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# The Value of Information Technology in E-Business Environments: The Missing Links in the Renewed IT Value Debate

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# THE VALUE OF INFORMATION TECHNOLOGY IN E-BUSINESS ENVIRONMENTS: THE MISSING LINKS IN THE RENEWED IT VALUE DEBATE

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## Abstract

*After more than a decade of intensive studies, business value of information technology continues to generate interest and debate among both academics and practitioners. Drawing upon the IT value literature and the resource-based view of the firm, we develop a process-oriented model of IT value creation in the context of electronic business. Instead of a dichotomous measure of “adoption vs. non-adoption” as typically found in the literature, this model incorporates three stages (investment–usage–value) of the diffusion process at the firm level, with actual usage being an important mediating variable. The model also includes both IT resources and organizational factors, and tests the complementarity between them. A large-scale international dataset, involving 2,139 firms from 10 countries, is used to test the theoretical model. After controlling for firm size and industry effects, our empirical analyses based on structural equation modeling have shown that the investment–usage–value linkages are significant (although the direct link between investment and value is weak), suggesting that usage would be a “missing link” if not included. Another finding is that, while IT still matters (especially deeper use of IT such as back-end integration), complementary organizational resources (e.g., management support and external relationships) are found to be highly significant in creating value from e-business investment. On the other hand, these relationships tend to be moderated by environmental factors. These findings contribute to the ongoing debate over IT value—in this case, the value of Internet technologies in the e-business environment. They also offer important implications for the way firms approach IT investment and management in the post-bubble Internet era.*

**Keywords:** IT investment, IT paradox, usage, business value, electronic business, firm performance, technology diffusion, resource-based view

## Introduction

The advances in information technology in general and the Internet in particular are creating opportunities (and risks) for profound economic and business change (Greenspan 2002). Investment in IT and electronic business (e-business or EB, defined as using the Internet to conduct business activities along the value chain) accounts for \$405 billion (or 4.23 percent of GDP), which represents almost half of the total capital spending in the U.S. economy (IDC 2002). With significant investment in e-business comes the pressure to provide economic justification. While the literature has long been interested in the business value of IT (Brynjolfsson and Yang 1996), today, more than ever, researchers and practitioners confront the issue of e-business payoff due to the change of economic environments. Carr (2003) argued that as IT’s power and ubiquity had grown, its strategic importance had diminished, owing to the trend of IT commoditization. His “IT Doesn’t Matter” article triggered a large volume of subsequent responses, which represents a new wave of debate on the important yet unsettled issue on IT value—the “new IT paradox” in e-business context or the “e-business paradox.”

Motivated by the renewed IT paradox, this study seeks to explore the following research questions: (1) What theories can be used to study the value of e-business? How can economic models of productivity be extended by organizational models of technology usage and impacts to increase our understanding of e-business value? (2) Under what circumstances do e-business investments add value to a firm? What factors (technological and organizational) can be identified as critical determinants of e-business value? (3) Further, introducing an international dimension to EB value literature, how would these issues be moderated by the economic environments (developed vs. developing economies)?

A useful step to advance our understanding of these issues is to develop a proper theory to guide the empirical work. One potential theoretical framework is the *process-oriented model* that focuses on the process in which IT is used and business value is created (Soh and Markus 1995). According to the process-oriented model, a multistage process involving investment and usage exists before the business value of IT can be realized (Cooper and Zmud 1990; DeLone and McLean 1992). However, this theoretical proposal has not been well implemented in most empirical studies in the existing literature (Devaraj and Kohli 2003).

Another potential theory for studying e-business value is the *resource-based view* (RBV) of the firm, which attributes firm performance to organizational resources that are valuable, rare, and difficult to imitate (Barney 1991). Adopting an RBV to analyze IT investment and firm performance, researchers contended that since ITs can be easily duplicated by competitors, technologies *per se* do not provide sustained value (Mata et al. 1995). As the Internet allegedly improves information transparency and reduces barriers for resource mobility (Porter 2001), it becomes even more difficult for firms in the e-business area to retain value from the use of technology *per se*. In light of this difficulty, the RBV suggests avenues to IT-enabled value creation, i.e., through fostering unique, costly-to-copy resources, and developing resource complementarity.

This study seeks to integrate these two theoretical frameworks. Broadly speaking, this study is based on the IT value literature. This literature has documented numerous studies examining the relationship between IT investment and payoff. There are, however, significant differences among studies with respect to the level of analyses, research methodologies, and measures of IT and EB return (Devaraj and Kohli 2003). Using firm-level data, we seek to build a process-oriented model that will account for post-investment variations of Internet usage and reveal resources needed to drive the process from investment to business value.

## Theoretical Development

### *The Process of E-Business Value Creation*

The *process-oriented model* for studying IT payoff attempts to explain the process through which firms commit financial resources, develop technology assets, use information technology, and finally improve firm performance (Soh and Markus 1995). It has been argued that IT value should show up on process measures before it can be observed on higher-level organizational performance. Applying the process-oriented model to e-business, our study posits three stages of e-business value creation: (1) *EB investment* is defined as allocating resources to Internet-based applications, including systems, software, services, and internal staff training; (2) *EB usage* refers to using the Internet to conduct or support value chain activities, including marketing and sales, customer services, procurement, and coordination (Chatterjee et al. 2002; Porter 2001);<sup>1</sup> (3) *EB value* is defined as the impact of e-business on firm performance along the value chain (i.e., impact on sales, internal operation, and coordination) (Tallon et al. 2000; Zhu et al. 2004). Using this process model, we will test the direct relationship between technology investment and firm performance, and more importantly test usage as a mediating stage.

### *Resource-Based View for E-Business Value*

We seek to extend the resource-based theory to study Internet technology, which, compared to previous generations of ITs, has unique economic characteristics—open standard (vs. proprietary standard), public network (vs. private network like EDI), broad connectivity (both front-end and back-end) (Kauffman and Walden 2001; Shapiro and Varian 1999). These salient characteristics enable novel ways of value creation, but at the same time, facilitate information and resource mobility and may lower entry barriers for conducting e-business (Porter 2001). Many Internet-based initiatives, especially functionality on the Website, can be

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<sup>1</sup>Given that the focus of our study is at the *organizational* level, usage here is defined along the value chain. This definition is different from *individual* usage of technology specified in the technology acceptance models (Davis et al. 1989). The concept of e-business usage at the organizational level is virtually absent in the literature.

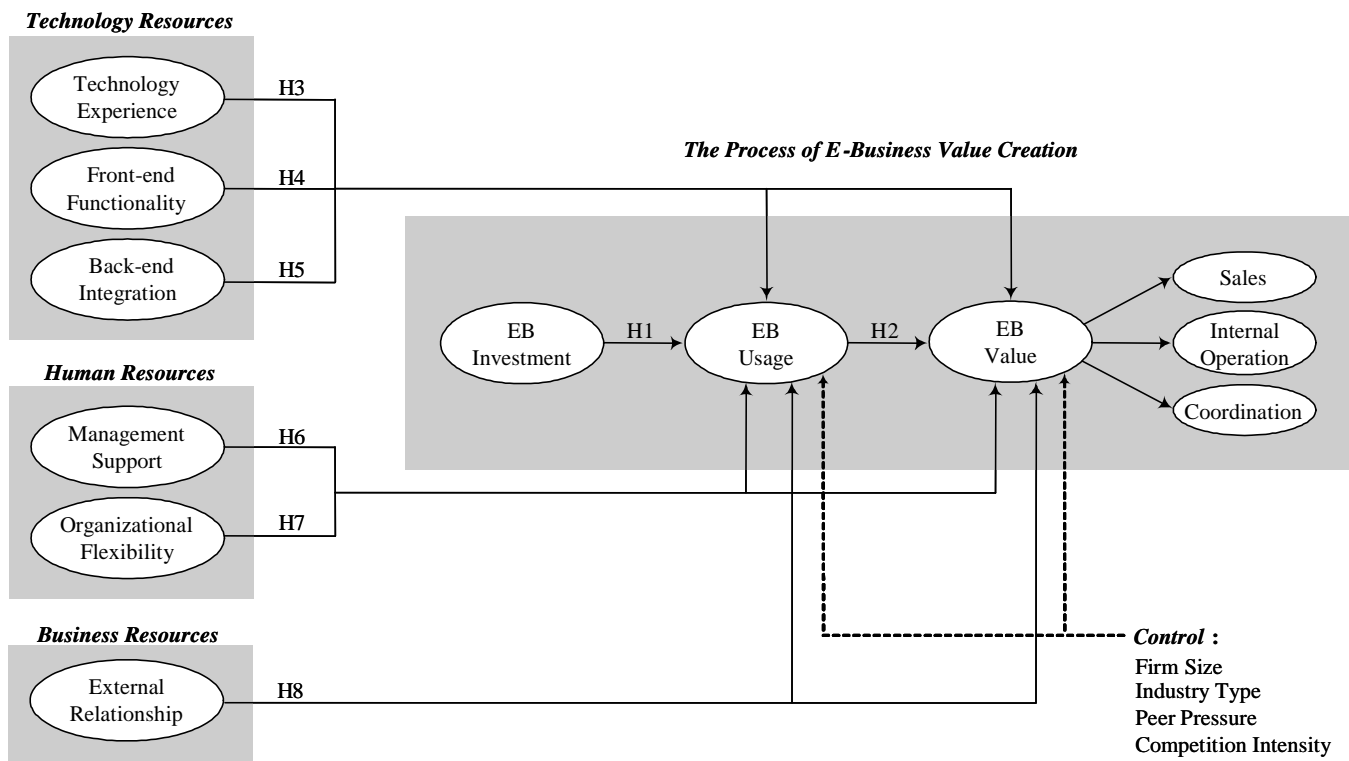
easily observed and then copied by competitors. Furthermore, Internet technologies such as XML and Java are open to both users and developers, which makes it more difficult for firms to control core technologies and retain business value from Internet investments. Thus, we need to study what other resources, beyond the Internet technology *per se*, can serve as value drivers.

Powell and Den-Micallef (1997) suggested three types of firm-level resources that may contribute to EB value: (1) technology resources such as IT infrastructure, (2) human resources such as management support, and (3) business resources such as business partner relationship. Using empirical data, they showed that human and business resources are complementary to technology resources. Bharadwaj (2000) specified a consistent classification, identifying tangible IT infrastructure, human resources, and IT-related intangibles as key IT resources contributing to firm performance. Brynjolfsson et al. (2002) suggested that intangible assets, especially organizational capital, are complementary to IT resources and can enhance IT's capability to create value at the firm level. Our review of the literature leads us to believe that the *combination* of IT resources and organizational resources is a promising path to e-business value. Thus, we incorporate both IT resources and organizational resources in the process model of e-business value creation.

While the RBV has been traditionally used to explain competitive advantage, several recent studies have applied the RBV to performance impacts on value chain processes (e.g., Schroeder et al. 2002). As Porter argued (1991, p. 108), "resources are not valuable in and of themselves, but they are valuable because they allow firms to perform activities...business processes are the source of competitive advantage." IT-enabled resources can be a source of competitive advantage only if exploited on value chain processes. In the same vein, we believe that e-business impact on a firm's competitive position depends on whether it has effectively implemented e-business in downstream, internal, and upstream processes.

**The Research Model**

Grounded in the RBV and the process model of IT value creation as discussed above, we developed a research model as shown in Figure 1. Major components of the model are elaborated below.



**Figure 1. The Conceptual Model**

We posit three stages in the process of EB value creation: EB investment–usage–value. (1) EB investment is measured by the percentage of a firm's revenue devoted to e-business. (2) EB usage is measured along two dimensions: breadth and depth. **Breadth** refers to the extent of e-business usage along the value chain, i.e., the number of value chain activities that have been conducted on the Internet. This includes marketing, sales, customer services, and procurement (Porter 1985). **Depth** refers to the percentage of each value chain activity that has been conducted on the Internet, as opposed to a traditional physical platform. (3) Consistent with the specification of EB usage, we conceptualize EB value as a multidimensional construct to describe performance impacts of e-business along the value chain—impact on **sales**, impact on **internal operation**, and impact on **coordination** with suppliers and business partners. Prior research has shown that these dimensions should not be considered in isolation from each other. Rather, they should be viewed as mutually reinforcing elements of IT impacts along the value chain (Tallon et al. 2000, Zhu et al. 2004).

Drawing upon the technology-human-business categorization of firm resources (Bharadwaj 2000; Powell and Den-Micallef 1997), we have identified six specific resources within the three categories. First, we examine technology experience and front-end functionality, since they help firms to form the technology basis for e-business transactions (Zhu and Kraemer 2002). Then, we posit back-end integration as a deeper strategy of converting technology components into firm-unique resources, by connecting technology infrastructure and Website functionality (Bharadwaj 2000). Back-end integration is a tailored factor for the e-business phenomenon, since the Internet, with its open network standards, can greatly facilitate the connection of heterogeneous technologies (Zhu and Kraemer 2002). Second, conducting e-business may greatly influence or even reshape business strategy and organizational structure (Chatterjee et al. 2002). Thus, management support and organizational flexibility become critical in that they help to facilitate e-business implementation and to promote e-business usage and eventually value creation. Third, we posit external relationship as a supportive business resource, due to the network nature of e-business that involves activities of customers, suppliers, and business partners (Zhu and Kraemer 2002).

Finally, we consider several control variables: firm size, industry type, peer pressure, and competition intensity. Firm size and industry type are among the most widely used controls in the IT literature. In addition, as the Internet tends to intensify competition and facilitate resource mobility (Porter 2001), it is necessary to consider industry rivalry and the pressure from peer firms to drive e-business usage and diffusion. These variables allow us to control for variations at the firm and the industry levels.

## Hypotheses

We first propose relationships in the value creation process. Implementing an e-business system requires investment in hardware, software, system integration, and employee training. Committing adequate investment would help firms to build e-business functionalities and to facilitate their usage in value chain activities. Thus, we form the following hypothesis:

**H1: Greater EB investment will be positively related to the extent of EB usage.**

EB usage in turn is tied to firm performance, because technology cannot improve firm performance unless the technology is used (DeLone and McLean 1992). With richer information about downstream markets, e-business helps improve firms' responsiveness to market demand and improve customer relationships. Inside the organization, e-business has the potential to streamline business processes, hence increasing operational efficiency and staff productivity (Kauffman and Walden 2001); Given the broad connectivity of the Internet, e-business can improve information flow and strengthen online integration with suppliers and business partners (Zhu 2004). These considerations suggest that using e-business would lead to performance impacts (value creation) along these dimensions. Thus, we put forward the following hypothesis:

**H2: Greater EB usage will be positively related to EB value creation.**

Existing technology experience is a critical resource for the investment, usage, and value of e-business. E-business is viewed as a technology-driven innovation (Chatterjee et al. 2002), and thus implementing e-business requires technical skills and organizational experience with related technologies. When firms have greater experience on related technologies, it is more likely that they have developed relevant skills for e-business transformation (Mata et al. 1995). Such firms are more likely to use e-business and achieve value from e-business (Zhu et al. 2004). This leads to the following hypothesis:

**H3: Technology experience will be positively related to the process of e-business value creation.**

Drawing upon Internet-enabled connectivity and interactivity, front-end functionality helps firms deliver real-time information to customers, better understand market demand, allow customers to track delivery status, and provide customer support, thereby promoting e-business usage along the value chain (Zhu and Kraemer 2002). Further, front-end functionality helps create value

by reaching new customer segments, increasing sales from existing customers, enabling customization, and reducing transaction costs. This leads to

***H4: Front-end functionality will be positively related to the process of e-business value creation.***

Beyond front-end functionality, back-end integration is critical for e-business systems to function (Zhu and Kraemer 2002). As a deeper strategy of using IT infrastructure, back-end integration capitalizes on the key feature of the Internet—its open-standard data exchange—which helps remove incompatibility of legacy information systems and achieve responsiveness among various modules and databases (Weill and Broadbent 1998). By integrating incompatible technologies using the Internet protocol, firms can build an integrated infrastructure that may facilitate e-business automation within a firm and enhance information flow along the value chain (Zhu 2004). This will promote the extent of e-business usage. Furthermore, an integrated infrastructure enables firms to offer novel and complementary services via a single customer interface, facilitate transactions, and reduce inventory (Lee 2000), all of which are important dimensions of e-business value creation. These discussions lead to the following hypothesis:

***H5: Back-end integration will be positively related to the process of e-business value creation.***

Management support is deemed to be an important resource for EB value creation. The literature suggests the critical role of management support for IS success, either measured by IS usage or IS impacts (Amstrong and Sambamurthy 1999; Chatterjee et al. 2002). This is also supported by the more general innovation diffusion literature (Rogers 1995). The commitment of financial resources to e-business requires top executives to act as champions or “prioritizers,” clearly articulating and supporting the need for conducting e-business. In firms where senior managers believe that e-business offers a strategic importance, top management generally provides support for e-business in two critical areas: EB resource allocation and cross-department coordination (Amstrong and Sambamurthy 1999). Such supportive activities further serve as a signal to the whole organization about the strategic importance of e-business. Top management support thus would enhance EB success by making resources available for EB implementation, legitimizing the migration of value chain activities onto the Internet, and ensuring continuity in EB investment and usage over time (Chatterjee et al. 2002). This discussion leads to the following hypothesis:

***H6: Management support will be positively related to the process of e-business value creation.***

Organizational flexibility refers to the extent to which organizational strategy, structure, and processes can be adjusted to match e-business requirements. In order to realize benefits of e-business, firms need to pursue a synergy between Internet-enabled business and the overall business strategy. Business process reconfiguration is commonly needed to facilitate e-business usage and reveal value. Drawing upon both quantitative and qualitative data, Clark and Hammond (1997) found that channel transformation involving interorganizational electronic linkages and redesign of replenishment processes enabled performance improvements more than an order of magnitude greater than implementation of interorganizational linkages alone. Collectively, managerial abilities to adjust the overall business strategy, organizational structure, and business processes significantly influence the extent to which e-business is used and value is realized. Thus, we form the following hypothesis:

***H7: Organizational flexibility will be positively related to the process of e-business value creation.***

Finally, e-business is not confined to a single organization. E-business may necessitate tight integration with customers and suppliers, which goes well beyond the walls of an individual organization (Kauffman and Walden 2001). Such network nature of e-business suggests external relationship to be a critical business resource. For transactions on the Internet to take place, it is necessary that all trading partners adopt compatible electronic systems and provide Internet-enabled services for each other (Teo et al. 2003). It is well documented in the supply chain literature that supportive external relationships enhance the effectiveness of network technologies (Lee 2000). Hence we have our final hypothesis:

***H8: External relationship will be positively related to the process of e-business value creation.***

## **Methodology**

### ***Data***

To test the research model and the hypotheses, we used a secondary dataset that is a part of the larger survey database created by the Globalization and E-Commerce project of the Center for Research on Information Technology and Organizations (CRITO) at the University of California, Irvine. The survey of the Globalization and E-Commerce project covered both manufacturing and

services-oriented (retail and financial services) industries, and was conducted in the United States and nine other countries (Brazil, China, Denmark, France, Germany, Japan, Mexico, Singapore, and Taiwan) during February–April 2002. The sampling of the survey was a stratified sample by country, industry, and firm size, with sites selected randomly within each sampling category. Respondents of the survey were individuals in each firm best qualified to speak about the firm’s overall e-business activities. For medium and large sites, the respondent was the CIO, an IT director, or IT manager. For small sites, it was the CEO, owner, or IT manager.

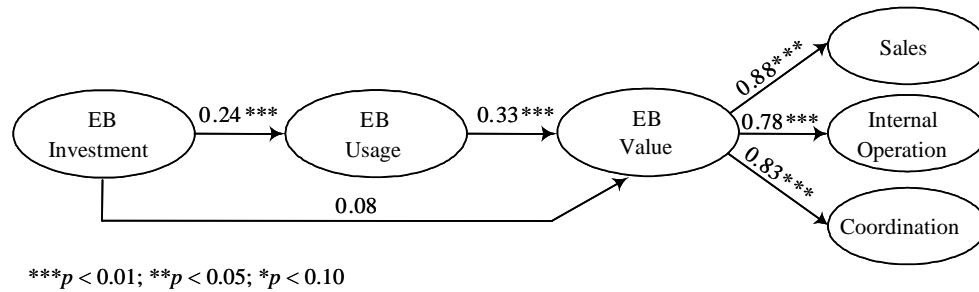
After we received the dataset, we checked for consistency of the data. Our final dataset contains 2,139 respondents. Characteristics of the sample involved in the final dataset are shown in Table 1. Distribution of firm size reflects a balance of large and small businesses. The positions of respondents suggest a good quality data source. We compared the responses by IS and non-IS managers and did not find a significant difference between them. We also examined common method bias, and the statistical tests suggested that the dataset did not have significant bias caused by common method variance.

**Instrument Validation**

Operationalizations that had been studied by previous research were used as much as possible. To validate the instruments, we conducted a confirmatory factor analysis using partial least squares (PLS). We examined **convergent validity**, **construct reliability**, and **discriminant validity**. All standard loadings are significant ( $p < 0.01$ ) and of acceptable magnitude, suggesting good convergent validity. The composite reliability for all constructs ranged between 0.76 and 0.90, over the cutoff of 0.70 (Chin 1998). To test discriminant validity, we used Fornell and Larcker’s (1981) criteria: The square root of the average variance extracted (AVE) should be greater inter-construct correlations. All of our constructs meet this criterion. Finally, our second-order construct, EB value, has a high T ratio of 0.96, implying that the relationship among first-order constructs is sufficiently captured by the second-order construct.

**Table 1. Sample Characteristics (N = 2139)**

<b>Country</b>	<b>Category</b>	<b>(%)</b>	<b>Industry</b>	<b>Category</b>	<b>(%)</b>
Brazil		9.4	Manufacturing		34.7
China		9.5	Retail/wholesale distribution		32.8
Taiwan		9.4	Financial services		32.5
Denmark		9.4	<b>Number of Worldwide Employees</b>		
France		9.4	< 100		16.1
Germany		9.4	100 – 300		16.7
Japan		10.6	300 – 500		13.0
Mexico		9.4	500 – 1000		15.3
Singapore		9.4	1000 – 5000		21.8
United States		14.0	> 5000		17.0
<b>Annual Revenue (\$ million)</b>			<b>Respondent Title</b>		
< 1		6.1	President, Owner, Managing Director, CEO		3.6
1 – 10		21.3	CIO/CTO/VP of IS		17.0
10 – 50		25.8	IS Manager, Director, Planner		35.5
50 – 100		11.6	Other Manager in IS Department		21.0
100 – 500		18.7	Business Operations Manager, COO		4.8
500 – 1000		6.3	Administration/Finance Manager, CFO		8.0
> 1000		10.3	Others (Marketing VP, Other Manager)		10.1



**Figure 2. Baseline Model: Three Stages of EB Value Creation**

## Data Analysis and Results

### *Testing the Mediating Effect of EB Usage*

H1 and H2 hypothesized the mediating role of EB usage between EB investment and EB value. To test this relationship, we fitted a baseline model (with the three-stage process only) using PLS. The PLS result (Figure 2) shows significant and positive paths from investment to usage ( $b = 0.24$ ,  $p < 0.01$ ) and from usage to value ( $b = 0.33$ ,  $p < 0.01$ )—significant mediating effect. Yet, the path directly linking investment to value turns out to be insignificant ( $b = 0.08$ ,  $p > 0.10$ )—insignificant direct effect. We further confirmed the significance of the mediating effect using the approach suggested by Baron and Kenney (1986), which involves testing a series of nested models. These tests provide support for the process model, in which usage serves as an important intermediate construct mediating investment and value.

### *Results of the Full Structural Model*

We proceed to test the full structural model (Figure 1), which can be considered as an extension of the three-stage baseline model (Figure 2) by incorporating firm resources. We fitted the full structural model on the full sample ( $N = 2139$ ). The two major dependent constructs in our model, EB usage and EB value, have  $R^2$  of 34 percent and 36 percent, suggesting significant data variation explained by the model. To test each hypothesis (H1 through H8), we examined the sign and the significance of path estimates. Significant and positive paths exist from EB investment to EB usage to EB value, which provides consistent support for the process model. Back-end integration, management support, and external relationship have significant and positive paths leading to EB usage and EB value. In contrast, the links from front-end functionality and technology experience to EB value are statistically insignificant.

### *Cross-Country Comparison*

Given that e-business is an international phenomenon, we believe it is important to consider the international dimension of e-business value. We wanted to understand the differences of e-business value across countries, as each country has its own unique national environment for e-business (e.g., economic, legal, cultural, business practices, and consumer behavior). Several environmentally imposed obstacles that managers face in implementing information technology in less-developed countries were identified in previous literature, including a scarcity of managerial, technical, and financial resources at the firm level (UNCTAD 2002), the inadequacy of basic infrastructure at the national level (Dewan and Kraemer 2000), and other institutional factors such as culture and regulation. The dataset used in this study covered both developing and developed countries, which allowed us to examine the effect of national environment on e-business value.

Drawing upon the work of Dewan and Kraemer (2000), we evaluated two dimensions of national environments: (1) aggregated IT investment as a percentage of GDP and (2) GDP per capita. According to these two dimensions, we split the full sample into two subsamples: (1) Brazil, China, Mexico, and Taiwan ( $N = 807$ ), named DG (i.e., developing) subsample, with lower IT



infrastructure and less per capita income; and (2) Denmark, France, Germany, Japan, Singapore, and the United States ( $N = 1332$ ), named DD (i.e., developed) subsample. We then ran PLS on each subsample respectively.

Further, we used  $t$ -test to compare the DD and DG subsamples with respect to each path. We find that the path from EB investment to EB usage, and the path from EB usage to EB value in the DD subsample are statistically greater than those in the DG subsample. Thus, we conclude that the mediation effect of EB usage is stronger in developed countries than in developing countries. We also find different effects of resources between the two subsamples. Back-end integration and management support have greater effects on value creation in developed countries than in developing countries, while technology experience and external relationship have greater effects in developing countries than in developed countries.

### **Resource Complementarity**

Having studied the main effects of resources on EB value, we proceed to test the resource complementarity between back-end integration (a technology resource) and external relationship (a business resource), both of which help to strengthen value chain coordination. We rank all firms on the factor score of external relationship and divide them at the mean into two subsamples. We find that back-end integration has a greater effect ( $b = 0.21, p < 0.01$ ) when external relationship is above the mean than when external relationship is below the mean ( $b = 0.13, p < 0.01$ ). This difference is confirmed to be significant by Wald test ( $p = 0.07$ ). Therefore, we find statistical evidence that back-end integration has greater effect on EB value when greater external relationship is present.

## **Discussion**

### **Major Findings**

1. *EB usage is a significant mediating construct between EB investment and EB value, indicating that usage would be a missing link in the value creation process if not included.*

As shown in the baseline model (Figure 2), we find strong linkages from e-business investment to usage and then to business value ( $b = 0.24^{***}$  and  $0.33^{***}$ , respectively). In contrast, the direct link from investment to value turns out to be insignificant. Linking this to the ongoing debate on IT and EB payoff, our study points to the usefulness of the three-stage process model. That is, focusing on intermediate stages in the process of IT value creation, instead of solely on IT capital that is only the initial phase in the chain leading to business value, is likely to be a promising approach to resolving the renewed IT paradox.

2. *As e-business diffuses among firms, the role of EB usage in the value creation process becomes more significant.*

E-business usage has a more significant role in the value process in developed countries than in developing countries, in that usage has stronger associations with both investment ( $b = 0.12^{***}$  vs.  $0.08^*$ ) and value ( $b = 0.20^{***}$  vs.  $0.12^{***}$ ). As indicated by macro-level statistics (UNCTAD 2002), e-business has achieved higher levels of diffusion in developed countries. Our results show that as more firms have adopted e-business, adoption by and in itself is unlikely to lead to business value. Instead, value comes from actual usage.

3. *Back-end integration and management support are stronger value drivers in developed countries than in developing countries, which seems to suggest that deeper (integrative, strategic) usage becomes more critical as e-business evolves.*

Suggested by the results of cross-country comparison, back-end integration and management support tend to have greater influences on both EB usage and value in developed countries than in developing countries. In general, firms in developed countries have moved into deeper stages of e-business innovation (UNCTAD 2002). Our analyses show that as e-business evolves, the integrative and strategic manner of Internet usage becomes critical. Particularly from the RBV, we consider back-end integration as a deeper strategy of using technologies, i.e., to create resource embeddedness (Zhu and Kraemer 2002). Although the individual components that go into an e-business platform are commodity-like, the process of integrating them to develop a platform tailored to a firm's strategic context is complex and imperfectly understood (Weill and Broadbent 1998). Thus, leveraging the Internet technology to connect heterogeneous systems can facilitate e-business value creation. Our finding is consistent with the view of Mata et al. (1995) that business value of IT resides more in IT management skills than in the technology *per se*.

4. *Technology experience and front-end functionality facilitate EB usage, while back-end integration, management support, and external relationship drive value creation.*

Front-end functionality and technology experience facilitate EB usage ( $b = 0.19^{***}$  and  $0.29^{***}$ , respectively), but not EB value. This can be explained from the RBV. Internet-related technologies tend to become commodities, and functionalities that are open on the Internet can be easily observed and imitated by competitors (Kauffman and Walden 2001). In this sense, they are deemed as value necessities, as e-business value creation requires e-business usage, but they are not value drivers. In contrast, the positive and significant paths associated with back-end integration ( $b = 0.21^{***}$ ), management support ( $b = 0.30^{***}$ ), and external relationship ( $b = 0.20^{***}$ ) seem to suggest their roles as value drivers. They seem to fit the resource characteristics for value creation (i.e., economically valuable, firm-specific, and costly-to-copy) in the resource-based theory (Barney 1991). These results support our earlier resource-based conceptual analysis.

5. *With a stronger external relationship, back-end integration tends to have greater contribution to EB value, which suggests the need to exploit resource complementarity.*

Back-end integration appears to be a more significant value driver when a stronger external relationship coexists. Previous research has suggested that interorganizational linkage would be more likely to improve firm performance if business partners are willing to support technology innovation and process reconfiguration (Clark and Hammond 1997). Our study tested the reinforcing relationship between back-end integration and external relationship in the e-business environment, which suggested the need to exploit resource complementarity for deriving e-business value.

6. *The effects of technology experience and external relationship are stronger in developing countries than in developed countries.*

The effects of technology experience and external relationship are more significant in developing countries than in developed countries. Relative to firms in developed countries, firms in developing countries lack technology infrastructure and skills of using technology (Dewan and Kraemer 2000). In addition, since e-business has not been adopted as extensively as in developed countries (UNCTAD 2002), firms in developing countries confront the difficulty to find e-business partners. Thus, whether firms have obtained e-business-related experience and support from business partners is deemed as more critical in developing countries. This finding, together with findings 2 and 3, illustrates the different relationships in the value creation process across developed and developing countries. This also shows that it is useful to add the international dimension to the IT and e-business research.

Overall, these findings demonstrate the value of using the process model to examine EB value creation, and tend to emphasize the importance of intangible, heterogeneous resources that help firms to leverage technologies in strategic and innovative ways.

### ***Managerial Implications***

Several implications for management follow from these results. IT managers have been struggling for justifying investments in Internet technologies. This study shows that investments in the Internet have positive payoff when e-business usage as an intermediate stage is considered. Thus, to realize e-business value, firms should promote the usage of e-business in value chain processes including marketing, sales, customer services, and procurement.

This study also revealed key resources that facilitate e-business usage and drive e-business value. Specifically, firms need to build up technological capabilities by integrating various IT components into a streamlined system, based on essential e-business-related infrastructure, functionality, and human resources. Yet technology integration, while important, is not enough. Our results highlight the importance of intangible resources such as management support and external relationship. Realizing the full economic potential of technologies requires complementary organizational resources. Finally, managers need to adjust their managerial activities and strategies as e-business evolves and the external environment changes. At the early stages of e-business evolution (e.g., in developing countries), building basic technology skills and infrastructure for conducting e-business is critical. However, as e-business evolves into advanced stages, firms need to shift their focus to deeper usage of the Internet.

### ***Limitations and Future Research***

We believe that the key limitations of this study are as follow. First, the impact measures were based on survey responses from managers. Although we have been careful in assessing potential biases, we acknowledge that survey data are often subject to bias,

and remind readers that our results need to be understood with this in mind. Researchers could use complementary research methodologies to test and strengthen the validity of our model, including field research and longitudinal case studies. Second, since the dataset used in this study is cross-sectional in nature, we cannot analyze longitudinal processes, such as the evolution of EB usage and value in a dynamic context. We consider this as only a preliminary test of the process model. A more complete test of the process model would require more comprehensive, longitudinal data or in-depth case studies over time. Third, the phenomenon we are studying is changing in the very process of studying it. This means that even longitudinal surveys will have limitations, and calls for greater use of multiple methods, including historical case studies in both firms and countries.

## Concluding Remarks

The debate over business value of information technology has been renewed in the e-business environments (Carr 2003). The new IT paradox has made it necessary to study the link between e-business and organizational performance. Through successive stages of theoretical modeling and empirical testing, we have developed a conceptual model for studying the process of e-business value creation. Having shown the mediation effect of e-business usage in the value process, this study sheds new light on why IT investment does not always lead to improved organizational performance, and thus helps move the research focus from simple relationships between spending and performance to intermediate links such as usage. The middle process requires more study because less is known about it.

Based on a large-scale secondary dataset, our results show the usefulness of the process model integrated with the resource-based theory for studying e-business value. Researchers could develop process models to study the performance impacts for other information systems, such as wireless technology and supply chain management systems.

In addition, by testing specific resources, we have identified technological, human, and business resources to facilitate the value process, and further examined resource complementarity between external relationship and back-end integration. Our results differentiated value drivers (e.g., back-end integration, management support, and external relationship) from value necessities (e.g., front-end functionality and technology experience). Broadly speaking, this research contributes to the relationship among organizational resources, information technology, and organizational performance in the e-business environment. We hope these findings are useful for other researchers to further examine these issues.

Unlike most of the studies in the literature, this study is not limited to one particular country. The broad dataset of 2,139 firms from 10 countries allowed us to examine how economic environments influence e-business value. Because the dataset included both developed and developing countries, the generalizability of our model and findings is strengthened. We hope our work will stimulate more research in this important area.

These results also provide implications to managers on critical areas such as key IT management processes, specification of appropriate EB usage, and business value. Managers should promote e-business usage that is a significant mediating stage between e-business investment and e-business value, and foster organizational capital that interacts with technologies, such as complementary business resources and organizational capability of integrating technology components.

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