary. Fifteen percent of both forest products and non-forest products industry sector respondents indicated that eIntermediaries were used in their customer interface (p=.935>.05). Six of the eleven respondents not using any of the IICT applications in their customer interface were forest products sector companies.

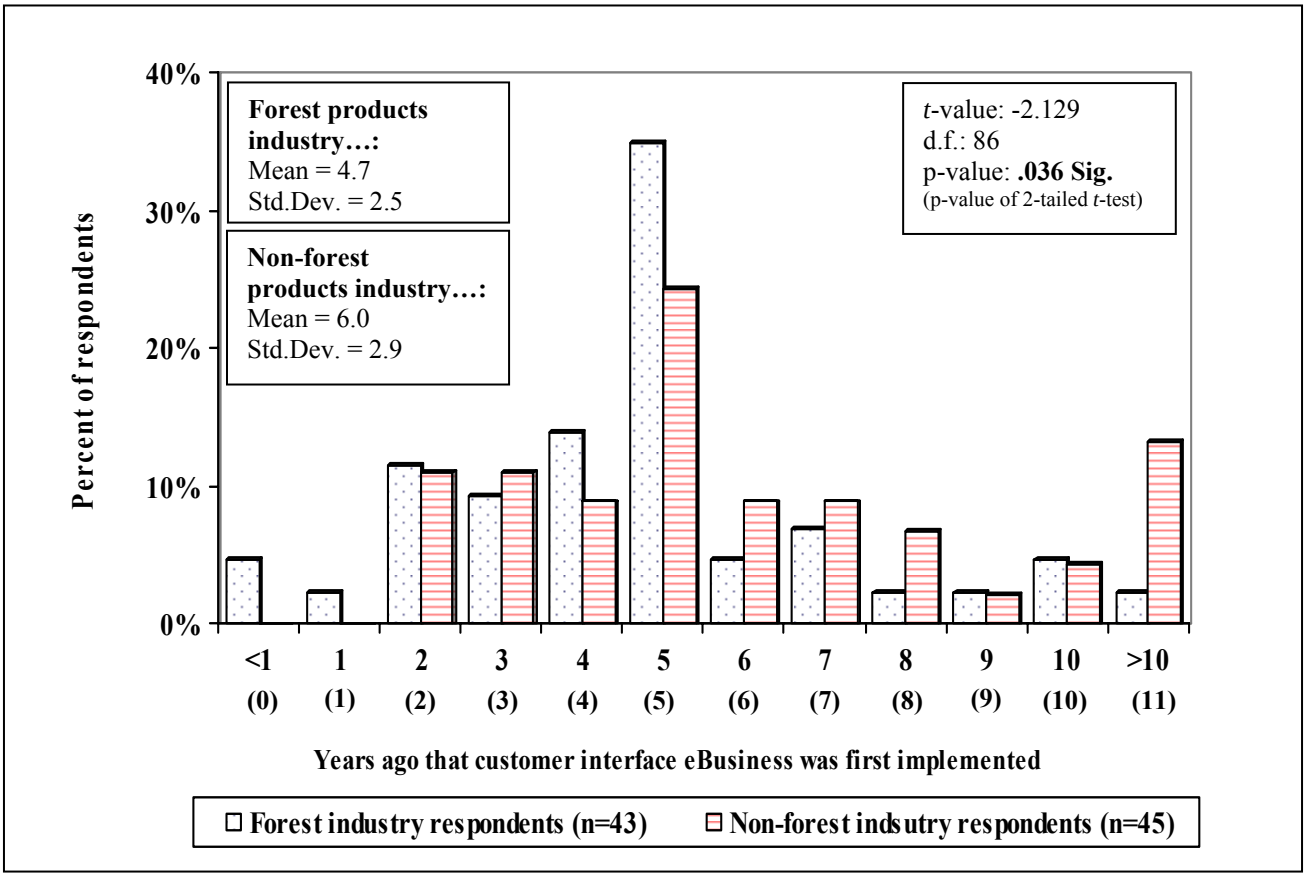


Figure 26. When eBusiness was first implemented: comparison between forest products industry and non-forest products industry respondents

Table 39. Implemented IICT applications: comparison between forest industry and non-forest industry respondents

	Application adopted by respondents (%)			
	Website [a]	**Extranet [a]**	**eIntermediary [a]**	**P2P [a]**
Forest products (n=52)	42 (81%)	16 (31%)	8 (15%)	11 (21%)
Non-forest products (n=54)	48 (89%)	29 (54%)	8 (15%)	26 (48%)
Total (n=106)	90 (85%)	45 (43%)	16 (15%)	37 (35%)
Pearson Chi-Square	1.363	5.703	.007	8.496
d.f.	1	1	1	1
Significance[+]	.243	.017*	.935	.004**

* Significant at α=0.05; ** Significant at α=0.01;
[+]Assymp. Sig. (2-sided)
[a] 0 cells (0%) have expected count less than 5

Respondents were asked to indicate the extent to which certain business functions and operations were done in their company using eBusiness on a scale: 0=0 percent, 1=1-20 percent, 2=21-40 percent, 3=41-60 percent, 4=61-80 percent, and 5=81-100 percent of the function conducted by eBusiness applications. Table 40 shows the average extent of IICT utilization in different business processes and function in forest products industry and non-forest products industry respondents. Forest products industry respondents have a lower utilization mean in every business function/process than non-forest products industry respondents. All, except "product information dissemination" and "sales lead generation" were significantly different without a Bonferroni family significance level adjustment. If the more conservative Bonferoni adjustment significance test at family level significance α=.05 (0.05/11=0.004) is used, only "order management", "complaint reporting", "customer support", "customer information tracking", and "sales revenue" are significantly different between industry sectors. Despite whether or not a conservative significance test is used, Table 42 indicates an important conclusion: the forest products industry is lagging the other industry sectors in utilizing IICT in customer-related business functions and operations.

Table 40. Business process/function by eBusiness: comparison between forest industry and non-forest industry respondents

Business process/function	Sector	n	Mean	Std. Dev.	Mean Diff.	t	d.f.	Sig.[+]
Promotion and advertising	Forest	45	1.1	1.1	-0.6	-2.69	89	0.009**
	Non-forest	46	1.7	1.0				
Product information dissemination	Forest	45	1.9	1.4	-0.4	-1.52	90	0.133
	Non-forest	47	2.3	1.3				
Presales support[++]	Forest	45	0.9	1.1	-0.7	-2.83	85	0.006**
	Non-forest	47	1.7	1.5				
Order management	Forest	45	0.9	1.4	-1.5	-4.64	89	0.000***[/b]
	Non-forest	46	2.4	1.6				
Electronic payment	Forest	45	1.2	1.5	-0.8	-2.35	89	0.021*
	Non-forest	46	2.0	1.7				
Complaint reporting	Forest	45	0.9	1.3	-0.9	-2.95	90	0.004**[/b]
	Non-forest	47	1.8	1.5				
Customer support	Forest	45	1.0	1.3	-0.9	-3.09	89	0.003**[/b]
	Non-forest	46	1.9	1.5				
Sales lead generation	Forest	45	1.5	1.3	-0.1	-0.38	90	0.706
	Non-forest	47	1.6	1.4				
Customer information tracking[++]	Forest	45	0.8	1.2	-1.1	-3.40	83	0.001**[/b]
	Non-forest	47	1.8	1.7				
Product development collaboration and feedback[++]	Forest	45	0.5	0.9	-0.6	-2.45	81	0.017*
	Non-forest	46	1.1	1.4				
Sales revenue	Forest	45	1.0	0.6	-0.7	-4.07	68	0.000***[/b]
	Non-forest	45	1.7	1.1				

Scale: 0=none, 1=1-20%, 2=21-40%, 3=41-60%, 4=61-80%, 5=81-10% of business process/function conducted with eBusiness
* Significant at α=0.05; ** Significant at α=0.01; *** Significant at α=0.001
[b] Bonferroni adjustment at family level significance α=.05 (0.05/11=0.004)
[+] p-value of 2-tail *t*-test
[++] Equal variance not assumed

Respondents were asked which business objectives were the primary motivators for IICT implementation in their companies. Table 41 shows that "improvement in customer service" (70 percent of forest products industry respondents, 80 percent of non-forest products industry respondents) was the most cited motivator for customer interface IICT adoption, followed by "deepening existing customer relationships" (48 percent of forest products industry respondents, 71 percent of non-forest products industry respondents), and "reaching new customers" (59

percent of forest products industry respondents, 49 percent of non-forest products industry respondents). The desire to cut out middlemen in distribution or marketing channels was the least important objective for IICT adoption for both forest products (7 percent) and non-forest products respondents (8 percent).

Table 41. eBusiness implementation objectives: Pearson Chi-Square comparisons between forest industry and non-forest industry respondents

IICT objective	Forest industry (n, % of respondents)	Non-forest industry (n, % of respondents)	Chi-Square	Sig.[+]
Improve customer service [a]	35 (76%)	39 (80%)	.169	.681
Reach new customers [a]	27 (59%)	24 (49%)	.901	.343
Deepen existing customer relationship [a]	22 (48%)	35 (71%)	5.507	.019*
Improve operational efficiency [a]	17 (37%)	19 (39%)	.033	.855
Improve brand image [a]	16 (35%)	19 (39%)	.163	.687
Reduce transaction cost with customers [a]	13 (28%)	23 (47%)	3.517	.061
Faster inventory turns [a]	6 (13%)	9 (18%)	.506	.477
Reduce employee count [a]	5 (11%)	9 (18%)	1.062	.303
Joint product development [a]	4 (9%)	9 (18%)	1.879	.170
Cut out middlemen in distribution channel [b]	3 (7%)	4 (8%)	.094	.760

* Significant at α=0.05
[+]Assymp. Sig. (2-sided); (n=95)
[a] 0 cells (0%) have expected count less than 5;
[b] 2 cells (50%) have expected count less than 5

Overall, results indicate that IICT adoption for both forest products industry and non-forest products industry respondents is strongly driven by the desire to strengthen company's customer orientation. Customers, as opposed to an emphasis on manufacturing processes, are the focus of all top three objectives (improve customer service, deepen relationships, reach new customers). The only significant difference in objectives between industry sectors was the objective of "closer customer relationships". Significantly more non-forest products industry

respondents indicated “deepening customer relationships” ($p=.019<.05$) as an objective for IICT implementation than forest products industry respondents.

5.5.2. IICT Effectiveness

Another goal of this research is to explore if forest products or non-forest products industry respondents have been better able to benefit from customer interface IICT implementation. Previously discussed multiple regression and bivariate correlation analysis of IICT total effectiveness have provided evidence that forest products industry respondents have been less effective in utilizing IICT. Additionally, independent samples *t*-tests were conducted to compare IICT effectiveness constructs between industry sectors. As expected, Table 42 shows statistically significant differences between industry sector success in IICT total effectiveness ($p=0.004<0.01$) and internal business process efficiency ($p=0.012\leq0.01$), when a Bonferroni adjustment is used to determine family level significance at $\alpha=.05$ ($0.05/5=0.01$). Even though all IICT adoption impacts were directionally lower for forest products industry respondents, the independent samples *t*-tests did not indicate statistically significantly different IICT driven impacts on information dissemination ($0.071>0.01$), customer relationships ($0.041>0.01$), or competitive position ($0.254>0.01$). In addition, both sector respondents reported equal satisfaction ($0.452>0.01$) with IICT adoption in their organization’s customer interface.

The *t*-tests confirm that overall non-forest products industry respondents have been more successful in total IICT effectiveness than the forest products industry respondents. In particularly, non-forest products industry respondents have been able to better gain internal business process efficiency through customer interface IICT implementation. This is supported by significant results in all *t*-tests, multiple regression, and bivariate correlations. This finding points out that the forest industry, which in general has a strong emphasize on production process

efficiency, has not been able to integrate customer interface IICT in their business processes as successfully as other industries represented in the study.

Table 42. IICT adoption effectiveness and success: comparison between forest industry and non-forest industry respondents

	Industry	n	Mean	Std. Dev.	Mean Diff.	*t*-value	d.f.	Sig.[+]
Total effectiveness	Forest	46	50.8	3.8	-2.6	-2.96	93	0.004*
	Non-forest	49	53.4	4.8				
Information diffusion with customers	Forest	46	15.0	1.9	-0.7	-1.83	93	0.071
	Non-forest	49	15.7	2.1				
Internal business process efficiency	Forest	46	13.2	1.6	-1.0	-2.57	93	0.012*
	Non-forest	49	14.2	2.2				
Customer relationship[++]	Forest	46	15.5	1.2	-0.7	-2.08	75	0.041
	Non-forest	49	16.2	2.1				
Competitive position	Forest	46	7.2	0.9	-0.2	-1.15	93	0.254
	Non-forest	49	7.4	1.0				
IICT adoption satisfaction	Forest	43	12.0	1.9	-0.3	-0.76	86	0.452
	Non-forest	45	12.3	2.0				

* Significant at family level α=0.05 (α=0.01 Bonferoni adjustment)
[+] p-value of 2-tailed *t*-test; [++] Equal variance not assumed

5.5.3. Organizational Capabilities

Based on independent samples *t*-tests, results in Table 43 do not indicate any significant differences in organizational capability constructs (adhocracy culture, hierarchy culture, information dissemination, technology opportunism, IT resources, managerial IT knowledge, and change management) between forest products industry and non-forest products industry respondents with or without Bonferroni adjustment for family level significance at α=.05. These results indicate that the observed differences in IICT implementation success between industry sectors is likely due to other additional organizational factors than the organizational resource and capability constructs identified in the conceptual and empirical research models for effective customer interface IICT adoption.

Table 43. Organizational capabilities: comparison between forest industry and non-forest industry respondents

	Industry	n	Mean	Mean Diff.	Std. Dev.	*t*-value	d.f.	Sig.[+]
Adhocracy	Forest	46	11.4	-1.1	3.1	-1.512	93	0.134
	Non-forest	49	12.5		4.0			
Hierarchy	Forest	46	10.6	0.6	2.0	1.329	93	0.187
	Non-forest	49	10.0		2.5			
Information dissemination	Forest	46	14.3	0.7	2.4	1.246	93	0.216
	Non-forest	49	13.6		3.1			
Technology opportunism	Forest	46	11.0	-1.2	3.3	-1.746	93	0.084
	Non-forest	49	12.3		3.6			
IT resources	Forest	46	8.7	0.03	2.5	0.066	93	0.948
	Non-forest	49	8.6		2.7			
Managerial IT knowledge	Forest	46	12.4	-0.7	3.2	-0.998	93	0.321
	Non-forest	49	13.1		3.4			
Change management	Forest	46	11.2	-1.0	3.4	-1.395	93	0.166
	Non-forest	49	12.2		3.5			

[+] p-value of 2-tailed *t*-test

As a result of no differences found between sectors with regard to organizational capability constructs, differences in other organizational characteristics which might explain differences in IICT success between the industry sectors should be investigated. Accordingly, business strategy types, revenue, and IT spending between sectors were examined.

A cross tabulation Chi-Square test indicates that the strategy profiles between the forest industry and non-forest industry respondents are statistically different at α level .05 ($\chi^2(3,95)=9.895$, p=.019<.05) (Table 44). A majority of forest industry companies (54 percent), that had implemented IICT indicated a business strategy that most resembles the "analyzer" business strategy described by Miles and Snow (1978). Characteristics typical for the analyzer business strategy are: sales and financial management core competencies; high product price, quality, and service level; moderate levels of business process formalization and employee autonomy. This finding does not support the often argued (e.g. Bjorheden and Helstad 2005; Bush and Sinclair 1991; Rich 1986) forest industry business strategy type of "cost leader" (Porter

1985) or "defender" (Miles and Snow 1978), which place significant emphasis on production process efficiency and commodity products. One possible explanation is that Marketing Executive respondents identified their company's desired business strategy rather than current strategy characteristics.

Table 44. Business strategy types: Pearson Chi-Square comparison between forest products and non-forest products respondents

	Forest industry (n=46)		Non-forest industry (n=49)		Chi-Square [a]	d.f.	Sig. [+]
Strategy Type	**Frequency**	**Percent**	**Frequency**	**Percent**			
Prospector	6	**13**	20	**41**	9.895	3	.019*
Analyzer	25	**54**	20	**41**			
Defender	8	**17**	6	**12**			
Missing	7	**15**	3	**6**			

* Significant at α=0.05
[+] Assymp. Sig. (2-sided)
[a] 1 cell (12.5%) have expected count less than 5 (4.84)

The second most common business strategy type among the forest industry respondents was the "defender" strategy (17 percent) (Miles and Snow 1978). Process engineering and production core competencies; emphasis on securing market position; low price and low service product offering are typical "defender" strategy characteristics associated with forest products industry companies.

Only 15 percent of forest products industry respondents identified their company with "prospector" strategy (Miles and Snow 1978) characteristics. Prospectors proactively seek and exploit new market opportunities, compete on innovation, and hunt for first-mover advantage. In addition, companies with a prospector business strategy typically have a broad, technically sophisticated, high priced product portfolio, complimented by high customer service standards.

Forty-one percent of non-forest industry respondents indicated that their organization most resembled the prospector business strategy type. Also, 41 percent identified their

organization with analyzer strategy characteristics. Only 12 percent of non-forest industry companies indicated that defender strategy characteristics best describe their organization.

A significant difference was found between forest and non-forest products industry respondent revenue in 2005 (p=.003) (Table 45). A significant difference was found also between the industry sector groups in annual IT spending. Based on the results in Table 45, non-forest products industry respondents had higher revenue in 2005 and annual IT budgets than forest products industry respondents, on average. However, despite these significant differences, it can not be concluded that differences in industry sector IICT success are due to differences in IT spending as revenue or IT spending were not found to significantly impact IICT success in any of the bivariate correlation tests or multiple regression analysis.

Table 45. Revenue and IT spending: comparison between forest products and non-forest products respondents

		n	Mean	Mode	Pearson Chi-Square	d.f.	Sig.+
Corporate revenue in 2005	Forest industry	45	2.2	2	14.18	3	0.003**
	Non-forest industry	48	2.6	2			
Annual IT spending	Forest industry	40	1.5	1	23.19	3	0.000**
	Non-forest industry	41	2.0	2			

** Significant at α=0.01
+ p-value of 2-sided Pearson Chi-Square test
Scale for revenue: 1=<$10million; 2=$10-100million; 3=$101-$499million; 4=>$500million
Scale for IT spending: 1=<$51,000; 2=$51,000-$250,000; 3=$251,000-$1million; 4=>$1.1million

In the light of the research results, it can not be concluded that forest industry and non-forest industry respondents have any significant gaps in the investigated organizational capabilities that have a relationship with IICT effectiveness. However, findings show that forest products industry respondents lag the other industry sectors on the IICT adoption curve. Forest products industry respondents adopted IICT later than non-forest products industry respondents and are currently using eBusiness applications less in their business functions. Less experience

and less utilization are factors that might explain these differences in IICT effectiveness. Also, results indicate that overall, industry sectors have different business strategy orientations. The forest industry sector is more aligned with analyzer and defender strategies as opposed to the prospector strategy found to be more prevalent in non-forest sector.

5.6. Perceived Value of eBusiness by IICT Application and Customer Portfolio Segment

The final section of the questionnaire, optional for respondents (Section III. eBusiness value), investigated respondents' perceptions of eBusiness value across the four IICT applications (website, extranets, eIntermediaries, direct point-to-pontl integration) and four customer relationship types (prospect customer, transactional customer, key customer, partner customer). Each respondent was asked to indicate perceived value for 16 experimental conditions (four IICT applications x four customer relationship types) on a scale anchored by 1=no value to 7=very high value. General linear model for repeated measures with 4 by 4 factorial design and multivariate test statistics was used to examine these value assessments.

Three overall effects were tested: 1) The main effect of IICT application: are there any differences between the mean evaluations given to websites, extranets, eIntermediaries, and direct integration; 2) the main effect of customer relationship: are there any differences between the mean evaluations given to prospect, transactional, key, and partner customers; 3) the interaction effect of IICT application and customer relationship: does the effect of IICT application depend on the customer relationship the IICT application is considered in.

Table 46 shows the mean, standard deviation, and number of subjects in each of the 16 experimental conditions. It also shows the total perceived mean value by IICT across customer types and total perceived value by customer relationship across IICT applications. These total

means are used in investigating the main effects. Thirty-four respondents participated in all 16 experimental conditions.

Table 46. Value perception descriptive statistics across experimental conditions

Experimental condition		Mean	Std. Dev.	n
IICT application	**Customer relationship stage**			
1. Website	1. Prospect	4.6	2.0	34
	2. Transactional	3.6	2.0	34
	3. Key	4.1	1.9	34
	4. Partner	4.1	2.0	34
	Total website	**4.1**		136
2. eIntermediary	1. Prospect	3.3	2.0	34
	2. Transactional	3.4	2.2	34
	3. Key	3.0	1.9	34
	4. Partner	3.2	2.0	34
	Total eIntermediary	**3.2**		136
3. Extranet	1. Prospect	3.9	2.1	34
	2. Transactional	3.7	2.2	34
	3. Key	4.7	2.0	34
	4. Partner	4.9	2.1	34
	Total extranet	**4.3**		136
4. Direct integration	1. Prospect	4.1	2.1	34
	2. Transactional	3.8	2.1	34
	3. Key	5.1	1.7	34
	4. Partner	5.3	1.7	34
	Total direct integration	**4.6**		
Total customer relationship	**Prospect**	**4.0**		136
	Transactional	**3.6**		136
	Key	**4.2**		136
	Partner	**4.4**		136

Dependent variable: Value; Scale: 1=no value; 7=high value

The multivariate test statistics table (Table 47) reveals that there is a significant main effect of IICT application on perceived eBusiness value in the customer interface ($F(3,31)=5.534$, $p=.004<.05$). Overall, when we ignore the customer relationship, the IICT application considered influences the perceived value of customer interface eBusiness. In

contrast, results indicate that the customer relationship type that eBusiness is adopted in does not have a significant main effect on perceived eBusiness value ($F(3,31)=2.185$, $p=.110>.05$). When we ignore the specific IICT application, the customer relationship environment does not influence the perceived value of eBusiness. However, results show a significant interaction effect between IICT application and customer relationship type on perceived eBusiness value ($F(9,25)=3.028$, $p=.014<.05$). This means that the effect of IICT application on eBusiness evaluation differs based on customer relationship type, i.e. the differences in IICT effect on perceived value are not consistent across customer types.

Table 47. Multivariate test statistics for IICT value perception by IICT and customer relationship main effects and interaction effect

Effect		Value	F	Hypo. df	Error df	Sig.
IICT	Pillai's Trace	0.35	5.534	3	31	0.004**
	Wilks' Lambda	0.65	5.534	3	31	0.004**
	Hotelling's Trace	0.54	5.534	3	31	0.004**
	Roy's Largest Root	0.54	5.534	3	31	0.004**
CUSTOMER	Pillai's Trace	0.17	2.185	3	31	0.110
	Wilks' Lambda	0.83	2.185	3	31	0.110
	Hotelling's Trace	0.21	2.185	3	31	0.110
	Roy's Largest Root	0.21	2.185	3	31	0.110
IICT x CUSTOMER	Pillai's Trace	0.52	3.028	9	25	0.014*
	Wilks' Lambda	0.48	3.028	9	25	0.014*
	Hotelling's Trace	1.09	3.028	9	25	0.014*
	Roy's Largest Root	1.09	3.028	9	25	0.014*
Design: Intercept; Within Subjects Design: IICT+CUSTOMER+IICTxCUSTOMER * Significant at α=0.05; ** Significant at α=0.01						

5.6.1. Interpretation of Main Effects: IICT Application and Customer Relationship

Figure 27 shows that when customer relationship type is ignored, overall eBusiness value is very similar between websites, extranets, and direct electronic integration (i.e. the means of these groups are approximately similar). Thus, the significant IICT application main effect is reflected by lower eBusiness value perceived with eIntermediaries.

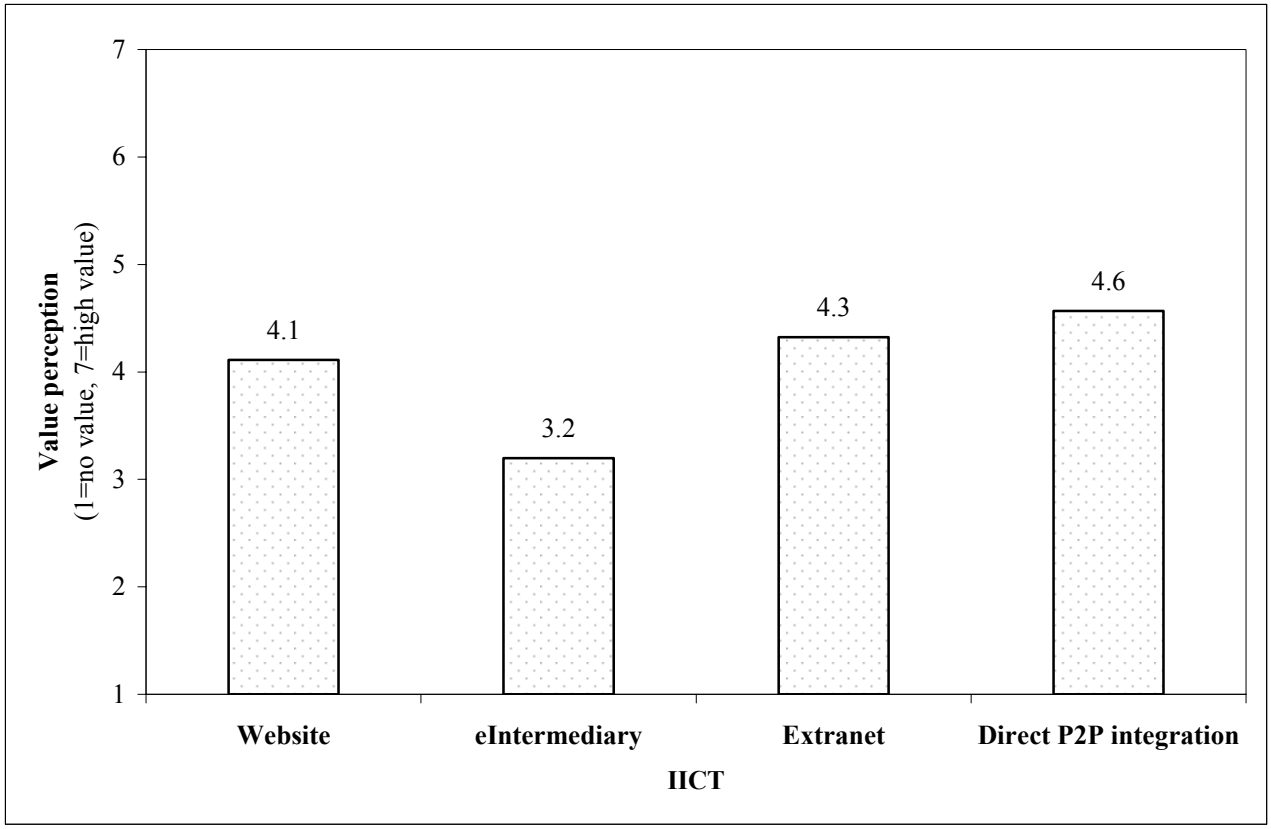


Figure 27. Mean perceived value by IICT application (n=34)

Conducted post-hoc tests (Table 48) confirm that the difference in value between eIntermediaries and other IICT applications (website, extranet, direct integration) is significant. Post-hoc tests consists of multiple pairwise comparisons that compare all combinations of treatment levels controlling the familywise error by Bonferoni adjustment correcting the level of significance for each test such that the overall type I error rate (α) across all comparisons remains at α=.05 (Field 2002). The post-hoc test confirmed that the perceived value of eIntermediaries was significantly lower than the perceived value of websites ($p=.014<.05$), extranets ($p=.004<.05$), and direct electronic integration ($p=.002<.05$). Perception of IICT value did not significantly differ between websites, extranets, and direct integration.

Table 48. Pairwise comparisons post-hoc tests: IICT application and perceived value

Pairwise Comparisons				
Dependent variable: Value		**Mean Diff. (I-J)**	**Std. Error**	**Sig.**
(I) IICT application	**(J) IICT application**			
Website	Extranet	0.9	0.3	0.014*
	eIntermediary	-0.2	0.2	1.000
	Direct integration	-0.5	0.3	0.526
eIntermediary	**Website**	-0.9	0.3	0.014*
	Extranet	-1.1	0.3	0.004*
	Direct integration	-1.4	0.3	0.002*
Extranet	Website	0.2	0.2	1.000
	eIntermediary	1.1	0.3	0.004*
	Direct integration	-0.2	0.2	1.000
Direct integration	Website	0.5	0.3	0.526
	Extranet	1.4	0.3	0.002*
	eIntermediary	0.2	0.2	1.000
* Significant at α=.05				

Figure 28 illustrates the mean perceived value of eBusiness by customer relationship type when the specific IICT application is ignored. Overall eBusiness value is very similar across the customer relationship types, as already indicated by the non-significant customer relationship main effect in Table 47. Due to the non-significant main effect, the effect of customer relationship should not be further interpreted; hence pairwise comparisons are not reported.

The findings on main effects indicate that websites, extranets, and direct point-to-point (P2P) integration are perceived as valuable customer interface eBusiness tools, as opposed to eIntermediaries which are not considered to bring as much relative value. The lower perceived value of eIntermediaries may be explained by an unfavorable image due to the 2001 dot.com crash and unfulfilled eIntermediary promises of supply chain efficiency. This low perceived value is likely to reflect companies' reluctance to offer products and communicate with customers in a third-party controlled marketplace environment. Customer relationship was not found to have a significant effect on respondents' customer interface eBusiness evaluation.

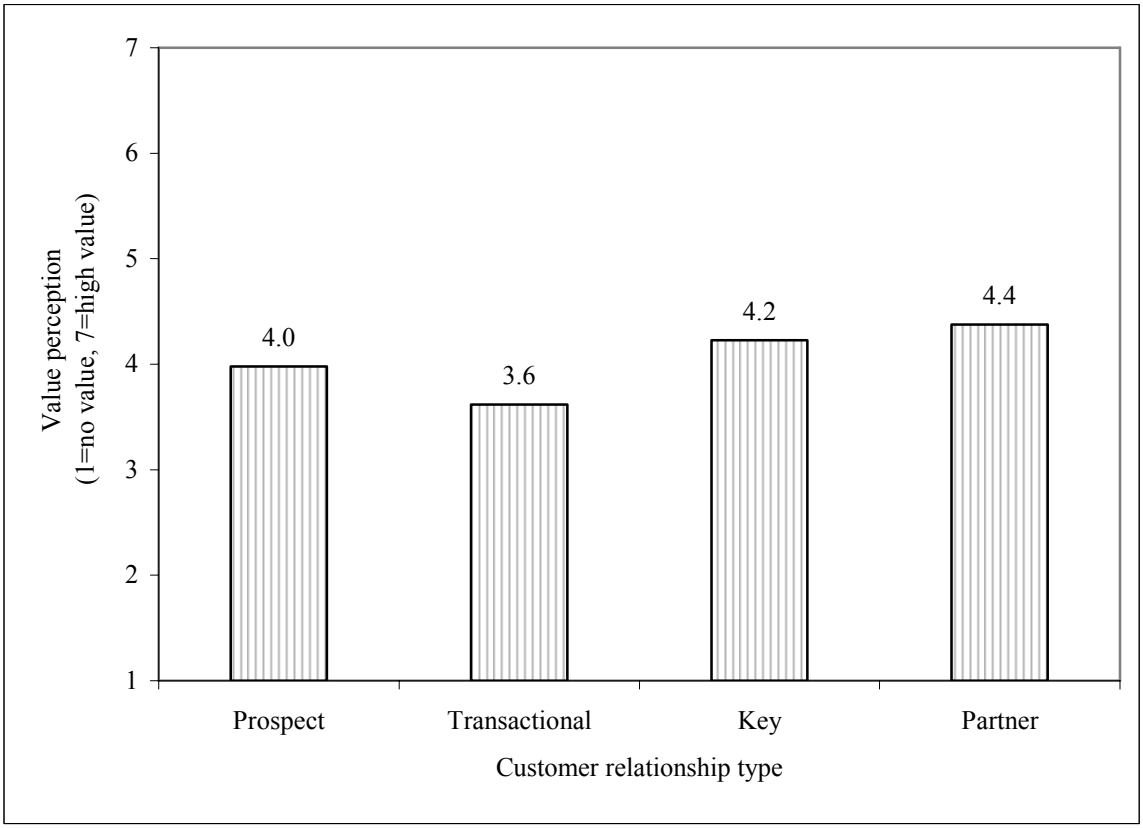


Figure 28. Mean perceived value by customer relationship (n=34)

5.6.2. Interaction Effect of IICT Application and Customer Relationship Type

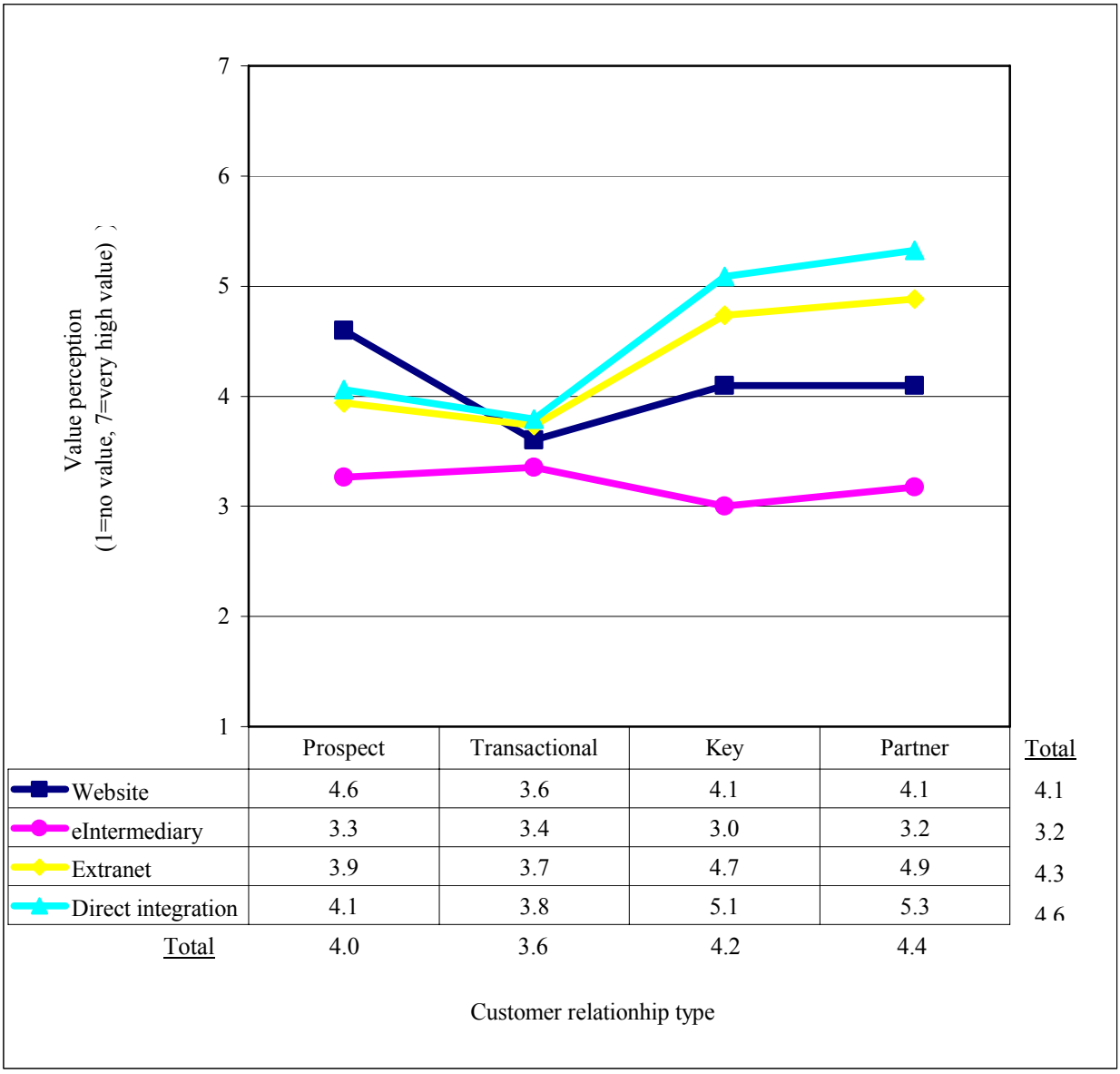
The significant interaction effect of IICT application and customer relationship type is next described in order to understand the joint effect of IICT application and customer relationship type on eBusiness value. In Figure 29, the vertical axis represents mean value across combinations of levels of IICT application and customer relationship type. The lines connect the group means for each IICT application across customer relationship stage.

Figure 29 shows very similar pattern of value for extranets and direct P2P integration. The value of both extranets and direct P2P integration is low for the first two levels of the customer relationship continuum (prospect and transactional), but increases for more established relationships (key and partner). eIntermediaries have a lower perceived value than extranets and

direct P2P integration across all customer relationship types, however, the value difference increases when moving from initial stages of customer relationship (prospect, transactional) to established relationship with key and partner customers. This change in value difference and the non-parallel lines describe an ordinal interaction effect. The IICT effect on perceived value difference is not consistent across the customer types; customer type effects evaluation of IICT applications.

In addition to the ordinal interaction effect, Figure 29 describes another interaction effect. Respondents' perceived value of websites with prospective customers is above perceived value for all other IICT applications in the prospective relationship stage. However, the value perception of websites sharply declines for established customer relationships, going below the perceived value level of direct P2P integration and extranets. The perceived value line for websites crossing the perceived value lines for extranets and direct P2P integration indicates disordinal interaction effect: the effect of one treatment (IICT application) is positive for some levels and negative for other levels of the other treatment (customer relationship) (Hair et al. 1998). In other words, differences in customer relationship type vary not only in magnitude but also in direction by IICT application.

In summary, Figure 29 indicates that respondents perceived websites to be of highest value with prospective customers, while extranets and direct integration with a customer's information system were perceived to be of highest value with key and partner type customers. The perceived value of eIntermediaries was always considered lower than the value of the other IICT applications. The value difference between eIntermediaries and extranets/direct P2P integration increased when moving from initial customer relationship stages to established relationships with key and partner type customers.



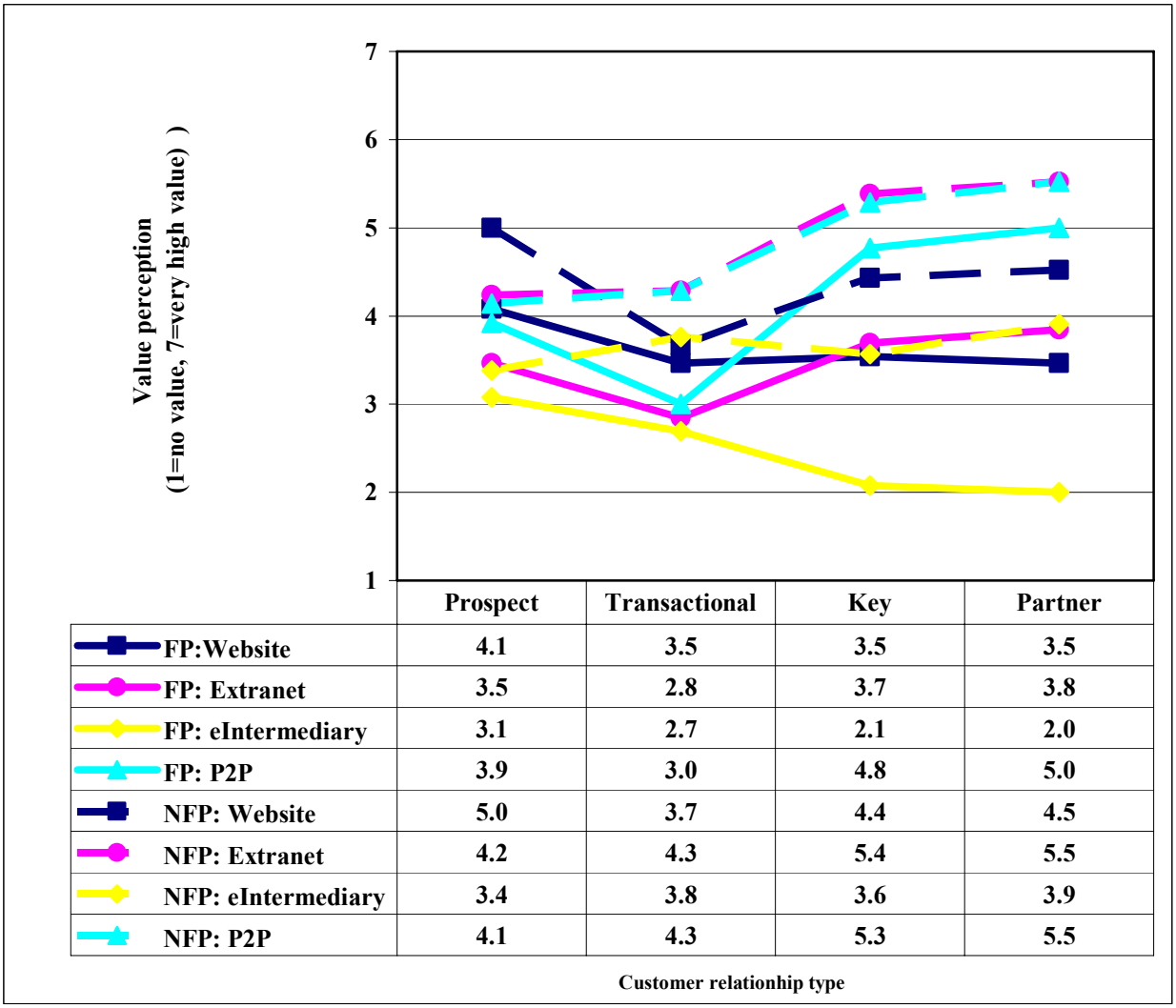
	Prospect	Transactional	Key	Partner	Total
Website	4.6	3.6	4.1	4.1	4.1
eIntermediary	3.3	3.4	3.0	3.2	3.2
Extranet	3.9	3.7	4.7	4.9	4.3
Direct integration	4.1	3.8	5.1	5.3	4.6
Total	4.0	3.6	4.2	4.4	

Figure 29. IICT value by customer relationship type

5.6.2.1. Industry Sector Comparison of Perceived eBusiness Value

The following figures describe eBusiness value by IICT application and customer relationship segment between forest products industry and non-forest products industry sector respondents. Figure 30 describes the value perceptions by industry sector when the interaction of IICT application and customer relationship type is considered. Overall, results indicate that non-forest products industry respondents' value perceptions are higher than those of forest products

industry respondents when both the IICT application and customer relationship are considered. Figure 31 implies that overall non-forest products industry respondents indicated higher value perceptions for all IICT applications when the effect of customer relationship is ignored. In addition, non-forest products industry respondents perceived eBusiness to bring more value for every customer relationship type environment regardless of the IICT application.



	Prospect	Transactional	Key	Partner
FP:Website	4.1	3.5	3.5	3.5
FP: Extranet	3.5	2.8	3.7	3.8
FP: eIntermediary	3.1	2.7	2.1	2.0
FP: P2P	3.9	3.0	4.8	5.0
NFP: Website	5.0	3.7	4.4	4.5
NFP: Extranet	4.2	4.3	5.4	5.5
NFP: eIntermediary	3.4	3.8	3.6	3.9
NFP: P2P	4.1	4.3	5.3	5.5

Figure 30. Forest products industry and non-forest products industry IICT value by customer relationship type (FPI n=13, NFPI n=21)

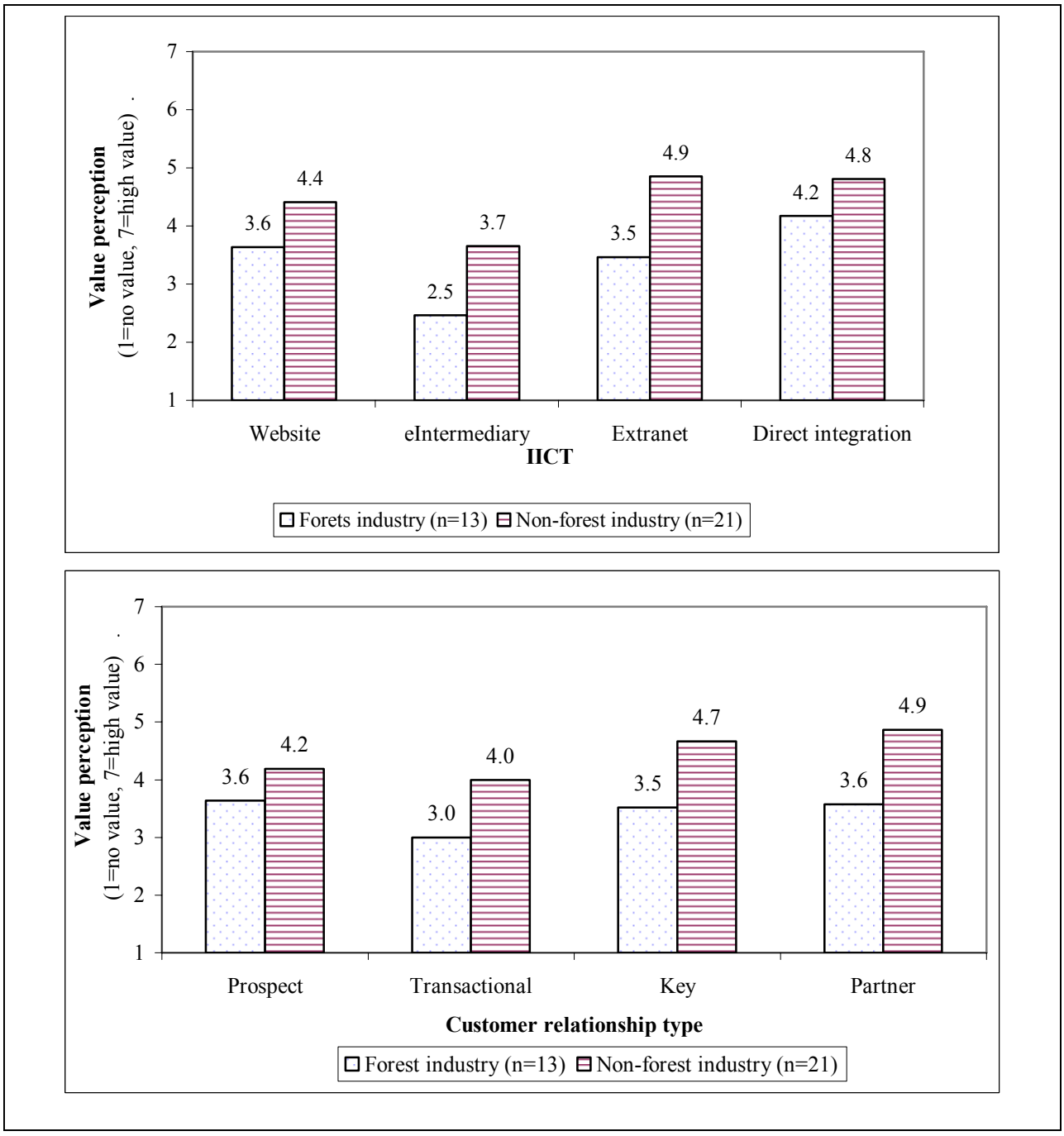


Figure 31. eBusiness value by IICT application and customer relationship type: forest products and non-forest products industry comparisons

6. CONCLUSIONS

6.1. IICT Adoption

Research results show that IICT has gained a foothold in the supplier-customer interface, with ninety percent of respondents having implemented IICT applications in their customer interface. The most widely used IICT application was company website, implemented by 85 percent of respondents, followed by extranets, implemented by 43 percent of respondents. Direct point-to-point (P2P) integration with customers was established in 35 percent of respondents and 15 percent of respondents transacted with customers through a third party eIntermediary.

Differences in IICT adoption were found between the forest products and non-forest products industry sectors. Non-forest products industry sector respondents had a higher adoption rate of extranets and direct electronic integration, while extranets were implemented by 31 percent of forest products industry respondents in comparison to 54 percent of non-forest industry respondents. Direct electronic integration with customers was established in 21 percent of forest industry respondents as opposed to 48 percent of non-forest industry respondents.

In addition to investigating the number of respondents that implemented IICT, it is important to explore how and in to what extent respondents use these applications in their business operations. Roughly 40 percent of respondents indicated that IICT are not used at all in the order fulfillment process. Results show an overall trend that eBusiness continues to play a small to moderate role in order fulfillment management and execution. Of all the investigated business functions and processes, eBusiness is used most in disseminating product information and least used in joint product development.

Overall, results suggest that IICT adoption in both forest products industry and non-forest products industry sectors is strongly driven by the desire to strengthen companies' customer

orientation. Customers, as opposed to an emphasis on manufacturing processes, are the focus of all top three ranked objectives (improve customer service, deepen relationships, reach new customers) for both industry sectors. However, the customer relationships were found to have the least impact from IICT adoption in customer interface. Hence, it can be argued that respondents have not been completely successful in achieving the IICT implementation objectives.

6.2. IICT Effectiveness

The research identified four different facets of impact that adopting IICT in the customer interface had on respondents' business: 1) internal business process efficiency, 2) customer relationships, 3) information diffusion with customers, and 4) competitive position. IICT adoption had the greatest impact on information dissemination. Respondents indicated that their ability to provide customers with up-to-date and accurate information had improved since IICT adoption. They also perceived an increase in the quality and amount of information shared with customers. Respondents perceived the second highest impact of IICT adoption to be on their company's competitiveness. Respondents felt that their company image had improved from IICT adoption and enabled them to be more competitive. IICT adoption also had a positive effect on respondents' business process efficiency. Respondents indicated that their ability to meet on-time delivery commitments had improved, as had order processing and production planning efficiency after IICT was implemented. IICT had the least impact on customer relationships. Overall, respondents found only a small positive change in their perceived trust and satisfaction with customers after IICT was adopted in customer interface.

Overall, this research offers a framework for business executives to consider areas of potential impact from customer interface IICT adoption. In addition, this research aids business

executives in setting objectives and building performance metrics for customer interface IICT implementation and management.

6.3. Organizational Antecedents for Effective IICT Adoption

This research 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.

Based on the multiple regression analysis, "change management", "industry sector", "technology opportunism", and "IT resources" were significant determinants of customer interface IICT adoption effectiveness. Investigation of bivariate correlations added "managerial IT knowledge" and "information dissemination" to the list of positive antecedents of "IICT total effectiveness". Employment of "change management" principles and "industry sector" had the strongest effect on IICT success both on the aggregate level of IICT effectiveness and on the constituent level.

In general, respondents were not completely convinced that their organization had a strong tradition in sensing technological change (technology opportunism) in their respective industry sector. Also, respondents seemed to doubt whether their organization has adequate tangible IT resources to adopt customer interface eBusiness. Respondents least agreed that their organization has sufficient change management capabilities for effective IICT implementation. These findings reveal that the organizational capabilities that were found most to impact IICT effectiveness were also the weakest organizational capabilities in respondent organizations.

Interestingly, results indicate that corporate revenue, which in previous research has been associated with organization's likeliness to use IICT (Vlosky 1999; Vlosky 2002), had a positive effect only on IICT implementation's impact on internal business process efficiency, but not on

IICT total effectiveness. This finding might be attributed to larger organizations' ability to achieve more significant cost savings in internal business processes due to larger volumes of automated business transactions facilitated by eBusiness.

Results also 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 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 (technology opportunism), 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.

6.4. Status of the Forest Products Industry

Overall, findings show that forest industry respondents are lagging non-forest products industry sectors in appropriating value from customer interface IICT implementation. Results indicate that non-forest products industries have been more successful in total IICT effectiveness than forest industry sector respondents. Specifically, forest products industry sector respondents have lower rates of IICT success on "internal operations efficiency." This finding indicates that the forest industry, which, in general, emphases production process efficiency, has not been able to integrate customer interface IICT in their business processes as successfully as other respondents.

Results did not identify any significant differences in the organizational capability constructs (adhocracy culture, hierarchy culture, information dissemination, technology opportunism, IT resources, managerial IT knowledge, and change management) between forest

products industry and non-forest products industry respondents. However, findings show that forest products industry respondents follow other industry sector respondents on the IICT adoption curve. Forest products industry respondents adopted IICT later than non-forest products industry respondents and are currently using eBusiness applications less in their business functions. Less experience and less utilization are factors that might explain differences in IICT effectiveness. Also, results indicate that overall, the industry sectors have different business strategy orientations. The forest industry sector is more aligned with analyzer and defender strategy characteristics as opposed to the non-forest products sector's higher orientation towards a prospector strategy. This, combined with the leading customer interface IICT adoption objective of improving customer orientation, might explain better IICT success in the non-forest products industry sector.

The main implication of this research for the forest industry is the empirical evidence that customer interface IICT implementation has a potentially significant positive effect on a variety of business activity outcomes. However, the forest industry has not been able to reap the benefit from IICT to the same extent as the non-forest products industry sectors. As stated, this research was unable to identify specific organizational resources and capabilities which lead to this gap.

6.5. Perceived Value of eBusiness Across IICT Applications and Customer Relationship

Findings indicate that websites, extranets, and direct integration are perceived to be as valuable eBusiness tools in the customer interface. Respondents found eIntermediaries less valuable, regardless of customer relationship type. The value difference between eIntermediaries and extranets/direct P2P integration increased when moving from initial customer relationship stages to established relationships with key and partner type customers. Customer relationship alone was not found to have a significant effect on respondents' customer interface eBusiness

evaluation. The lower evaluation of eIntermediaries is likely to reflect companies' reluctance to offer their products and communicate with customers in a third-party controlled marketplace, an environment suspect to placing an emphasis on price. Respondents perceived websites to be the most effective communication channel with prospective customers, but extranets and direct P2P integration with established customer (key and partner).

Non-forest products industry sector respondents' perceived overall higher value across all combinations of IICT applications and customer relationship types. They perceived more value in all IICT applications than the forest products industry respondents. In addition, non-forest products industry respondents perceived eBusiness to offer more value in every customer relationship environment regardless IICT application.

The investigation of respondents perceived value from different IICT applications across customer relationship stages provides managers with a framework for integrated IICT application and customer portfolio management. The results also imply that all IICT applications except eIntermediaries are perceived to be valuable customer interface business tools.

6.6. 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. Three limitations pertain to the sample frame. First, only four industry sectors were investigated. Second, the results were obtained from a small sample of companies operating in the U.S. There is a future research opportunity to extend the investigation on other industry sectors and geographical areas. Third, 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 should consider other informants. Potential informants could be other executives,

e.g. Chief Executive Officers (CEO), or information technology executives, e.g. Chief Information Officer (CIO). CEOs could be argued to possess the most comprehensive picture of firm's resources effect on overall performance, whereas CIOs could be argued to have most familiarity with IICT project metrics tracking. In addition, 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.

The results did not signify any significant differences in the organizational capability constructs (adhocracy culture, hierarchy culture, information dissemination, technology opportunism, IT resources, managerial IT knowledge, and change management) between forest products industry and non-forest products industry respondents. These results point to the direction that the observed differences in IICT implementation success between the industry sectors are due to other factors other than organizational resource and capability constructs in the conceptual and empirical research models. Further research should be conducted to identify the organizational resources and capabilities that could have an effect on IICT implementation effectiveness.

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 interface IICT implementation. Potential future research could investigate what kind of metrics companies use in evaluating IICT success.

From a statistical analysis perspective, because of the small sample size *t*-tests were used to investigate differences in organizational resources and capabilities (i.e. significance of mean difference) between the industry sectors. Future research could test these differences through organizational capability and industry interaction effects using multiple regression to achieve more robust findings.

In addition, further development of the change management construct is needed. This would be especially valuable as the change management capability was found to have the strongest relationship with IICT effectiveness. A measure for business strategy and IICT objective fit should also be further developed. It is possible that non-significant business strategy fit results might be due to shortcomings in the measure used to capture the business strategy and IICT adoption objective fit.

Overall, this research offers a framework for business executives to consider areas of potential impact from customer interface IICT adoption. By doing so, it aids business executives in setting objectives and building performance metrics for customer interface IICT implementation and management. This research suggests a model of organizational resources and capabilities (which can be affected internally) that have a relationship with successful IICT adoption. Hence, it directs business executives' attention beyond the tangible IT resources in implementing IICT. In addition, this research explores the status of IICT utilization in the U.S. forest products industry relative to non-forest products industry sectors. Finally, this research draws attention and provides a framework for integrated IICT portfolio and customer relationship management.

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APPENDIX I. QUESTIONNAIRE COVER LETTER

February 2006

HOW TO ACHIEVE SUCCESS WITH CUSTOMER INTERFACE eBUSINESS?

What is customer interface eBusiness?
eBusiness includes buy-side, inside, and sell-side operations of a firm handled via information and communication technology network. This survey is designed to collect information about organizational issues that affect on sell-side, i.e. customer interface, eBusiness success on business-to-business markets. Customer interface eBusiness refers to the electronic (virtual) bridge between supplier and customers to enable communication, transactions, collaboration and integration. Customer interface eBusiness applications include the Internet, extranet, third party eMarketplaces and eExchanges, integration with customers' information system etc.

Why should you participate in this survey?
By completing this survey, you will receive valuable information about how your existing firm resources could be used to improve eBusiness effectiveness in your company. A **complimentary copy of the survey results** will be sent to you as a token of our appreciation for completing the survey.

Privacy?
The survey is **completely anonymous and confidential** and only summary information will be reported in study results. The number at the top of this survey is an identifier only that allows us to track when we receive your completed survey, ensuring that you do not receive subsequent surveys or phone calls.

When you have completed the survey, please put it in the postage paid envelope and return to us.

Thank you.

Sanna M. Kallioranta
PhD Candidate
School of Renewable Natural Resources
Louisiana State University

Dr. Richard P. Vlosky
Director and Professor, Louisiana Forest Products Development Center
School of Renewable Natural Resources
Louisiana State University

APPENDIX II. QUESTIONNAIRE

How to Achieve eBusiness Success with Customers?



When you have completed the survey, please return it by fax (225) 578-4251 or by e-mail skalli1@lsu.edu or by mail PhD Candidate Sanna Kallioranta,
School of Renewable Natural Resources,
Louisiana State University, Baton Rouge, LA 70803.

Your response will insure the success of this study.

If you have any questions about this survey, please contact Sanna Kallioranta, PhD Candidate, Graduate Research Assistant, Forest Products Marketing, Louisiana Forest Products Laboratory, School of Renewable Natural Resources, Louisiana State University, Baton Rouge, LA 70803; Phone: (225) 578-4133; Fax (225) 578-4251; e-mail: skalli1@lsu.edu

Section I. Company Background

1. Please indicate the primary manufacturing industry sector of your company.

_____

2. Please estimate your company's 2005 corporate sales revenue. (Circle only one)

1. Less than $10 million
2. $10 – 100 million
3. $101 – 499 million
4. $500 - $999 million
5. $1 billion – $4.99 billion
6. Greater than $5 billion

3. Please estimate your company's Information Technology (IT) spending in 2005. (Circle only one)

1. Less than $50,000
2. $51,000 - $250,000
3. $251,000 - $1 million
4. $1.1 - $4 million
5. More than $4 million
6. Unknown

4. Please indicate your perception of the eBusiness adoption rate of <u>your industry sector (not your company) overall relative to ALL other industry sectors.</u> (Circle only one)

The first adopter	Early adopter	Adopted with the majority	Late adopter	Laggard
1	2	3	4	5

5. Please indicate your level of agreement with the following statements. (Circle only one for each)

In my company…	**Strongly disagree**				**Somewhat agree**	**Strongly agree**
everyone believes that sharing information is important.	1	2	3	4	5	
there is a tradition of inter-functional communication.	1	2	3	4	5	
information sharing between functions is strongly encouraged.	1	2	3	4	5	
managers of different functions are expected to share information.	1	2	3	4	5	
IT infrastructure (hardware and software) is adequate for implementing eBusiness.	1	2	3	4	5	
level of internal information system integration is adequate for implementing eBusiness.	1	2	3	4	5	
the IT budget is adequate for meeting business objectives.	1	2	3	4	5	
top management supports eBusiness implementation.	1	2	3	4	5	
functional management believes eBusiness has potential to improve their business processes.	1	2	3	4	5	
IT management is capable of aligning IT projects with our business operations.	1	2	3	4	5	
IT management is capable of developing IT solutions that match our strategies.	1	2	3	4	5	
My company…						
is often one of the first in our industry to detect technological developments that might affect our business.	1	2	3	4	5	
actively seeks intelligence on technological changes in the environment.	1	2	3	4	5	
is often slow to detect changes in technologies that might affect our business.	1	2	3	4	5	
periodically reviews the likely effect of changes in technology on our business.	1	2	3	4	5	
generally responds very quickly to technological changes in the environment.	1	2	3	4	5	
lags behind the industry in responding to new technologies.	1	2	3	4	5	
for one reason or another, is slow to respond to new technologies.	1	2	3	4	5	
tends to resist new technologies, which in turn, causes our current investments to lose value.	1	2	3	4	5	

6. The following profiles characterize overall strategies that companies can use to position themselves relative to their competition. Please first look at each characteristic and options, then select the profile that best describes your company. (Circle only one profile on the first row)

MY COMPANY MOST RESEMBLES (circle) →	Profile: A	Profile: B	Profile: C
Characteristics			
Core competencies	Marketing, sales, R&D, engineering	Sales, financial management	Process engineering, production
Market tactics	Rapid response to business opportunities in many areas	Quickly follow carefully selected opportunities	Maximize competitiveness in stable market(s)
Price	High	High	Low
Product line breadth	Broad, technically sophisticated	Narrow, high quality	Narrow, moderate technical sophistication
Service quality goals	High	High	Moderate/Low
Level of business process formalization	Low	Moderate	High
Level of employee autonomy	High	Moderate	Low

7. Most businesses will be some mixture of the various descriptions noted below. Indicate the level to which these qualities reflect your company.

My company is very…	**Strongly disagree**				**Somewhat agree**	**Strongly agree**
dynamic and entrepreneurial. Employees are willing to stick their necks out and take risks.	1	2	3	4	5	
chain of command oriented.	1	2	3	4	5	
The head of my company is generally considered to be…						
an entrepreneur, an innovator, or a risk taker.	1	2	3	4	5	
a coordinator, an organizer, or an administrator.	1	2	3	4	5	
The glue that holds my company together is…						
a commitment to innovation and development. There is an emphasis on being first.	1	2	3	4	5	
a set of formal rules and policies. Maintaining a smooth-running institution is important here.	1	2	3	4	5	
My company emphasizes…						
growth and acquiring new resources. Readiness to meet new challenges is important.	1	2	3	4	5	
permanence and stability. Efficient, smooth operations are important.	1	2	3	4	5	

8. From the list below, please indicate the eBusiness applications that have been implemented by your company in the U.S. to facilitate communication, transactions, collaboration, or virtual integration <u>with customers only.</u> (Circle all that apply)

1. Company web-site (public access through the Internet)
2. Extranet (authorized access to customer specific information through the Internet)
3. Third-party eMarketplace, eExchange (transactions through a "dot.com" company)
4. Direct electronic integration with customers' information system (e.g. EDI, Internet EDI, XML)
5. Other: _____
6. My company has NOT implemented any eBusiness applications WITH CUSTOMERS

If NO eBusiness applications with customers have been implemented, please go to Section III on page 7. Otherwise continue with Section II below.

Section II. eBusiness with Customers

1. Which of the following business objectives were the primary motivators for your company to implement eBusiness application(s) <u>with customers</u>? (Circle all that apply)

1. Improve customer service
2. Deepen existing customer relationships
3. Cut out middlemen in distribution channels
4. Joint product development with customers
5. Improve brand image
6. Improve operational efficiency (e.g. better forecasting, production planning)
7. Reach new customers
8. Reduce transaction cost with customers (e.g. sales, service, negotiation cost)
9. Reduce employee count
10. Faster inventory turns
11. Other: _____
12. No objectives were set or I don't know

2. Overall, how do you feel about your company's success from using eBusiness <u>with your customers</u>? (Circle only one)

Terrible	Unhappy	Mostly dissatisfied	Mixed (about equally satisfied and dissatisfied)	Mostly satisfied	Pleased	Delighted
1	2	3	4	5	6	7

3. Please indicate your level of agreement with the following statements. (Circle only one for each)

In my company…	Strongly disagree		Somewhat agree		Strongly agree
the different functional managers easily reached consensus on how to implement eBusiness.	1	2	3	4	5
the different functional managers agree on current eBusiness objectives.	1	2	3	4	5
customer service and sales representatives are involved with developing customer oriented eBusiness projects.	1	2	3	4	5
the eBusiness strategy has been effectively communicated internally.	1	2	3	4	5
the eBusiness strategy has been effectively communicated to customers.	1	2	3	4	5
business processes have been reorganized due to eBusiness implementation.	1	2	3	4	5
performance metrics have been formally adjusted to match changes due to eBusiness implementation.	1	2	3	4	5
sufficient internal training on eBusiness system has been provided.	1	2	3	4	5
Overall, I would…					
strongly recommend continuing eBusiness with customers.	1	2	3	4	5
strongly encourage use of eBusiness in the customer interface if we could develop new markets/business opportunities.	1	2	3	4	5

4. When <u>dealing with your customers</u>, using the scale provided, please indicate the extent to which each <u>function</u> is done by <u>eBusiness</u> in your company. (Circle the appropriate number for each function. Circle 0 if eBusiness is NOT utilized in the function)

<u>Examples</u>

- No promotion and advertising is done using eBusiness → → →→→→→→ <u>Circle 0</u>
- Approximately 25% of customer presales support is done using eBusiness → <u>Circle 2</u>

Business function	Percentage (%) of function conducted with eBusiness					
	0%	1-20%	21-40%	41-60%	61-80%	81-100%
Promotion and advertising	0	1	2	3	4	5
Product information dissemination (e.g. catalogue, brochures)	0	1	2	3	4	5
Presales support (e.g. inventory visibility or availability)	0	1	2	3	4	5
Order management (e.g. order status, tracking or changes)	0	1	2	3	4	5
Electronic payment	0	1	2	3	4	5
Complaint reporting	0	1	2	3	4	5
Customer support (e.g. online help, instant messaging)	0	1	2	3	4	5
Sales lead generation	0	1	2	3	4	5
Customer information tracking (e.g. purchase level, requirements)	0	1	2	3	4	5
Product development collaboration and feedback	0	1	2	3	4	5
Overall, what is your estimate of company sales revenue made using eBusiness in 2005?	0	1	2	3	4	5

5. How have eBusiness applications in your company <u>impacted</u> the following <u>business outcomes</u> compared to <u>before eBusiness</u> was implemented for use in the customer interface? (Circle one appropriate response for each outcome based on your perception)

Business Outcomes	Impact of customer interface eBusiness application					Don't Know (DK)
	DECREASED		NO EFFECT	INCREASED		
	Highly	Somewhat		Somewhat	Highly	
Sales revenue	1	2	3	4	5	DK
Quality of customer service	1	2	3	4	5	DK
Number of customers	1	2	3	4	5	DK
Company image	1	2	3	4	5	DK
Company competitiveness	1	2	3	4	5	DK
Customer satisfaction	1	2	3	4	5	DK
Information sharing with customers	1	2	3	4	5	DK
Timeliness of information supplied to customers	1	2	3	4	5	DK
Quality of information supplied to customers	1	2	3	4	5	DK
Our understanding of customer needs	1	2	3	4	5	DK
Our trust of our customers	1	2	3	4	5	DK
Our leverage over customers	1	2	3	4	5	DK
Our dependence on customers	1	2	3	4	5	DK
Our reliance on long-term customer relationships	1	2	3	4	5	DK
Our satisfaction with long-term customer relationships	1	2	3	4	5	DK
Data errors	1	2	3	4	5	DK
Inventory levels	1	2	3	4	5	DK
Order fulfillment (cycle) time	1	2	3	4	5	DK
Production planning efficiency	1	2	3	4	5	DK
Order processing efficiency	1	2	3	4	5	DK
Ability to meet on-time delivery commitments	1	2	3	4	5	DK
Timely reporting to management	1	2	3	4	5	DK
Sales force size	1	2	3	4	5	DK

6. How long ago was the first customer interface eBusiness application of any kind implemented in your company? (Circle only one)

0. Less than 1 year ago
1. 1 year ago
2. 2 years ago
3. 3 years ago
4. 4 years ago
5. 5 years ago
6. 6 years ago
7. 7 years ago
8. 8 years ago
9. 9 years ago
10. 10 years ago
11. More than 10 years ago

7. Please indicate the business functional area that was the leading proponent (champion) of eBusiness implementation with customers in your company. (Circle only one)

1. Information Technology (IT)
2. Marketing
3. Sales
4. Finance
5. Top management
6. Other: _____

***** THE LAST SECTION (p.8-9) IS OPTIONAL *****

The following two pages address the value of specific eBusiness applications to your company.

We would greatly appreciate if you would continue with the survey OR YOU MAY STOP HERE.

By completing the last two pages of the survey, the version of study results you receive will include:

1) **A managerial framework for integrating eBusiness with customers**
2) **A tool to help your company with eBusiness customer portfolio management**

Thank you for your cooperation and time in completing this survey!

*** Section III. eBusiness Value ***

1. **Please indicate YOUR OPINION on the VALUE YOUR COMPANY CURRENTLY RECEIVES (OR COULD) RECEIVE for different eBusiness applications implemented with different customer relationship types.**

Customer relationship types are:

- **Partner/Loyal customer:** Long-term committed relationship with high trust and interdependence
- **Key/Friend customer:** Established valuable relationship
- **Switcher/Transactional customer:** Price sensitive customer; Likely to switch suppliers
- **Prospect customer**: Potential customer (business transaction not yet occurred)

Value is based upon many types of benefits and cost. In general, we define value as:

VALUE = (Economic benefit + Psychological benefit) – (Economic cost + Non-economic cost)

Please circle your perception of level of value received by your company for the following eBusiness applications by customer type. (Circle only one)

a) COMPANY WEB-SITE (public access through the Internet)

Customer relationship type	**No VALUE**						**Very High VALUE**	**No Opinion**
Partner/Loyal customers	1	2	3	4	5	6	7	NO
Key/Friend customers	1	2	3	4	5	6	7	NO
Switcher/Transactional customers	1	2	3	4	5	6	7	NO
Prospect customers	1	2	3	4	5	6	7	NO

b) EXTRANET (limited access, secure online interface to manage and track orders)

Customer relationship type	No VALUE						Very High VALUE	No Opinion
Partner/Loyal customers	1	2	3	4	5	6	7	NO
Key/Friend customers	1	2	3	4	5	6	7	NO
Switcher/Transactional customers	1	2	3	4	5	6	7	NO
Prospect customers	1	2	3	4	5	6	7	NO

c) Transactions **via third-party eMARKETPLACE** or **eEXCHANGE**

Customer relationship type	No VALUE						Very High VALUE	No Opinion
Partner/Loyal customers	1	2	3	4	5	6	7	NO
Key/Friend customers	1	2	3	4	5	6	7	NO
Switcher/Transactional customers	1	2	3	4	5	6	7	NO
Prospect customers	1	2	3	4	5	6	7	NO

d) DIRECT ELECTRONIC INTEGRATION between your company and customer information systems (via e.g. EDI, XML)

Customer relationship type	No VALUE						Very High VALUE	No Opinion
Partner/Loyal customers	1	2	3	4	5	6	7	NO
Key/Friend customers	1	2	3	4	5	6	7	NO
Switcher/Transactional customers	1	2	3	4	5	6	7	NO
Prospect customers	1	2	3	4	5	6	7	NO

2. Indicate the percentage of your customers transacting via eBusiness for each application listed below.

	% of Customers Transacting Via eBusiness					
eBusiness application	**0%**	**1-20%**	**21-40%**	**41-60%**	**61-80%**	**81-100%**
Extranet	0	1	2	3	4	5
Via eMarketplace, eExchange	0	1	2	3	4	5
Direct electronic system integration	0	1	2	3	4	5

3. Distribute 100% to describe the share of partner, key, and switcher customers in your total customer portfolio.

Partner/Loyal customers	_____	**%**
Key/Core customers	_____	**%**
Switcher/Transactional customers	_____	**%**
Total	**100**	

Thank you for your cooperation and time in completing this survey.

VITA

Sanna Maria Kallioranta was born in 1978 in Tampere, Finland. She received her Bachelor of Science degree in forest economics and marketing from the University of Helsinki, Finland, on May 2001. She completed her Master of Science degree as the first forest industry sponsored ForestExpress eBusiness Fellow in Louisiana State University in May 2003. Her Doctor of Philosophy degree has a strong specialization on forest products marketing and eBusiness. In addition to majoring in forest products marketing, she has strong minors both in marketing and information and decision sciences. She has several internship experiences from the paper industry and eBusiness, both from Finland and United States.