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Measuring E-Commerce Technology Enabled Business Value:
An Exploratory Research

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ABSTRACT

While a plethora of anecdotal evidence exists, there is little empirical evidence on the value-creating potential of e-commerce technologies. The present research investigates whether firms using e-commerce technologies are successful in generating business value and, if so, what e-commerce drivers determine success and how to best use these drivers. This work shows how diffusion theory can be used to analyze the wide-spread utilization of e-commerce technologies and how they create business value. It presents an exploratory model of e-commerce business value grounded in information technology (IT) business value and productivity literature. We use a sample from more than 550 company executives, identified as innovative and successful users of IT.

Keywords: *B2B e-commerce; B2C e-commerce; e-business; e-commerce models; Internet-commerce*

INTRODUCTION

Internet has been used to share information for quite some time, but the idea of using it for commercial exchange and as a supplier of commercial value matured in the mid to late 1990s. Reasons were that, initially, the Internet lacked both the necessary security and the degree of standardization needed to share data safely.

In the late 1990s, companies scrambled to create their online "shopping centers," allowing them to bypass intermediaries. This enabled cost savings, often passed on to customers. Internet provided value by increasing processes effi-

ciency, shortening lead times, and automating processes that previously required personnel.

The ease of establishing companies online (e-business) and marketing products through the Internet became a tremendous lure for many technically inclined with entrepreneurial interests. This affected the economy through the proliferation of companies whose core competency is partially or fully associated with Internet. Despite the 1999-2000 demise of a number of dot-coms, many traditional brick-and-mortar companies have invested and continue to invest heavily in e-commerce technologies. The U.S. Census Bureau estimated that retail e-commerce sales for 2005 were $87.1 billion, an increase of 24.88% over 2004 (www.census.gov). Forrester Research forecasts that retail online sales will continue to grow at annual rates of up to 25% (Johnson, Delhagen, & Yuen, 2003). Measuring benefits from e-commerce initiatives is hard because some benefits are qualitative and the difficulty of collecting data.

The information technology (IT) productivity and business value literature suggests that these firms have achieved enormous performance and productivity gains by integrating e-commerce channels with their existing brick-and-mortar channels, transforming themselves into a click-and-mortar business. Cisco, Dell, and Boeing are examples of click-and-mortar organizations that have achieved significant economic benefits with e-commerce technologies. Cisco claims to be the single largest e-commerce user in the world, with 90% of its 2000 sales (about $18.9 billion), from online sales. 82% of its customer inquiries are handled online (McIlvaine, 2000) and 83% of questions concerning support are answered through Cisco's Web-based self service tools ("Customer Care," 2001). Cisco's revenues and net income increased significantly since 1992 and its stock price soared to the point that Cisco is the company with the highest market capitalization in the world in 2000 (Kraemer & Dedrick, 2002).

Dell reported over 250% return on invested capital from its logistics and order fulfillment systems (Dell.com, November 2000). In July of 2004, the Dell site logged 9.2 million first time visitors and ranked 49th in the Top 50 Internet Properties (marketingfacts.nl, http://www.mediafact.nl/comments.php?id=9_0_1_0_C). Online PC sales are more than $1 million dollars every day. Boeing's electronic intermediary, PART online, allowed it to process 20% more shipments per month in 1997 than in 1996 with the same number of data entry people while eliminating 600 phone calls per day (Teasdale, 1997). Boeing employs an information integration system, Exostar, to coordinate information between 11,000 suppliers. (Exostar, http://www.mediafact.nl/comments.php?id=9_0_1_0_C).

Despite these anecdotes and others, there is little empirical evidence in the IT productivity and business value literature regarding the payoffs from e-commerce business, especially for large click-and-mortar companies (Brynjolfsson & Kahim, 2000). Except for a study by Zhu (2004), we found no articles that investigated the business value of e-commerce. Zhu assessed the e-commerce payoffs indirectly via an interaction effect between IT infrastructure and e-commerce capability, which he found positive, concluding that this relationship positively contributes to firm performance in terms of sales per employee, inventory turnover, and cost reduction. Zhu's study did not look at the stand-alone impact of e-commerce technologies on firms' performance. He grounded his research on resource-based theory, whereas we used Rogers' (1983) diffusion theory for ours.

The fundamental objective of this research is to assess the e-commerce technology enabled business value. Specifically, we investigate whether firms using e-commerce technology are successful in generating business value, what e-commerce drivers determine success, and how to best use these drivers. We propose using diffusion theory to analyze the widespread utilization of e-commerce technologies to better understand how these technologies create business value. We present an exploratory model of e-commerce business value grounded on IT business value and productivity literature (e.g., Kauffman & Kriebel, 1988; Mahmood &

Mann, 1993; Zhu, 2004) and validate it using data from companies with e-commerce experience. Our research pertains mainly to B2C e-businesses, but we believe our results also apply to B2B e-commerce business success because all constructs in our model also refer to B2B e-businesses.

THEORETICAL FOUNDATION

Diffusion theory studies adoption of innovations through (as a function of) time and identifies and understands factors that influence adoption behavior. Mahajan and Peterson (1985) and Rogers (1983) are good sources for the fundamental and other diffusion models, which include the logistic, Gompertz, and exponential: $f(t) = (K + C*B^t)^{-1}$, $f(t) = K * C\text{^}(B^t)$, and $f(t) = e^{C - B/t}$, respectively. Here t is time; f(t) measures diffusion; and K, C, and B are parameters (estimated with time series curve-fitting techniques) that determine the function shape. The cumulative adoption of innovations is S-shaped.

Gurbaxani and Mendelson (2001) studied IT diffusion in the United States. They argue that the innovation (or technology) price is an important factor that should be incorporated into diffusion models. Their price-adjusted logistics, Gompertz, and exponential models are $f(t) = e^{\lambda t} * (K + C*B^t)^{-1}$, $f(t) = K * C\text{^}(B^t) * e^{\lambda t}$, and $f(t) = e^{C - B/t + \lambda t}$, respectively, where λ captures price change. They conclude that these models explain diffusion patterns and IT spending growth better than "pure diffusion" models.

We contribute an idea that takes diffusion models one step forward. Price reduction is important, but diffusion may be strong even if prices rise (when benefits more than offset costs). We propose incorporating cost-benefit relations. A thorough analysis would study these models using longitudinal data, not yet available. Thus this research requires two steps: 1) identifying factors that result in positive cost-benefit relationships, and 2) incorporating these factors into diffusion models. We cannot validate these models here (lack of longitudinal data), but we use cross-sectional data to analyze relationships among the following factors, selected based on a thorough literature review: 1) Interorganizational systems availability (IOrSA): extent to which e-commerce helps integrating different systems and makes workflow processes easier; 2) Online systems efficiency (OnSE): availability of uniform operating and highly automated mechanisms using e-commerce technologies; 3) IT Alignment to organizational strategies (ITOrS): how much the organization supports Internet-enabled IT; 4) Online systems quality and effectiveness (OnSQE): Web site design and availability; and 5) e-commerce business success (ECBS). Because the latter clearly indicates "benefits," we propose incorporating IOrSA, OnSE, ITOrS, and OnSQE in e-commerce diffusion models as indicators of the cost-benefit relationship. When historical data become available, we will build on Gurbaxani and Mendelson's (2001) ideas to develop and test (i.e., curve-fit) the corresponding models. For example, the "price and e-commerce-business-success-adjusted" Gompertz model may include:

$$f(t) = K * C\text{^}(B^t) * e^{\lambda t} * \alpha_1 \text{ IOrSA} * \alpha_2 \text{ OSE} * \alpha_3 \text{ ITOS} * \alpha_4 \text{ OnSQE},$$

where $\alpha_1, \alpha_2, \alpha_3$, and α_4 are four parameters to estimate from the data, like K, B, and C. One can build similar "price and e-commerce-business-success-adjusted" logistics or exponential models. This idea is a contribution of this research.

LITERATURE REVIEW

There is little or no empirical research in e-commerce business value, but some related concepts already identified include business value; e-commerce impact; and e-commerce businesses success and failure. We drew useful insights from IT business value and other related literature. There are studies on factors contributing to IT systems success or failure comparable to e-commerce success and failure. Thus, the IT business value literature provides background information and theoretical support for our e-commerce success model. Our IT business value literature review suggested incorporating five constructs in our analysis.

IT Alignment to Organizational Strategies (ITOrS)

This construct measures the degree to which the strategies, goals, and objectives of a firm's IT are aligned to its organization's strategies, goals, and objectives. If so, top management support for IT initiatives is strong, which is a critical success factor for IT projects. This support takes various forms including appointing an executive level manager as the Chief Information/Technology Officer and allowing IT to influence, through the adoption of e-mail and other Internet technologies, the way the company conducts business. Indicators of alignment include the presence of IT managers with executive authority; the level of executives support to e-commerce and other IT-related initiatives; and whether the organization has a learning and adaptive culture that allows innovations to take root in its functional environment.

Segars and Grover (1998) evaluate the strategic impact of IT. They suggest that paying attention to aligning IT strategy with business strategy, understanding systems processes, and support of management and end-user groups are crucial to IT planning success. Barua, Kriebel, & Mukhopadhyay (1991) analyze the strategic use and impact of IT implementation. Reich and Benbasat (2000) found that communication between IT and business executives, the connection level between IT and business planning processes, and the extent of shared domain knowledge leads to better alignment of IT and business strategies in the short and long terms. Feeny and Ives (1990) focus on sustained strategic advantage generated through IT applications. Teo and Ang (1999) identify top management commitment to the strategic use of IT, IS management business knowledge, and top management confidence in the IS department as critical success factors. Teo and King (1996) studied potential inhibitors and facilitators of development of successful IT applications with strategic value. They found that integrating business planning and IT planning results in IT more effectively supporting business strategies. Some companies explicitly align IT to organizational strategy. Wal-Mart, for example, has separate e-commerce headquarters in California for the company's e-commerce business needs.

Interorgnizational Systems Availability (IOrSA)

IOrSA refers to the extent to which e-commerce helps integrating different systems and makes workflow processes easier between different organizations, thus creating e-commerce business value. E-commerce technologies like extranets allow businesses to connect suppliers, customers, and other partners, resulting in competitive advantages. E-commerce adds value by introducing new channels for buying, selling, and providing information to stakeholders. Some of the readily apparent benefits are reduction in employee costs and communication costs. Hidden benefits include better relationships with upstream and downstream business partners.

Dai and Kauffman (2002) point out that firms can conduct successful B2B transactions by creating interorganizational systems. Barua, Konana, Whinston, and Yin (2001) indicate that the readiness of business partners to implement e-commerce technologies is critical to achieving business excellence and online systems efficiency. Bakos (1991) uses economic theory to understand why electronic marketplaces work and when they are of strategic value. Electronic marketplaces improve interorganizational coordination and reduce search costs. Bakos (1997) points out that commodity and differentiated markets respond differently to the integration enabled by electronic marketplaces. Reduction in search costs occurs differently in these markets. Bakos (1998) explains that electronic marketplaces create more efficient and friction-free markets. According to Benjamin and Scott (1988), one of the reasons for IT success is that it enables, through online databases and telecommunication networks, new forms of integration that result in better cost performance and increased data integration. Kickul and Gundry (2001) argued that maintaining better relationships and integrating with suppliers is crucial for the company sustenance process. Johnston and Vitale (1988) suggested that, if carefully identified and used,

interorganizational systems give significant competitive advantages to organizations.

Online Systems Efficiency (OnSE)

Automated, uniform operating mechanisms through e-commerce technologies that function in tandem with existing mechanisms result in better online systems efficiency and cost savings. Online customer service in terms of FAQ's, chat rooms, and links to call centers indicate high levels of online systems efficiency.

Banker, Kauffman, and Morey (1990) distinguish between impacts of IT investment on competitive efficiency and on online systems efficiency. Mukhopadhyay, Kekre, and Kalathar (1995) study an electronic data interchange system at Chrysler over 10 years and observe that it has caused massive cost savings and has imparted system-wide discipline and integrative value to the company. Stratopoulos and Dehning (2000) show that firms making successful IT investments are more successful at solving the productivity paradox than those that make failed or abortive IT investments. Hitt and Brynjolfsson (1997) analyze the effects of IT on the internal firm organization and find that IT is associated with authority decentralization, increased knowledge work, and decreased observability. Brynjolfsson and Hitt (1998) find that productivity payoffs from computerization are not automatic, but part of a series of productivity changes that make financial sense. Barua, Konana, Whinston, and Yin (2001) show that the readiness of business partners to implement e-commerce technologies is critical for business excellence and online systems efficiency.

Online System Quality and Effectiveness (OnSQE)

OnSQE relates to online presence effectiveness through e-commerce site design and availability. Previous research analyzes factors that make a Web site successful, which is associated to overall e-business success. E-commerce has improved interaction of companies with customers. The ability to offer products and services worldwide on a 24/7 basis is a value-adding attribute of e-business. Web sites are means that firms can use to influence customer's perceptions of its business. Customers perceive Web site security and access time as critical. This is why firms try to improve users' perceptions by increasing their Web site security and aligning with recognizable Internet security agencies and protocols. Other important factors include ease of use, quality of design, and value for the customer.

Moon and Kim (2001) argue that the acceptance of Internet is similar to the "perceived ease of use" (PEOU) component of the Technology Acceptance Model. Acceptance of new technologies varies depending on the technology type, target users, and context. They measure online presence effectiveness through design and availability aspects of e-commerce sites. Gefen and Straub (2000) argue that PEOU plays an important role in actual use and success of systems. Liu, Arnett, and Litecky (2000) indicate that attractiveness, design quality, and information available on Web sites are the most important factors influencing purchase decisions of customers. Zhang, Von Dran, Small, and Barcellos (1999, 2000) use Herzberg's hygiene-motivation theory to study how the general "hygiene" or perceptual quality of a Web site affects users' motivation to use the Web site. Zhang and Von Dran (2001) study features that generate "delight," "motivation," and "loyalty" of Web site users. For Lederer, Maupin, Sena, and Zhuang (2000) the "ease of use" is important for successful Web sites. Keeney (1999) stresses the importance of identifying value propositions and developing e-commerce value models for customers. Rose and Straub (1999) identify excessive download time as one of the most serious technological impediments to e-commerce.

E-commerce Business Success (ECBS)

Performance, productivity, and perception are factors that can be used to measure ECBS. Performance has been measured in the IT business value literature with financial ratios: return on investment (ROI), return on equity (ROE), re-

turn on sales (ROS), growth in revenue (GINR), and net income over invested capital (NIC). Cron and Sobol (1983) and Dos Santos, Peffers, and Mauer (1993) employed ROI. Barua, Kriebel, and Mukhopadhyay (1995), Hitt and Brynjolfsson (1994), and Strassman (1990) used NIC. Hitt and Brynjolfsson (1994) and Mahmood and Mann (1993) applied ROS. Woo and Willard (1983) used GINR. Dehning and Richardson (2002) analyze the IT systems success through ROI, ROE, and ROS. Productivity has been assessed in terms of two ratios: sales to total assets (STA) and sales by employee (SE). Brynjolfsson and Hitt (1993) used a measure similar to STA, total sales. Strassman (1990) employed SE.

Perception has been measured through company's image, customer satisfaction, product service innovation, and number of return customers. The first three create customer loyalty that results in return purchases. Loyalty is one of the most significant contributors to business profitability (Turban, King, Lee, Warkentin, & Chung, 2002). It can also reduce costs: it costs five to eight times more acquiring new customers than keeping existing ones. Reichheld (2001) provides a review of the use of Internet to foster customer loyalty.

Despite the fact that initial costs are high, continuous support for e-commerce strategy is essential for the success of e-commerce initiatives. Barua et al. (2001) observe that e-business affects large and small companies differently. Smaller companies experience a quick impact because of immediate expanded geographic reach. Larger companies face more complexity and need to pay considerable attention to the drivers and need to establish an appropriate infrastructure before acceptable payback is received. Dekleva (2000) identifies four environmental variables that affect e-businesses: building trust so consumers engage in e-commerce, establishing a legal framework for e-commerce operations, enhancing information systems infrastructure by improving technical resources, and maximizing benefits via increased integration across systems. Amit and Zott (2001) identified four value creating components in e-commerce companies: efficiency, complimentarity, lock-in, and novelty. Lee and Clark (1997) analyze factors contributing to the successful implementation of electronic market systems.

Other factors affect ECBS similar to IT investments (Mahmood et al., 2000; Mahmood & Mann, 2001). Melville, Kraemer, and Gurbaxani (2004) used an integrative model of IT business value to describe relationships between IT and organizational performance. Chan (2000) identifies the need to take "soft" factors into account when measuring IT value. Chircu and Kauffman (2000) consider hard (e.g, better financial performance and sales increases) and soft (e.g, better market position and supplier relationships) IT benefits. DeLone and McLean (1992) review existing research (180 articles) on MIS success and identify six IS success dimensions: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. Teo and Ang (2000, 2001) analyze how IT planning leads to IT success and study existing problems during IT planning processes. Dos Santos, Peffers, and Mauer (1993) and Im, Dow, and Grover (2001) discuss effects of IT investments on firm's value.

The fundamental objective and contribution of the current exploratory research is to formulate and test a model for e-businesses value creation. The model is a reference framework for strategic managers with guidelines for e-business initiatives. Also, the model constructs can be a foundation for investigation of different e-commerce drivers and their relationships with business value measures. There may be additional environmental factors associated with successful e-commerce implementations, so additional goals of this article are to establish theoretically grounded constructs, factors, and ideas for future research. This study is important because it is the first empirical study that **directly** addresses the business value of e-commerce technologies initiatives.

MODEL AND HYPOTHESES

We used five constructs identified in the IT business value/success literature to build a model (see Figure 1) that captures drivers of e-business success and relationships among them.

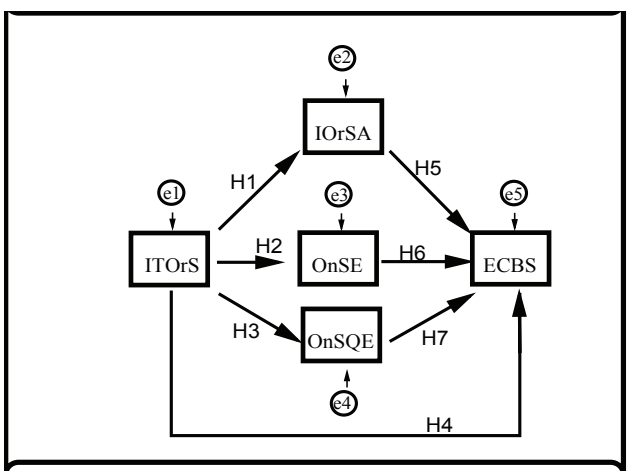
The model suggests the way ITOrS, IOrSA, OnSE, and OnSQE interact with each other and together affect ECBS. It also helps understanding the tasks a brick-and-mortar company has to complete as well as the processes it needs to undertake to have successful e-commerce initiatives.

Hypotheses

Hypothesis 1: This proposition examines the relationship between the degrees of ITOrS and IOrSA. ITOrS measures the degree to which the strategies, goals, and objectives of a firm's IT are aligned to its organization's strategies, goals, and objectives. When this occurs, top management support for IT initiatives is stronger, which appears to be critical for any IT project. Indicators of alignment include presence of IT managers with executive authority, level of support given by executives to e-commerce initiatives, and whether the organization has a learning and adaptive culture that allows innovations to take place in its functional environment. The presence of these indicators should have a positive impact on the integration of the different systems and improvement of workflow processes between organizations, creating e-commerce business value. Barua et al. (2001) indicate that the readiness of business partners to implement e-commerce technologies is critical to achieving business excellence and online systems efficiency. Segars and Grover (1998) evaluate the strategic impact of IT, suggesting that aligning IT strategy with business strategy, understanding systems processes, and support of management and end-user groups are crucial to IT planning success. These lead to:

H1: *Businesses with higher levels of IT alignment to organizational strategies (ITOrS) will be more likely to achieve higher levels of inter-organizational systems availability (IOrSA).*

Figure1. E-commerce business value model



ITOrS - IT alignment to organizational strategies
IOrSA - Inter-organizational systems availability
OnSE - Online systems efficiency
OnSQE - Online system quality and effectiveness
ECBS - Electronic commerce business success

Hypothesis 2: This proposition considers the relationship between the level of ITOrS and the likelihood of obtaining OnSE. While ITOrS is measured in terms of top management support, existence of top IT executives, and other similar factors, OnSE is measured with productivity and efficiency measures. Online systems that impact productivity and efficiency will garner more management support, which will ensure these systems are more aligned toward organizational goals and strategies. Huselid and Becker (1997) identify synergies between implementing efficient systems and their strategic alignment. Sanders and Premus (2002) classify firms into high-, medium-, and low-level IT users depending on their level of IT sophistication. They cite efficiencies gained via IT in terms of automation as an enabler for managers to focus on strategic issues and competencies. Lederer, Mirchandari, and Sims (2001) investigate strategic advantages from using Internet. They propose that efficiencies created by Web-enabled systems affect strategic alignment positively by improving customer relations. Banker et al. (1990) distinguish between impacts of IT investment on competitive efficiency and on online systems efficiency. Mukhopadhyay et al. (1995) observe that an electronic data interchange system at Chrysler has caused massive cost savings and imparted system-wide discipline and integrative value to the company. These lead to:

H2: *Businesses with higher levels of IT alignment with organizational strategies (ITOrS) will be more likely to achieve higher levels of online systems efficiency (OnSE).*

Hypothesis 3: This hypothesis examines the relationship between ITOrS and OnSQE. The more IT is aligned to the organization's strategies the more successful it will be at obtaining management support for creating higher quality and effective online presence. Also, because the online interface presents the gateway to the company, top management is eager to portray an elegant interface reflecting a better company image. Kowtha and Choon (2001) mention how the sophistication of a firm's Web site reflects the strategic priorities of the firm. They suggest that critical competencies in e-commerce have little to do with technology and more with managerial domain and priorities and that strategic commitment has substantive and high significant effects on Web site development. Peak and Guynes (2003, 2003-1) point out that aligning IT with organizational strategies improves information quality, resulting in improved quality of products and services. These lead to:

H3: *Businesses with higher level of IT alignment to organizational strategies (ITOrS) will be more likely to achieve higher levels of online system quality and effectiveness (OnSQE)*

Hypothesis 4: This hypothesis examines the critical relationship between ITOrS and ECBS. Some studies mention top management commitment and involvement in IT projects as important factors for IT systems success. Lack of commitment and involvement is among the top 10 problems leading to IT projects failure (Johnson et al., 2001). Pollalis (2003) confirms that alignment of IT to organizational strategies leads to better performance of banks. Sun and Hong (2002) find wide support in the literature for a significant direct effect of strategic alignment on business performance in manufacturing strategy. Burn and Szeto (1999) say that it is critically important to align business and IT planning. They point out that business success depends on linking business strategy; IT strategy; organizational infrastructure and processes; and IT infrastructure and processes. They argue that the role of IT management is to lead and maintain close alignment between IT functions and business strategy. Brown (2003) suggests that developing strategic performance metrics for the IT human resource function creates closer IT alignment with strategic objectives. These lead to:

H4: *Businesses with higher level of IT alignment to organizational strategies (ITOrS) will*

be more likely to achieve e-commerce business success (ECBS).

Hypothesis 5: This hypothesis examines the relationship between IOrSA and ECBS. Dai and Kauffman (2002) argue that firms can conduct successful B2B transactions by creating interorganizational systems. Barua et al. (2001) indicate that the readiness of business partners to implement e-commerce technologies is critical to achieving business excellence and online systems efficiency. For Bakos (1991), electronic marketplaces improve interorganizational coordination and reduce search costs. He explains that electronic marketplaces create more efficient, friction-free markets. According to Benjamin and Scott (1988) one of the reasons for IT success is that it enables new forms of integration that result in better cost performance and increased data integration. Kickul and Gundry (2001) argue that maintaining better relationships and integrating with suppliers is a crucial element of the company sustenance process. Johnston and Vitale (1988) defend that if carefully identified and used, interorganizational systems give significant competitive advantages to organizations. Epstein (2000) says that integration of processes and systems translates into business success. Huang, Chen, and Frolick (2002) argue that using Internet to integrate data leads to better business value. Dai and Kauffman (2002) say that firms can conduct successful B2B transactions by creating interorganizational systems. Mebane Packaging achieved better efficiency and the chain of supermarkets Somerfield Stores improved its business efficiencies with its systems integration project (Thomas, 2003). These lead to:

H5: *Businesses with higher level of Interorganizational systems availability (IOrSA) will be more likely to achieve e-commerce business success (ECBS).*

Hypothesis 6: Firms with efficient e-commerce systems should be at a relatively better position to achieve more business success. Lederer et al. (2001) point out that strategic advantage from Internet is created through increased efficiency of processes. Mukhopadhyay et al. (1995) observe that an electronic data interchange system at produced massive cost savings and imparted system-wide discipline and integrative value. Stratopoulos and Dehning (2000) show that firms making successful IT investments are more successful at solving the productivity paradox than those that make failed or abortive IT investments. Hitt and Brynjolfsson (1997) analyze the effects of IT on the internal firm organization and find that IT is associated with authority decentralization, increased knowledge work, and decreased observability. These lead to:

H6: *Businesses with higher online systems efficiency (OnSE) will be more successful in realizing e-commerce business value (ECBS).*

Hypothesis 7: This hypothesis purports that the quality and effectiveness of the Web site drives e-commerce success. Zhu and Kraemer (2002) point out that better e-commerce capability serves to improve the effectiveness of investments on e-commerce initiatives through firm performance. Chaudhury, Mallick, and Rao (2001) mention that enhancement of Web site quality can improve business value. Huang et al. (2002) say that evaluating Web data quality is important to determining business value of online data. Liu et al. (2000) indicate that the attractiveness, design quality, and information available on Web sites are the most important factors influencing customers purchase decisions. Lederer et al. (2000) point out that the "ease of use" quality is important for successful Web sites. Rose and Straub (1999) identify excessive download time as one of the most serious technological impediments to e-commerce. These lead to:

H7: *Businesses with higher levels of online system quality and effectiveness (OnSQE) will have better chances of achieving e-commerce business success.*

DATA COLLECTION

Based on existing literature, we designed a questionnaire (Appendix) to gather information on e-business success. It contains 31 questions, each on a seven-point Likert scale with values ranging from 1 (strongly disagree) to 7 (strongly agree). Each construct was built using a series of items. ITOrS comprises five items: *i*) alignment of IT strategies with top management strategies, *ii*) whether IT is considered part of the long term strategies, *iii*) whether IT executives have decision making roles, *iv*) IT structure features, and *v*) overall organizational learning environment. IOrSA was measured in terms of whether: *i*) the firm has Internet-enabled systems to share information with upstream and downstream entities, *ii*) there are effective automated order changing systems, *iii*) data is automatically transmitted and processed, *iv*) it is possible to track inventory and purchasing continuously, *v*) there exists an online procurement system, and *vi*) Internet expertise is an important selection criteria for suppliers/vendors. OnSE contains five items: *i*) degree of online business transactions, *ii*) availability of online customer service, *iii*) availability of automated order tracking systems, *iv*) possibility of resolving customer requests online, and *v*) availability of systems to monitor orders continuously. OnSQE is based on five Web site features: *i*) security, *ii*) attractiveness, *iii*) navigability, *iv*) flexibility, and *v*) continuous Web site availability. ECBS is measured in terms of *i*) return on investment; *ii*) return on sales; *iii*) revenue growth; *iv*) net income over invested capital; *v*) sales over total assets; *vi*) sales by employee; *vii*) company image; *viii*) customer satisfaction; *ix*) product/service innovation; and *x*) return of customers.

The data to test our model comes from surveying 550 companies, identified as premier companies that have successfully implemented e-commerce technologies or strategies and have been able to create positive value operationally or financially. They were listed in *Information week 500* and *Internet week 100*, two premier computer magazines that survey innovative and successful uses of IT for competitive advantage. The instrument was mailed to IT executives. The respondents replied via mail or online. In order to increase response rate, we sent the instrument to local stores managers of national chains (e.g., Target and Dillards). We also surveyed a group of Boeing executives attending an MBA-level e-commerce class. Individual identity and responses were masked for confidentiality.

We received 43 responses. Incomplete responses, seven of them, were not used. Forty one companies had more than 1 million in revenues. The other two companies did not provide revenue information. About 42% of the respondents were executive technology officers; 32% middle managers; and 26% store managers or associates. About 2% of the responses were from companies using all three modes of business: Business to Business (B2B), Business to Consumer (B2C), and Consumer to Consumer (C2C). Overall, there were 60% in B2B, 72% in B2C, and 2% in C2C. About 44% were involved in both B2B and B2C. Around 14% were exclusively B2B and 23% exclusively B2C. The average number of employees was 98,000. Surveying took about 6 months during 2002.

RESULTS

We report next statistical results for constructs validations; model fit; and hypotheses and paths analysis. Partial Least Square (PLS) is suited for problems with small sample sizes and is often used for exploratory model testing and validation. However, we used an AMOS/LISREL approach to analyze our structural equation model because it yields similar results for small samples and offers more statistics (AMOS (Arbuckle, 1989). Wold (1989), for example, also used this approach on a data set of 10 cases and 27 variables.

Constructs' Validation

Unidimensionality: To verify that all items loaded well in their constructs, we used factor analysis for unidimensionality tests with a reference norm of 0.40 as suggested by Mahmood and Sniezek (1989). Table 1 contains the results.

Except item #2, all remaining items in IOrSA load satisfactorily (> 0.40). All items in OnSE load well (> 0.46). All items in ITOrS load strongly (> 0.82) except item #3 which loads at 0.59. All items in OnSQE load well (> 0.58). The items in ECBS also load well (> 0.59). The average variance extracted (from communalities from factor analysis) is 0.54, 0.42, 0.62, 0.37, and 0.57 for IOrSA, OnSE, ITOrS, OnSQE, and ECBS, respectively.

Reliability: Cronbach's coefficient alpha, one of the most widely used reliability tests, was estimated to ensure that the items in the five constructs (convergent validity) were internally related as expected. ITOrS, IOrSA, OnSE, OnSQE, and ECBS have reliability scores of 0.90, 0.76, 0.67, 0.81, and 0.93, respectively. Nunnally (1978) and Hair, Anderson, Tatham, and Black (1998) suggested a Cronbach alpha threshold of 0.60 for exploratory research. All constructs met this level.

Validity: Table 2 presents correlations between constructs. Divergent or discriminant validity requires the constructs not correlating highly with each other (Campbell & Fiske, 1959). Almost all correlations are below 0.50, but IOrSA-OnSE, IOrSA-ITOrS, ITOrS-ECBS and OnSQE-ECBS involve some measure of overlap. In fact, all constructs correlate to some extent as the processes contributing to the success of an e-business can be expected to interweave and overlap among themselves.

Because our analysis did not provide unambiguous discriminant validity results, we used a more rigorous factor-based procedure: the average variance extracted (AVE) method proposed by Fornell and Larcker (1981) (see Tables 3 and 4). Constructs are different if the AVE for a set of constructs is greater than their shared variance. Table 4 provides a matrix of squared covariance of constructs with each other. The diagonal elements are replaced with the AVE for the column construct. Discriminant validity is confirmed if the diagonal element for a given construct is larger than any squared covariance in the column or row in which it is found. Using this benchmark, there is evidence that all constructs in our model pass the discriminant validity test.

Table 1. Scale development

Construct	Number of Items or questions	Mean	Standard Deviation	Cronbach Alpha	Factor Loadings	Variance Extracted
IOrSA	6	5.00	0.90	0.76	0.501, 0.148, 0.614, 0.763, 0.683, 0.648	0.54
OnSE	5	4.98	0.92	0.67	0.584, 0.701, 0.545, 0.613, 0.459	0.42
ITOrS	5	5.55	1.01	0.90	0.861, 0.881, 0.592, 0.837, 0.884	0.62
OnSQE	5	5.24	1.00	0.81	0.748, 0.752, 0.890, 0.583, 0.677	0.37
ECBS	10	5.29	0.98	0.93	0.767, 0.796, 0.807, 0.792, 0.751, 0.590, 0.794, 0.833, 0.880, 0.585	0.57

Table 2. Correlations among constructs

Construct	IOrSA	OnSE	ITOrS	OnSQE	ECBS
IOrSA	1.000				
OnSE	0.520	1.000			
ITOrS	0.641	0.464	1.000		
OnSQE	0.373	0.471	0.403	1.000	
ECBS	0.498	0.467	0.609	0.558	1.000

Table 3. Average variance extracted (AVE)

Construct	S1	S2	AVE
IOrSA	2.12	3.88	0.35
OnSE	1.72	3.28	0.34
ITOrS	3.35	1.65	0.67
OnSQE	2.72	2.29	0.54
ECBS	5.85	4.15	0.59

Table 4. Squared covariance and AVE

	ITOrS	IOrSA	OnSE	OnSQE	ECBS
ITOrS	0.35	0.331	0.198	0.181	0.365
IOrSA	0.331	0.34	0.186	0.116	0.181
OnSE	0.198	0.186	0.67	0.212	0.182
OnSQE	0.181	0.116	0.212	0.54	0.318
ECBS	0.365	0.181	0.182	0.318	0.59

Results

Paths ITOrS →IOrSA, ITOrS → OnSE, ITOrS → OnSQE, ITOrS → ECBS, and OnSQE → ECBS are significant, with coefficients 0.64, 0.46, 0.40, 0.39, and 0.34 (significant at .01, .05, .05, .05, and .05 levels), respectively. Paths IOrSA → ECBS and OnSE → ECBS, with regression weights .09 both, were not significant. The model itself is significant at .034 with a chi-square of 8.681 and 3 df (the chi-square value for SEM analyses should not be significant if there is good model fit to the data) (see Figure 2). The chi-sq is sensitive to sample size (Bentler & Bonnett, 1980), thus, we used the chi- sq/df ratio. This ratio is less than 5, threshold suggested by Hayduck (1987) as acceptable.

Because the sample size for this research is small, the comparative fit index (CFI) is first used to test fit between the model and the data. The CFI value for the proposed model is .90, satisfying the standard suggested by Hu and Bentler (1999). We further tested the model-to-data fitness with the goodness-of-fit index (GFI). Our GFI of 0.91 surpasses the .90 value recommended by Kline (1998). We finally report the incremental fit index (IFI), which is 0.91. A value above .90 is acceptable. Aforementioned results related to the model in Figure 2 reveal good fit of the model to the data.

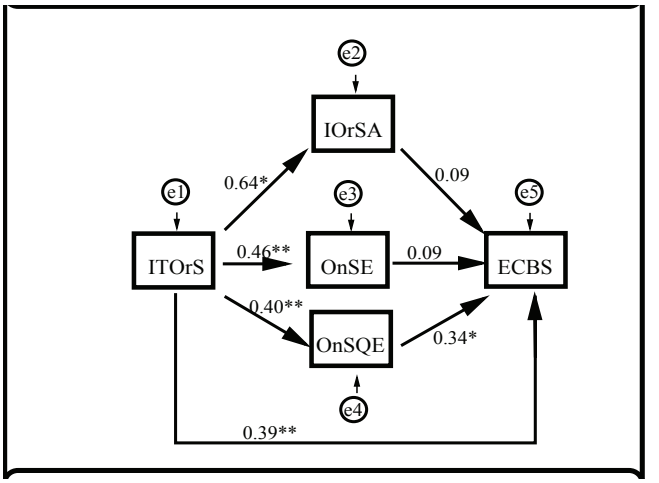
Discussion

Our results confirm that IT alignment to organizational strategies (ITOrS) positively and

Table 5. Model fit statistics

Model	Chi sq/ df	CFI	GFI	IFI
M1: Hypothesized Model	2.89	0.90	0.91	0.91
M2: Independent Model	6.61	0.00	0.49	0.00

Figure 2. Results of the hypothesized model



* *Significant at the .01 level*
** *Significant at the .05 level.*

ITOrS - IT alignment to organizational strategies
IOrSA - Inter-organizational systems availability
OnSE - Online systems efficiency
OnSQE - Online system quality and effectiveness
ECBS - Electronic commerce business success

significantly affect Interorganizational System Availability (IOrSA) (H1). In other words, if evidence of this alignment is present in a firm it should have a positive and significant impact on integrating different systems and making workflow processes easier between organizations. Our results support Barua et al. (2001), who indicated that the readiness of business partners to implement e-commerce technologies is critical to achieving business excellence and online systems efficiency. They also support Segars and Grover (1998) as they suggested that aligning IT strategy with business strategy, understanding the systems processes, and the support of management and end-user groups are crucial to IT planning success.

Our results confirm that higher ITOrS positively and significantly affect the likelihood of achieving OnSE (H2). They support Huselid and Becker's (1997) suggestion about synergies existence between implementing efficient systems and their strategic alignment. They also support Lederer et al. (2001) assertion that the efficiencies created by Web-enabled systems affect strategic alignment positively by improving customer relations. Our results are also in line with Mukhopadhyay et al. (1995) findings on EDI at Chrysler suggesting that the EDI system has caused massive cost savings and has

imparted system-wide discipline and generated integrative value for the company.

Our results confirm that ITOrS positively and significantly affect OnSQE (H3). That is, the more a company's IT is aligned to its parent organization's strategies the more successful it will be in obtaining management support for creating higher quality and effective online presence. These results are in line with the literature. Peak and Guynes (2003, 2003-1) point out that aligning IT with organizational strategies improves information quality, resulting in improved quality of products and services. Kowtha and Choon (2001) mention how the sophistication of a firm's Web site reflects the firm's strategic priorities. They suggest that strategic commitment has substantive and significant effects on Web site development.

Our results support the relationship between ITOrS and ECBS (H4), finding this relationship significant and positive. This agrees with the literature. Pollalis (2003) confirms that IT alignment to organizational strategies leads to better performance of banks. Sun and Hong (2002) find support in the literature for significant and direct effects of strategic alignment on business performance in manufacturing strategy. Burn and Szeto (1999) classify this alignment as critically important for business success.

Our results also support the relationship between OnSQE and ECBS (H7). Thus, we agree with Zhu and Kraemer (2002) in that better e-commerce capability serves to improve effectiveness of investments on e-commerce initiatives through firm performance. We also agree with Chaudhury et al. (2001) in that enhancement of Web site quality can improve business value and with Huang et al. (2002) as they stated that evaluating Web data quality is important to determining the business value of online data.

Our results do not support the relationship between IOrSA and ECBS (H5). We cannot, therefore, support Bakos' (1991) assertion that electronic marketplaces create interorganizational coordination and reduce search costs and increase economic efficiencies. We are also unable to concur with Kickul and Gundry's (2001) argument that maintaining better relationships and integrating with suppliers is crucial for the company sustenance process. We are also unable to agree with Johnston and Vitale's (1988) contention that, if carefully identified and used, interorganizational systems give competitive advantages to organizations.

Our results do not support the path between OnSE and ECBS (H6). We cannot explain why this path is not significant. We are, therefore, unable to support Hitt and Brynjolfsson's (1997) findings with regard to IT's association with decentralization of authority, increased knowledge work, and decreased observability. We are also unable to agree with Stratopoulos and Dehning (2000) that firms making successful IT investments are more successful at solving the productivity paradox than those that make failed or abortive IT investments.

CONCLUSION, IMPLICATIONS, AND LIMITATIONS

Our results suggest the importance of ITOrS and OnSQE toward achieving ECBS. More specifically, they suggest that ITOrS plays a significant and positive role toward IOrSA, OnSE, OnSQE, and ECBS. OnSQE plays a significant and positive role toward ECBS.

Our results showed that IOrSA and OnSE played no significant role toward e-business success. According to this research, the quality and effectiveness of these systems is more important than their availability and efficiency. These relationships need to be investigated further in future studies.

Implications of this Research

Our exploratory study of the determinants of e-commerce business success has helped elicit some general principles for practice. According to "Digital Economy 2002," (http://www.esa.doc.gov/DigitalEconomy2002.cfm), although e-commerce funding has taken a severe downturn after the dot-com frenzy of early 2000, a large percentage of venture capital funding is still directed toward e-commerce initiatives. When designing an e-business, practitioners

must pay attention to creating a Web site that is visually attractive and easily navigable. Practitioners must also focus on online system quality and effectiveness. Attention must be paid beyond online system components, toward establishing relationships and networks that endure and thus provide real and sustainable competitive advantage.

Limitations and Future Research

Our study has a number of limitations: first, the response rate was low so the power of the study may not be high. Second, the local survey involved representatives of national chains. Although managers of these stores are knowledgeable of IT processes supporting their operations, their IT expertise level may not like that of IT professionals. Third, this study was conducted on companies with successful e-business implementations, maybe omitting learning from mistakes of companies that did not implement e-businesses successfully. Future research should use both successful companies and companies that failed, even though it is difficult to get data from these.

The present research suggests a number of possible future studies: first, a study on e-business success to validate our model in a longitudinal setting using diffusion theory. As e-commerce technologies mature and more businesses adopt the e-business model, more data on e-business adoption should be available, making this study feasible. Second, most companies in our study are online B2C retailers but a higher percentage of dollars is spent in the B2B sector (GartnerG2, 2001). It may be appropriate to validate our model across B2B companies. Third, testing our model with pure "dot-com" companies because they represent a big percentage of failures related to e-commerce strategies. We expect the critical success factors to be the same. The fourth is investigating why IOrSA, OnSE, or IOrSA did not directly contribute to ECBS. An increase in power and homogeneity of the data might help in determining more accurate relationships.

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APPENDIX

Success factors of Internet enabled business questionnaire
(On a Likert Scale with values ranging from 1, strongly disagree, to 7, strongly agree)

- IT Alignment to Organizational Strategies (ITOrS)
  1. There is an alignment of information technology (IT) strategy and top management strategy
  2. There is agreement within the company that information technology is part of long term strategy
  3. The Chief Information Officer has significant decision-making power
  4. There is a strong structure within the company for information technology planning and implementation
  5. There is a positive environment for organizational learning associated with the use of new information technology

- Inter-Organizational Systems Availability (IOrSA)
  6. An Internet-enabled uniform system of information sharing is available
  7. An automatic change order system is available
  8. The system permits highly automated transmitting and processing of data
  9. Inventory and Purchase tracking systems are continuously monitored
  10. The online procurement system is satisfactory
  11. Internet expertise is a selection criteria for suppliers/vendors

- Online Systems Quality and Effectiveness (OnSQE)
  12. The website used for purchasing and customer relations is highly secure
  13. The website used for purchasing and customer relations is visually attractive
  14. The website used for purchasing and customer relations is easily navigable
  15. The website used for purchasing and customer relations offers personalized logons
  16. The website used for purchasing and customer relations is consistently accessible without experiencing loading delays

- Online Systems Efficiency (OnSE)
  17. There is a high quantity or percentage of online business
  18. Online customer service is available
  19. Customers requests are resolved online
  20. Continuous monitoring of orders is available
  21. A highly automated order tracking system is available

- E-commerce Business Success (ECBS)
  22. Return on Investment has increased
  23. Return on Sales has increased
  24. Growth in Net Revenue has increased
  25. Net Income over Invested Capital has increased
  26. Sales over total assets has increased
  27. Return on Sales per employee has increased
  28. The organization has a positive company image
  29. Customer satisfaction is high
  30. The organization engages in product/service innovation
  31. There are a large number of return customers

Organizational Characteristics

Company Name
Location
Primary products
Circle all that applies. Does your business do…?
Business to Business Business to Consumer Consumer to Consumer
Annual sales (US $ billions) <1 | 2 - 50 | 51 - 100 | 101 - 150 | 151 – 200
Total number of employees
Company's primary customers

Personal Characteristics

(This information is entirely voluntary, all information will be kept confidential)
Name
Position/Title
Phone
Email
□ *I would like a copy of the results emailed to me at* _____ *(e-mail address)*

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