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# Information Technology Payoff in E-Business Environments: An International Perspective on Value Creation of E-Business in the Financial Services Industry

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*Journal of Management Information Systems* / Summer 2004, Vol. 21, No. 1, pp. 17–54.

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0742-1222 / 2004 \$9.50 + 0.00.

His research is focused on the globalization of IT and the economic impacts of IT at the firm, industry, and national level. He is now working on a multicountry study of the adoption and impacts of electronic commerce, as well as a study of global knowledge networks in the personal computer industry. Mr. Dedrick is a coauthor, with Kenneth L. Kraemer, of *Asia's Computer Challenge* (Oxford University Press, 1998). He is also author of numerous journal articles, book chapters, and other publications.

**ABSTRACT:** Grounded in the technology–organization–environment (TOE) framework, we develop a research model for assessing the value of e-business at the firm level. Based on this framework, we formulate six hypotheses and identify six factors (technology readiness, firm size, global scope, financial resources, competition intensity, and regulatory environment) that may affect value creation of e-business. Survey data from 612 firms across 10 countries in the financial services industry were collected and used to test the theoretical model. To examine how e-business value is influenced by economic environments, we compare two subsamples from developed and developing countries. Based on structural equation modeling, our empirical analysis demonstrates several key findings: (1) Within the TOE framework, technology readiness emerges as the strongest factor for e-business value, while financial resources, global scope, and regulatory environment also significantly contribute to e-business value. (2) Firm size is negatively related to e-business value, suggesting that structural inertia associated with large firms tends to retard e-business value. (3) Competitive pressure often drives firms to adopt e-business, but e-business value is associated more with internal organizational resources (e.g., technological readiness) than with external pressure to adopt. (4) While financial resources are an important factor in developing countries, technological capabilities become far more important in developed countries. This suggests that as firms move into deeper stages of e-business transformation, the key determinant of e-business value shifts from monetary spending to higher dimensions of organizational capabilities. (5) Government regulation plays a much more important role in developing countries than in developed countries. These findings indicate the usefulness of the proposed research model and theoretical framework for studying e-business value. They also provide insights for both business managers and policy-makers.

**KEY WORDS AND PHRASES:** business value, cross-country comparison, electronic business, electronic commerce, financial services industry, firm performance, information technology investment, technology diffusion, technology–organization–environment framework.

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IN RECENT YEARS, ELECTRONIC BUSINESS<sup>1</sup> (e-business) has emerged as one of the most controversial research areas. Despite the burst of the dot-com bubble, many companies continue to deploy e-business extensively in their enterprise value chains. Firms such as Dell, Wal-Mart, Charles Schwab, and Capital One have achieved tangible improvements in operational efficiency and customer intimacy by integrating e-business into their business models. At the same time, many firms, concerned about falling behind on the technology curve, engage in e-commerce initiatives without deriving any business value [4]. Indeed, firms face a series of obstacles in adopting

e-business, particularly their ability to transcend significant technical, managerial, and cultural issues [59]. Puzzled by the mixed evidence, researchers and practitioners are struggling to determine whether e-business delivers value to firm performance, and if so, what factors contribute to e-business value.

Although showing recent signs of advancement, much of the existing e-business literature still relies heavily on case studies and anecdotes, with few empirical data to measure Internet-based initiatives or gauge the scale of their impact on firm performance [39], partly because of the difficulty of developing measures and collecting data [79]. A more fundamental issue is the lack of theory to guide the empirical work [75]. So far, the literature has been weak in making the linkage between theory and measures, let alone subjecting the proposed measures to empirical validation for reliability and validity [64]. Hence, there is a need for theoretical development. In particular, what is missing in the existing literature is: (1) a solid theoretical framework for identifying factors that shape e-business value, (2) a research model for studying the relationships of these factors to e-business value, and (3) empirical assessments based on a broad data set instead of a few isolated cases.

Our study seeks to reduce these gaps. Key research questions that motivated our work are: (1) What theory can be used to study e-business value? (2) What factors can be identified within this theoretical framework? and (3) How would the patterns of e-business value creation vary across different economic/organizational environments (e.g., developed versus developing countries)? In particular, prior research argued that theories developed in the context of mature markets and industrialized countries need to be reexamined in the context of developing countries [2] because these countries may have very different economic and regulatory environments [20, 38]. Despite the fact that the Internet is a global platform and e-business is an international phenomenon, most of the existing studies in this area have focused on one country, predominantly the United States [72]. So far, no international studies have been conducted based on firm-level data from multiple countries. We believe it is important to add an international dimension to the investigation of e-business value, extending beyond the United States to encompass the experience of organizations in other developed and developing countries.

To better understand these issues, we developed a conceptual model incorporating six factors for assessing e-business value based on the technology-organization-environment (TOE) framework [70]. Then we tested this model using survey data from 612 firms in the financial services industry from 10 countries (both developed and developing). We chose the financial services industry because this was one of the first to adopt the Internet technologies and to innovate with e-business applications such as online brokerage, banking, and mortgage lending. The data analysis was performed by structural equation modeling (SEM). The results identified significant factors shaping e-business value in general, but demonstrated varying patterns across different economic environments.

Broadly speaking, our study relates to the continued debate on information technology (IT) payoffs. The amount of empirical research on the business value of IT, and e-business in particular, has been diverse and yet limited both conceptually and

methodologically [79]. Kohli and Devaraj [40] and Dedrick et al. [17] have pointed out opportunities for future IT payoffs research. These include: (1) gathering data from primary sources; (2) increasing sample size for increased statistical power, and including small and medium-sized enterprises, which are not included in many major studies; (3) capturing the actual usage of IT—that is, how IT investment is converted into assets, resources, and firm performance; and (4) developing process-oriented dependent variables, especially for studies on the e-business phenomenon. Our study has incorporated these suggestions into the research design.

## Theoretical Foundations

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### The Technology–Organization–Environment Framework

To gain a comprehensive view on what factors may shape the value of e-business, we adopt the TOE framework developed by Tornatzky and Fleischer [70].<sup>2</sup> The TOE framework identifies three aspects of a firm's context that influence the process by which it adopts and implements a technological innovation: technological context, organizational context, and environmental context. *Technological context* describes both the internal and external technologies relevant to the firm. These include existing technologies inside the firm, as well as the pool of available technologies in the market. *Organizational context* is defined in terms of several descriptive measures: firm size and scope; the centralization, formalization, and complexity of its managerial structure; the quality of its human resources; and the amount of slack resources available internally. *Environmental context* is the arena in which a firm conducts its business—its industry, competitors, access to resources supplied by others, and dealings with government [70]. These three groups of contextual factors influence a firm's intent to adopt an innovation, and affect the assimilation process and eventually the impacts of the innovation on organizational performance.

Swanson [65] examined the three contexts of the TOE framework and contended that adoption of complex IT innovations requires a facilitating technology portfolio, certain organizational attributes such as diversity and sufficient slack resources, and a strong emphasis on the strategic environment. We extend this theoretical argument to the e-business environment: e-business is enabled by technology development [39], requires organizational enablers and may entail necessary business and organization reconfiguration [7], and may shape (and be shaped by) the strategic environment [41].

The TOE framework has been examined by a number of empirical studies in various information systems (IS) domains. In particular, electronic data interchange (EDI), an antecedent of Internet-based e-business, has been studied extensively in the past decade. Iacovou et al. [36] developed a model formulating three aspects of EDI adoption—*technological* factors, *organizational* factors, and *environmental* factors—as the main drivers for EDI adoption, and examined the model using seven case studies. Their model was further tested by other researchers using larger samples. For example, Kuan and Chau [44] confirmed the usefulness of the TOE framework for

studying adoption of complex IS innovations. After carefully reviewing the academic literature on IS innovations published in major IS journals, we summarize the relevant studies based on the TOE framework in Table 1. Although specific factors identified within the three contexts may vary across different studies, the TOE framework has consistent empirical support. Drawing upon the empirical evidence combined with the literature review, we believe that the TOE framework is an appropriate theoretical foundation for studying e-business.

Our review indicates that the existing literature is mainly focused on technology *adoption*. Only a few studies have been done to directly examine how TOE factors affect the *impact* of an IS innovation on firm performance. Iacovou et al. [36], using the TOE framework, found that the impact of EDI on performance was directly affected by its level of integration with other IS and processes. Ramamurthy et al. [57] posited the impact of EDI on firm performance as the consequence of technological, organizational, and environmental factors. Their empirical results indicated that the impact of EDI on operational and market-oriented performance was significantly affected by these factors. Given the relative paucity of research linking TOE factors to firm performance, we have developed a research model to examine the factors that may affect e-business value at the firm level. As mentioned earlier, our focus is the financial services industry, which has received limited attention in the e-business value literature.

## E-Business and the Financial Services Industry

The financial services industry differs in important ways from industries such as manufacturing or retailing, and its use of IT and e-business technologies reflects those differences [54]. Financial institutions are linked to customers and each other in an extensive network of interrelationships that is more complex, reciprocal, and less linear than traditional manufacturing and retailing industries [52]. There is a primary market in which customers interact with financial institutions such as retail banks, insurance agencies, real estate agencies and stock brokers. There is also a larger secondary market in which those institutions interact with each other and with others such as mortgage brokers, commercial banks, insurance companies, and investment bankers [34].

These industry characteristics influence the use of IT. In manufacturing and retailing, IT is used mainly to coordinate the processing and movement of physical goods, to manage supporting functions such as human resources, accounting and sales and marketing, and in some cases to buy and sell goods. By contrast, in financial services, there are no inherently physical goods; even cash, checks, contracts, and other documents are just forms of information that can be represented digitally. IT is used directly to store, process, and transport the “goods” in which the industry trades—for example, loans, stocks and bonds, insurance policies and claims, and real estate transactions [52]. Given its information intensity, the financial services industry is the largest user of IT among industry sectors; U.S. firms in this industry on average

Table 1. Literature Review

Reference/innovation studied/methodology	Factors examined	TOE framework		
		Technology	Organization	Environment
Iacovou et al. [36]/EDI/case study	<ul style="list-style-type: none"> <li>• Technological context (perceived benefits)</li> <li>• Organizational context (organizational readiness)</li> <li>• Interorganizational context (external pressure)</li> </ul>	✓	✓	✓
Kuan and Chau [44]/EDI/survey (N = 575)	<ul style="list-style-type: none"> <li>• Technological context (perceived direct benefits)</li> <li>• Organizational context (perceived financial cost, technical competence)</li> <li>• Environmental context (perceived industry pressure/government pressure)</li> </ul>	✓	✓	✓
Grover [29]/EDI/survey (N = 226)	<ul style="list-style-type: none"> <li>• Organizational factors (IS-related factors, firm size)</li> <li>• Environmental factors (market assessment, competitive need)</li> </ul>	✓	✓	✓
Ramamurthy et al. [57]/EDI/survey (N = 181)	<ul style="list-style-type: none"> <li>• Interorganizational (IOS) factors (compatibility, complexity)</li> <li>• Support factors (top management support)</li> <li>• Organizational factor (management support, expected benefits, resource intensity, compatibility, costs)</li> <li>• Interorganizational factor (competitive pressure, customer support)</li> </ul>	✓	✓	✓

Zhu et al. [81]/e-business/ survey (N = 3,100)	<ul style="list-style-type: none"> <li>• Technology competence</li> <li>• Organizational factors (firm scope, size)</li> <li>• Environmental context (consumer readiness, trading partner readiness, competitive pressure)</li> </ul>	✓	✓	✓
Chau and Tam [8]/open system/ survey (N = 89)	<ul style="list-style-type: none"> <li>• Characteristics of the innovation (perceived barriers, importance of compliance)</li> <li>• Organizational technology (satisfaction with existing systems)</li> <li>• External environment</li> </ul>	✓	✓	✓
Damanpour [15]/various innovations/ meta-analysis	<ul style="list-style-type: none"> <li>• Organizational complexity (organization size, horizontal complexity)</li> <li>• Contingency factors (environment uncertainty)</li> </ul>		✓	✓
Thong [69]/IS in small businesses/ survey (N = 166)	<ul style="list-style-type: none"> <li>• CEO characteristics (CEO's innovativeness and IS knowledge)</li> <li>• IS characteristics (relative advantage/compatibility, complexity)</li> <li>• Organizational characteristics (business size, employee's IS knowledge)</li> <li>• Environmental characteristics</li> </ul>	✓	✓	✓

*Notes:* Check marks indicate the intersection of the TOE framework with previous studies. Only factors that were statistically significant are listed.

spend 8 percent of their revenues on IT, compared to 2 percent in retail and 3 percent in manufacturing [37]. This pattern is similar in other countries as well [42].

The nature of IT in this industry is complex and heterogeneous. On the front end, IT is used to execute and record customer transactions, whether they are handled in person, by phone, by electronic funds transfer, or on the Internet. On the back end, funds are transferred among institutions via electronic transfer systems, such as Fedwire, CHIPS, and Swift, which handle hundreds of trillions of dollars in transactions yearly. Financial EDI systems are used to support information flows among institutions. Internal IT systems include a mix of packaged and custom applications that maintain account records and support internal financial and managerial functions. There is little standardization within and among firms' internal systems, and limited use of enterprise resource planning (ERP) systems that are rather common in manufacturing and retailing industries.<sup>3</sup> Some financial firms use ERP modules in narrow functional areas such as human resources, financial ledgers, and nonfinancial asset management.

E-business technologies have the potential to add significant value in all of these areas. Most striking is the potential for Web-based applications to improve customer service. Loan applications and insurance forms can be filled out, stock trades initiated, bills paid, and funds transferred online with no human interaction required. Research tools such as mortgage calculators or retirement planning applications can be made available, and account information can be accessed online. On the back end, applications based on common Internet standards can enable data sharing across firms in an industry marked by limited standardization of IT systems. Internally, e-business applications can likewise improve integration of various proprietary systems to move toward "straight-through processing," improving the links between decision (swap, credit extension, trade) and execution (funds transfer, account updates, settlement finality).<sup>4</sup>

To realize the full potential of e-business for value creation, Internet innovations need to be embedded into existing back-office databases and systems, such as enterprise applications and electronic fund transfer (EFT). For example, financial firms can use Web-based, graphical interfaces to improve the user friendliness of proprietary enterprise systems. They also can implement middleware and XML-based standards to make EDI connections more flexible and to increase the ability of exchanging invoice and payment documents online with check clearing centers and other banking institutions.

The financial services industry already has benefited from network-enabled connectivity and interactivity for more efficient information exchange [23] and has experienced improvement in operating efficiencies and reduction in operating costs.<sup>5</sup> Clemons and Hitt [12] demonstrated significant cost savings, owing to electronic business, in product origination processes and operational activities, such as billing and document processing, for a variety of sectors ranging from brokerage, mortgage, and insurance to credit cards. However, adoption of e-business technologies and practices has been gradual, limited by security concerns, lack of standards, regulations, and the very complexity of the industry's network structure [52].



## The Research Model and Hypotheses

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### A Research Model for E-Business Value

BASED ON THE DISCUSSIONS ABOVE, we believe that the three contexts in the TOE framework are well suited for studying e-business value. To identify specific factors within this framework, we conducted a literature review of major IS journals. We found 51 articles that investigated factors shaping organizational usage of IT and the consequences. Among these articles, technology infrastructure and competence, firm size, financial resources, and competition intensity are four of the most commonly studied independent variables and thus are included in our model.

In addition, we posited two more independent variables—global scope and regulatory environment. Although not widely examined in the prior literature, they are critical for the e-business phenomenon. First, the great connectivity of the Internet enables firms to operate on a wide scope. This is particularly the case for the financial services industry, where most products can be digitized. Leveraging the Internet, firms in this industry are capable of operating in more markets and providing more services than before [35]. Second, since transactions in the financial services industry often involve very sensitive information, an adequate regulatory environment in which e-business activities can be conducted smoothly and securely is deemed vital [59]. Also, our research design is cross-country in nature, which enables a comparison of government regulations in different countries. Hence, these two factors are included in our research model.

Our research model for studying e-business value (see Figure 1) includes six factors within the three contexts of the TOE framework: technology readiness (as a surrogate for e-business-related infrastructure and organizational capabilities), firm size, global scope, financial resources, competition intensity, and regulatory environment. These six factors are hypothesized to affect the impact of e-business on firm performance, which has been conceptualized, from a process orientation, as consisting of three dimensions—impact on commerce with customers, impact on internal operation efficiency, and impact on coordination with business partners [40].

These three dimensions of e-business value are grounded in the value chain analysis of Porter [55], which has been broadly used in the IS literature to study the business value of IT. For instance, Mahmood and Soon [49] developed a comprehensive model for measuring the potential impact of IT. Their model suggests that IT can help firms to improve performance along the value chain, on downstream dimensions (e.g., by developing products more suited for market demand, and offering better postselling services), internal dimensions within the organization (e.g., enhancing internal process efficiency and employee productivity), and upstream dimensions (e.g., improving interorganizational efficiency and coordination with suppliers). Following Mahmood and Soon [49], Tallon et al. [66] decomposed IT business value into downstream dimensions (sales support, customer services, and market expansions), internal dimensions (internal process, internal operation, and staff productivity), and upstream dimensions (coordination with suppliers and business partners).

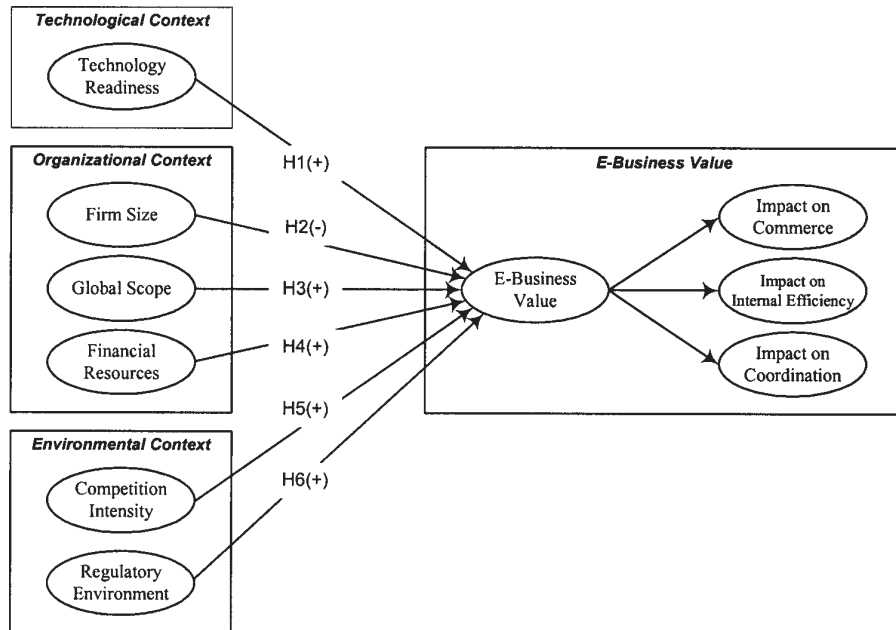


Figure 1. A Research Model for E-Business Value Based on the TOE Framework

Our study extends these notions to the e-business environment, as e-business may have impacts on all three value chain processes. With richer information about downstream markets, e-business can improve firms' responsiveness to market dynamics [68] and help firms to expand sales channels and improve customer relationships [45]. Inside the organization, e-business has the potential to improve staff productivity and operational efficiency when complementary resources exist [10, 12]. Upstream, the broad interactivity and connectivity of the Internet can facilitate firms' coordination with business partners and reduce transaction costs [50]. In particular, major value chain activities in the financial services industry feature information transactions (with customers and business partners) or information processing (within firms), both of which can be enhanced and made more efficient by the Internet [12, 23]. These prior studies motivated us to theorize e-business value on these three dimensions along the value chain. The operationalization of this construct will be discussed in the empirical section. Next, we will form hypotheses corresponding to the six TOE factors.

## Hypotheses

### Technological Context

Given its technology-driven nature, whether e-business can create value would heavily depend on the extent to which firms efficiently use the Internet technologies, and more importantly, on their ability to effectively convert the Internet technologies into

capabilities [19]. We develop a construct—technology readiness—to capture the actual usage of the Internet by financial firms. This construct incorporates three dimensions: (1) technologies in use, (2) Web site functionality at the front end, and (3) back-office integration within and beyond the firm's boundary.

On the front end, customer-facing Web site functionalities help firms provide real-time information to consumers, update product/pricing offerings, and facilitate self-service via online account management and research tools, thereby improving customer services and expanding revenue sources (called the "single customer view" in the financial services industry). Certain unique sources of e-business value, such as novelty and lock-in [61], originate from initiatives at the front end.

On the back end, while financial service firms have been using various ITs for a long time, the connectivity and open-standard data exchange of the Internet help improve compatibility of the legacy systems and achieve data integration among various databases so as to provide integrated accounts for customers ("single-customer view" in the financial services industry). Given the information-intensive nature of the financial services industry, it is particularly critical for firms to pursue information integration on the back end, thereby unleashing the hidden value of disparate information sources.

Hence, front-end functionality and back-end integration are important for e-businesses to create value, yet they have to be built on common technologies in use such as intranet, extranet, EDI, and EFT. E-business is often built upon existing enterprise systems (such as ERP) and transaction databases inside the firm and fund transfer systems among financial institutions. Therefore, combined together, the three dimensions—technologies in use, Web site functionality, and back-end integration—reflect the extent to which the firm's technologies are ready to create value for conducting financial services. These three dimensions are significantly linked with each other and are consistent with our earlier definition of e-business. That is, Web site functionality represents ways to conduct transactions and offer services; back-end integration enables information processing within the firm and coordination with business partners; and the Internet-related technologies in use provide the means to support e-business initiatives on the front end and back end.

Technology readiness is critical for e-business value in the financial services industry. We have pointed out earlier that firms in this industry are required to offer personalized and integrated customer services [59]. A tight connection between front-end data generated via Web applications and back-end processes can result in streamlined data integration and consistent customer services [12]. Conversely, offering integrated services requires frictionless connections among heterogeneous databases and technologies serving various business processes. This discussion leads to the following hypothesis:

*H1: Technology readiness is positively associated with e-business value.*

#### Organizational Context

Firm size is one of the most commonly studied factors in the innovation literature (see Damanpour [14] for a meta-analysis). In our study, firm size is defined by the

number of employees in the firm, which is deemed appropriate for the financial services industry [58, 69]. Different opinions exist as to the role that firm size plays in the process of innovation implementation. On one hand, large firms often possess resources that can facilitate implementation [60, 70]. On the other hand, large firms tend to be less agile than small firms. The possible structural inertia associated with large firms may entail more effort and cost for innovation implementation [32]. By contrast, smaller firm size is expected to facilitate innovation implementation, as small firms “require less communication, less coordination, and less influence to gather support” [53, p. 18]. To improve profitability through e-business, financial firms need to offer hybrid (i.e., cross-boundary), personalized, and integrated financial services that are different from traditional services [12, 59]. This may require radical change in firms’ business strategies, organization structure, and daily operations, which might be retarded by the structural inertia associated with firm size. Since our model has controlled for certain organizational resources (technological and financial) that large firms may possess, the notion of structural inertia leads us to expect that large firm size may deter e-business transformation and value creation. This leads to the following hypothesis:

*H2: Firm size is negatively associated with e-business value.*

Scope is another commonly studied organizational factor in the IS literature [21, 30]. In this study, scope is defined as the geographical extent of a firm’s operations in the global market; hence it is termed *global scope*. The role of global scope in shaping e-business value can be explained from a transaction-cost perspective. In general, companies may face a steep rise in transaction costs when they expand into heterogeneous market segments [30]. For instance, firms operating in different geographic regions need to locate the target market and form channels in every region, resulting in higher search costs (for both consumers and business partners). E-business may help reduce such transaction costs [26, 50], including “the time spent by managers and employees searching for customers and suppliers, communicating with counterparts in other companies regarding transaction details . . . the costs of travel, physical space for meetings, and processing paper documents” [46, pp. 56–57]. In addition to these direct costs, indirect costs of transactions could also be reduced, such as the costs of adverse selection, moral hazard, and holdup, due to increased information transparency facilitated by e-business [78]. The reduction of transaction costs is of particular importance for the financial services industry, because this industry is intensively transaction based [73]. Financial firms with greater scope would face higher transaction costs, and thereby may realize more value from e-business, because e-business helps financial firms to lower transaction costs [12, 59]. This leads to the following hypothesis:

*H3: Global scope is positively associated with e-business value.*

Prior research has shown that financial resources are an important factor for technology implementation [57]. Adopting e-business requires investment in hardware, software, system integration, and employee training. Sufficient financial resources

help companies to obtain these necessary IT resources and develop them into superior e-business functionalities, so as to realize the potential e-business value [10]. In addition to technology costs, marketing costs for online banking amount to between \$150 and \$300 per customer [71]. Thus, firms that devote greater financial resources to IT and Web-based development are more likely to achieve successful e-business implementation and to realize more e-business value. Hence, we have the following hypothesis:

*H4: Financial resources are positively associated with e-business value.*

#### Environmental Context

Competition intensity has long been recognized as an important factor in the adoption literature [29, 36]. Competitive intensity refers to the degree that the company is affected by competitors in the market. Porter and Millar [56] analyzed the strategic rationale underlying the relationship between competition intensity and IT innovations. They suggested that by adopting IT, firms might be able to alter the rules of competition, affect the industry structure, and leverage new ways to outperform rivals, thus changing the competitive environment. Therefore, firms facing more intense competition in the market tend to attribute more value to IS innovations. We apply this argument to the Internet domain, and hypothesize the following:

*H5: Competition intensity is positively associated with e-business value.*

Within the TOE framework, the *regulatory environment* has been recognized as a critical environmental factor affecting innovation diffusion. For example, Williamson summarized two ways in which government regulation could affect innovation diffusion: “One is to take specific actions to increase or decrease payoffs—by taking tax and other measures to encourage research and development. . . . The second way of influencing innovations is by altering the climate in which they are received” [76, p. 126]. Accordingly, governments could help financial services providers to implement e-business by regulating the Internet to make it a trustworthy business platform (e.g., dealing with fraud and credit card misuse) and establishing supportive business laws to protect e-business transactions [71]. Recent empirical studies indicate that regulatory environment plays an important role in e-business diffusion [42].

Given that financial transactions often involve very sensitive information, an adequate regulatory and institutional framework is deemed more critical for the financial services industry than for others. Sato et al. [59] posited that regulatory environments, together with communications platform, are supporting infrastructures for e-business, highlighting the importance of regulatory environment in the financial services industry. These theoretical assertions and empirical evidence suggest the following hypothesis:

*H6: A supportive regulatory environment is positively associated with e-business value.*

## Research Methodology

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### Data and Sample

TO TEST THE CONCEPTUAL MODEL in Figure 1 and the associated hypotheses proposed above, we designed a questionnaire and conducted a multicountry survey. The survey questionnaire was designed on the basis of a comprehensive literature review and interviews of managers and was refined via several runs of pretests and revisions. Each item on the questionnaire was reviewed by an expert panel for its content, scope, and purpose (content validity). After the questionnaire was finalized, the survey was executed by International Data Corporation (IDC), a professional survey firm that specializes in large-scale survey research and has accumulated considerable experience and a well-connected network of corporate executives.

To have a broad representation of both developed and developing economies, the survey was conducted in the United States and nine other countries (Brazil, China, Denmark, France, Germany, Japan, Mexico, Singapore, and Taiwan)<sup>6</sup> during the February–April 2002 period.<sup>7</sup> The establishment (physical location or site) was the sampling unit and is the unit of the database. The sampling was a stratified sample by size (large—250 or more employees, and small—between 25 and 250 employees), with sites selected randomly within each size cell. The sample frame was obtained from a list source representative of the entire local market.<sup>8</sup>

A predetermined number of interviews were completed in each establishment-size category to ensure an adequate sample for each size group. Interviews were conducted only with those companies that make use of the Internet in conducting their business. Target completes were about 65 interviews per country (except for 100 interviews in the United States), equally divided by size (large/small).

Eligible respondents were the individuals at each site best qualified to speak about the site's overall computing activities. For medium/large sites, the respondent was the CIO, an IT director, or IT manager. For small sites, it was an IT manager or owner. The response rate ranges from 8 percent in Germany and 38 percent in Taiwan, with an average rate of 13 percent. Our final data set contains 612 respondents.<sup>9</sup> Table 2 shows the sample characteristics. Distribution of firm size measured by employee number reflects a balance of large and small businesses. We also examined nonresponse bias, and no statistically significant differences were found in terms of revenue and firm size.

All of the firms in the sample belong to the financial services industry (banking, securities, brokerage, credit institutions, insurance, and real estate). This industry has long been recognized as an information-intensive sector that is at the forefront of IT applications [13]. IT investment was about \$5,000 per employee in an average financial firm from 1995 to 1999; the rest of the private sector spent just \$440 per employee [54]. This trend continues into the Internet era, in which firms in this industry, on average, spend 8 percent of their revenues on IT, compared to 2 percent in retail and 3 percent in manufacturing [37]. Associated with the heavy IT investment is the wide adoption of e-business. Macro-level statistics published in 2002 by the United

Table 2. Sample Characteristics ( $N = 612$ )

	Observations	Percent
<i>Country</i>		
Brazil	50	8.2
China	63	10.3
Denmark	56	9.2
France	62	10.1
Germany	62	10.1
Japan	59	9.6
Mexico	51	8.3
Singapore	62	10.1
Taiwan	57	9.3
United States	90	14.7
Total	612	100
<i>Number of employees</i>		
< 100	185	30.2
100–199	97	15.8
200–499	200	32.7
> 499	130	21.2
<i>Respondent title</i>		
CEO, president, managing director	26	4.2
CIO, CTO, VP of IS	110	18.0
IS manager, director, planner	207	33.8
Other manager in IS department	136	22.2
COO, business operations manager	23	3.8
CFO, administration/finance manager	51	8.3
Others (IS analyst, marketing VP, other manager)	59	9.6

Nations show that Internet banking represents 5 percent to 10 percent of the total volume of retail banking in the United States and in Europe, much higher than overall business-to-consumer e-business, which represents less than 2 percent of total retail transactions [71]. Given the early adoption and extensive use of e-business in the financial services industry, value creation from e-business is probably more likely in this industry than others. These facts make the financial services industry an appropriate testing field for our research model. From an empirical perspective, concentrating on a single industry also allows us to control for extraneous industry factors that could otherwise confound the analysis, thereby enhancing internal validity.

### Operationalization of Constructs

The development of the measurement model included successive stages of theoretical modeling, statistical testing, and refinement, as suggested by Straub [63]. Measurement items were developed on the basis of a comprehensive review of the literature as well as expert opinion. We then tested multi-item constructs using confirmatory factor analysis (CFA).<sup>10</sup> Based on the CFA assessment, the measurement model was

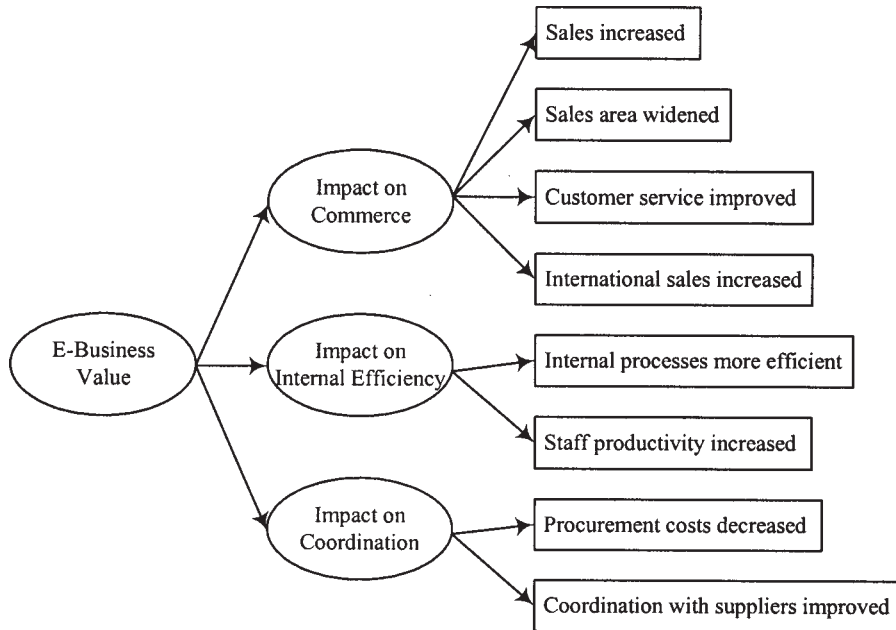


Figure 2. A Specification of E-Business Value

further refined and then fitted again. Constructs and associated indicators in the measurement model, as well as prior research support, are listed in the Appendix and discussed below.

#### Dependent Variable

Consistent with the theoretical arguments made earlier, we operationalize *e-business value* as a second-order construct manifested in three related dimensions—impact on *commerce* (increasing sales, improving customer services, and widening sales channels); impact on *internal efficiency* (increasing employee productivity and internal processes efficiency); and impact on *coordination* (reducing transaction costs with business partners, and improving coordination with business partners or suppliers). As shown in Figure 2, indicators for the three dimensions were drawn from prior research measuring IT impact [49, 66]. Recognizing the fact that many factors other than e-business may affect firm performance, we asked firms to evaluate, using a five-point Likert scale, the *net* impacts of e-business on the three dimensions. These three dimensions should not be considered in isolation from each other; rather, they should be viewed as mutually reinforcing elements of value creation along the value chain. Hence, the e-business value construct represents an integrative measure of the level of Internet-enhanced business performance along these three dimensions. Previous research notes that this operational perspective represents a theoretically strong basis for capturing complex measures [62].



### Technological Context

Consistent with the conceptualization in the theoretical section, we examined *technology readiness* along three dimensions: (1) technologies in use, such as intranet, extranet, EDI, and EFT, that form basic e-business–related technology infrastructure; (2) front-end Web site functionalities, such as online services and account management; and (3) back-end integration—the extent to which various information sources and databases in the back office are connected within and beyond a firm’s boundary. These items were designed on the basis of the e-commerce metrics proposed and tested by Zhu and Kraemer [80]. Combined together, these three dimensions reflect the extent to which the firm’s technologies are ready to create value. That is, they serve as indicators of technology readiness in the sense that it is reflected by significant technologies in use, capable functionalities on the front end, and well-integrated back-office systems. They tend to be linked with each other. Both front-end functionality and back-end integration have to be built upon a strong technology infrastructure. This is especially true in the financial service industry, where online transactions and online account management require smooth interactions and data exchange with the back-end systems.

### Organizational Context

*Firm size* is measured by the number of employees in the entire organization, log-transformed to reduce data variance [58]. *Global scope* in our study mainly measures geographic scope (e.g., having multiple establishments and conducting business transactions with other countries), which has been shown to be a significant factor for studying e-business usage in prior research [81]. *Financial resources* are measured by annual IT spending and Web-based spending as percentages of total revenue, which serves as a measure of e-business–related spending [48].

### Environmental Context

*Competition intensity* is measured by the degree of rivalry among existing competitors, based on one of Porter’s [55] concepts of five competitive forces. Such operationalization has been used in the IT literature [22, 69]. The survey items assess the degree to which firms’ business activities were affected by existing local, nationwide, and worldwide competitors. Drawing upon a previous e-business study examining national environment and policies [42], we designed four items to measure *regulatory environment*. These items include e-business usage incentives provided by the government, requirements for government procurement, legal protection of consumers’ Internet purchases, and supportive business and tax laws for doing e-business.

### Instrument Validation

To empirically assess the constructs theorized above, we conducted CFA using AMOS 4.0. We chose the algorithm of maximum likelihood estimation (MLE), which has

been shown to be robust to departures from normality assumptions [6]. We assessed construct reliability, convergent validity, discriminant validity, and validity of the second-order construct. The measurement properties are reported in Tables 3 and 4.

#### Construct Reliability

Construct reliability measures the degree to which items are free from random error and therefore yield consistent results. In our measurement model (Table 3), most constructs have a composite reliability over the cutoff of 0.70, as suggested by Straub [63], while three constructs have a reliability close to this cutoff (0.67 for technology readiness, 0.65 for global scope and regulatory environment).

#### Convergent Validity and Discriminant Validity

Convergent validity assesses the consistency across multiple operationalizations. As shown in Table 3, all estimated standard loadings are significant ( $p < 0.01$ ), suggesting good convergent validity. To assess the discriminant validity—the extent to which different constructs diverge from one another—we used the criterion suggested by Gerbing and Anderson [27]: testing whether the correlations between any two constructs are significantly different from unity. Such test can be performed by comparing an unconstrained measurement model that “freely” estimates the correlation between two constructs of interest with a constrained model with that correlation fixed as unity. To satisfy discriminant validity, the  $\chi^2$  between these two models should be significantly different [45, 62]. In all paired comparisons, we found that the  $\chi^2$  difference was highly significant ( $p < 0.001$ ), suggesting that constructs in our measurement model are distinct in nature.<sup>11</sup>

#### Validity of the Second-Order Construct

Table 4 shows the estimation of the second-order construct, e-business value. Its structure is illustrated in Figure 2. The paths from the second-order construct to the three first-order factors are significant and of high magnitude, greater than the suggested cutoff of 0.7 [9]. We evaluated the efficacy of the second-order model by the target coefficient ( $T$ -ratio) with an upper bound of one [62]. Our model has a very high  $T$ -ratio of 0.98, implying that the relationship among first-order constructs is sufficiently captured by the second-order construct [62]. Therefore, on both theoretical and empirical grounds, the conceptualization of e-business value as a higher-order, multidimensional construct seems justified.

In summary, our measurement model satisfies various reliability and validity criteria. Furthermore, we used bootstrapping to examine the robustness of our measurement model, since discrete measurement items are involved [74], although the MLE algorithm is robust to violations of the normality assumption. It turns out that the measurement results reported in Tables 3 and 4 are consistent with the bootstrapping results. Thus, constructs developed by this measurement model are robust and could be used to

Table 3. Measurement Model: Loadings, Convergent Validity, and Reliability

Constructs	Indicators	Standardized factor loadings	Convergent validity ( <i>t</i> -statistic)	Composite reliability
Technology readiness	TR1	0.73 <sup>a</sup>	—	0.67
	TR2	0.63 <sup>***</sup>	10.66	
	TR3	0.44 <sup>***</sup>	7.92	
	TR4	0.51 <sup>***</sup>	9.22	
Global scope	GS1	0.69 <sup>a</sup>	—	0.65
	GS2	0.77 <sup>***</sup>	13.82	
	GS3	0.38 <sup>***</sup>	7.49	
Financial resources	FR1	0.87 <sup>a</sup>	—	0.82
	FR2	0.81 <sup>***</sup>	4.74	
Competition intensity	CI1	0.62 <sup>a</sup>	—	0.75
	CI2	0.91 <sup>***</sup>	3.65	
Regulatory environment	RE1	0.71 <sup>a</sup>	—	0.65
	RE2	0.80 <sup>***</sup>	10.52	
	RE3	0.36 <sup>***</sup>	6.26	
	RE4	0.33 <sup>***</sup>	6.48	
Impact on commerce	IC1	0.79 <sup>a</sup>	—	0.79
	IC2	0.75 <sup>***</sup>	17.23	
	IC3	0.64 <sup>***</sup>	14.79	
	IC4	0.58 <sup>***</sup>	12.96	
Impact on internal efficiency	IIE1	0.79 <sup>a</sup>	—	0.80
	IIE2	0.83 <sup>***</sup>	17.36	
Impact on coordination	ICO1	0.78 <sup>a</sup>	—	0.73
	ICO2	0.73 <sup>***</sup>	12.70	

Notes: \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.1$ ; <sup>a</sup>loadings are specified as fixed to make the model identified. Insignificant indicators (GS4, GS5, and CI3) are dropped.

Table 4. Measurement Model: Second-Order Construct of E-Business Value

Second-order construct	First-order constructs	Loadings	<i>t</i> -statistic	Composite reliability	Target coefficient ( <i>T</i> -ratio)
E-business value	Impact on commerce	0.89 <sup>a</sup>	—	0.87	0.98
	Impact on internal efficiency	0.76***	11.73		
	Impact on coordination	0.85***	12.94		

*Notes:* \*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ ; <sup>a</sup> loadings are specified as fixed to make the model identified.

test the conceptual model and the associated hypotheses proposed earlier. We show descriptive statistics in Table 5 and discuss empirical tests in the following section.

### Empirical Analysis

BEFORE FORMALLY TESTING THE HYPOTHESES, we examined whether there exists survey bias in our data set, since respondents in our survey include both IS and non-IS managers. One might suspect that IS managers tend to have positive bias when rating the impacts of e-business on firm performance. For this reason, it is worthwhile to conduct formal tests to examine whether answers offered by IS managers to items measuring e-business value (see Figure 2) differ significantly from those offered by non-IS managers.

We split the whole sample into two groups: IS managers (CIO, CTO, VP of IS, IS manager, IS director, IS planner, and other manager in IS department) versus non-IS managers (CEO, president, managing director, COO, business operations manager, CFO, administration/finance manager, and other managers). We used the Mann-Whitney U-test to compare the means between the two groups, given that the data are ordinal in nature. We further computed the Kolmogorov-Smirnov test statistic to test the null hypothesis that the sample distribution of the IS manager group is equal to that of the non-IS manager group [5]. The results are shown in Table 6. The  $p$ -value associated with each test statistic on each item is insignificant ( $p \geq 0.10$ ), with only one exception—the Mann-Whitney U-test on the item of “international sales increased.” Hence, we conclude that responses from the two groups do not differ significantly, in terms of both the sample mean and the sample distribution.<sup>12</sup> With this concern addressed, we will pool the two groups together for hypotheses testing.

### Analysis of the Full Sample

We tested the research model shown in Figure 1 by SEM. Again, covariance-based SEM, as implemented in AMOS 4.0, was chosen primarily because its emphasis is on the overall variance-covariance matrix and on the overall model fit, making it more

Table 5. Descriptive Statistics

Correlation matrix	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) E-business value	—	0.48***	0.13***	0.18***	0.28***	0.14***	0.35***
(2) Technology readiness		—	0.29***	0.22***	0.20***	-0.06	0.10
(3) Firm size			—	0.56***	0.04	0.10**	0.09*
(4) Global scope				—	0.02	0.11**	0.18**
(5) Financial resources					—	0.01	0.13
(6) Competition intensity						—	0.06
(7) Regulatory environment							—
Minimum	0.74	0.82	3.22	0.00	0.00	0.60	0.77
Maximum	3.70	3.26	12.77	0.41	0.72	3.00	3.72
Mean	1.92	2.04	6.92	0.16	0.06	1.97	1.48
Standard deviation	0.88	0.63	2.18	0.15	0.10	0.77	0.75

Notes: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ ; \*  $p < 0.1$ .

Table 6. IS Managers Versus Non-IS Managers

Items measuring e-business value (five-point Likert scale)	IS managers		Non-IS managers		Mann-Whitney test		Kolmogorov-Smirnov test	
	Mean	S.D.	Mean	S.D.	z-score	p-value	z-score	p-value
Sales increased	2.59	1.17	2.57	1.27	-0.30	0.77	0.70	0.72
Sales area widened	2.60	1.29	2.52	1.44	-0.91	0.36	0.86	0.45
Customer service improved	3.23	1.16	3.03	1.34	-1.65	0.10	0.96	0.32
International sales increased	1.83	1.17	1.62	1.11	-2.26	0.02	1.14	0.15
Internal processes more efficient	3.02	1.20	2.95	1.36	-0.46	0.64	0.82	0.52
Staff productivity increased	2.74	1.18	2.71	1.30	-0.44	0.66	0.65	0.80
Transaction costs decreased	2.12	1.17	2.15	1.29	-0.17	0.87	0.51	0.96
Coordination with suppliers improved	2.57	1.23	2.50	1.38	-0.74	0.46	0.97	0.30

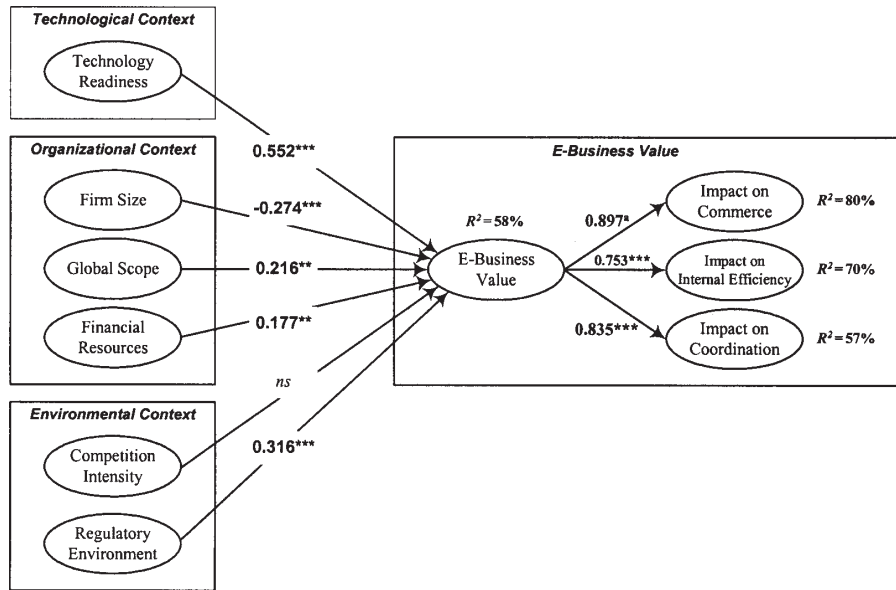


Figure 3. Empirical Results—Full Sample. Notes: \*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.10$ ; normed  $\chi^2 = 3.377$ ; NFI = 0.967; RFI = 0.957; IFI = 0.977; TLI = 0.969; CFI = 0.977; RMSEA = 0.058; <sup>a</sup> loadings are specified as fixed to make the model identified; ns:  $p > 0.10$ .

model analytic and more suited for testing the theory as a whole [67]. Given that the nature of our study is theory testing and development, covariance-based SEM is the preferred technique [24].

Standardized paths and various model-fit indices are shown in Figure 3.<sup>13</sup> To assess model fit, normed  $\chi^2$ , the ratio of  $\chi^2$  to the degree of freedom, is a standard measure. A normed  $\chi^2$  with value between one and five implies a good model fit and no evidence of overfitting [1]. Our model has a normed  $\chi^2$  of 3.377, indicating a good model fit. In addition, we examined five incremental fit indices—normed fit index (NFI), relative fit index (RFI), incremental fit index (IFI), Tucker-Lewis index (TLI), and comparative fit index (CFI)—and one parsimonious fit index—root mean square error of approximation (RMSEA). The incremental fit indices are all above the conventional cutoff of 0.9 [31], indicating an excellent model fit compared to a baseline model. Our model also has an acceptable RMSEA of 0.058. In summary, using the normed  $\chi^2$  and various indices, we have verified that our model has a good fit with the empirical data.

Our model was also evaluated in terms of statistical power, which refers to the ability to reject a poor model specification. Power analysis should be included in model evaluation and hypotheses testing, as advocated by researchers in social science and the IS field [3]. Following the RMSEA-based procedure developed by MacCallum et al. [47], we find that our model has a statistical power greater than 0.99, far above the conventional threshold of 0.8, as suggested by Baroudi and Orlikowski [3].

The dependent variable, e-business value, has a significant  $R^2$  of 58 percent, meaning that 58 percent of the variance can be explained by the six factors. The three first-order constructs also have high values of  $R^2$  (80 percent for impact on commerce, 70 percent for impact on internal efficiency, and 57 percent for impact on coordination). Thus, we believe that the six TOE factors have significantly explained data variations for e-business value and its underlying dimensions.

Technology readiness, global scope, financial resources, and regulatory environment have positive and significant paths ( $p < 0.01$  for technology readiness and regulatory environment;  $p < 0.05$  for global scope and financial resources) leading to e-business value. Firm size has a significant but negative path ( $-0.274$ ,  $p < 0.01$ ) leading to e-business value. The path from competition intensity to e-business value is insignificant. Thus, all hypotheses, except H5, are supported.<sup>14</sup> Implications of these results will be discussed soon.

### Sample Split: Developed Versus Developing Countries

Given the fact that e-business is a global phenomenon and the multinational nature of our survey, we believe it is important to add an international dimension to the study of e-business value. Specifically, within the environmental context of the TOE framework, we wanted to understand the differences of e-business value across countries, as each country has its own unique national environment for e-business. A national environment embeds many environmental factors (economic, legal, cultural, business, and consumer markets), as suggested by Watson et al. [72]. We were particularly interested in differences between developed and developing countries. It has been argued that most theories were developed in the context of industrialized countries, and that these theories need to be reexamined in the context of developing and newly industrialized countries [2]. Several environmentally imposed obstacles that managers face in implementing IT in less-developed countries have been identified, including a scarcity of managerial, technical, and financial resources at the firm level [16]; the inadequacy of basic infrastructure at the national level [20, 71]; and other institutional factors such as culture and politics [38]. In addition, our data show that developing and developed countries differ significantly in terms of e-business use. This theoretical and empirical evidence motivated us to investigate how different economic environments shape e-business value.

As shown in Table 2, our survey covered developing countries, newly industrialized countries (NICs), and developed countries, which enabled us to examine the role of national environment on e-business impact. We split the full sample into two subsamples: (1) developing countries and NICs (Brazil, China, Mexico, Singapore, and Taiwan),  $N = 283$ ; and (2) developed countries (Denmark, France, Germany, Japan, and the United States),  $N = 329$ . We then ran SEM on each subsample, respectively. Figure 4 shows estimated paths for the developed-country subsample and the developing country subsample (reported in parentheses).

Again, we evaluated our model on subsamples in three steps: (1) in each subsample, our model showed a good fit with the empirical data, as suggested by normed  $\chi^2$

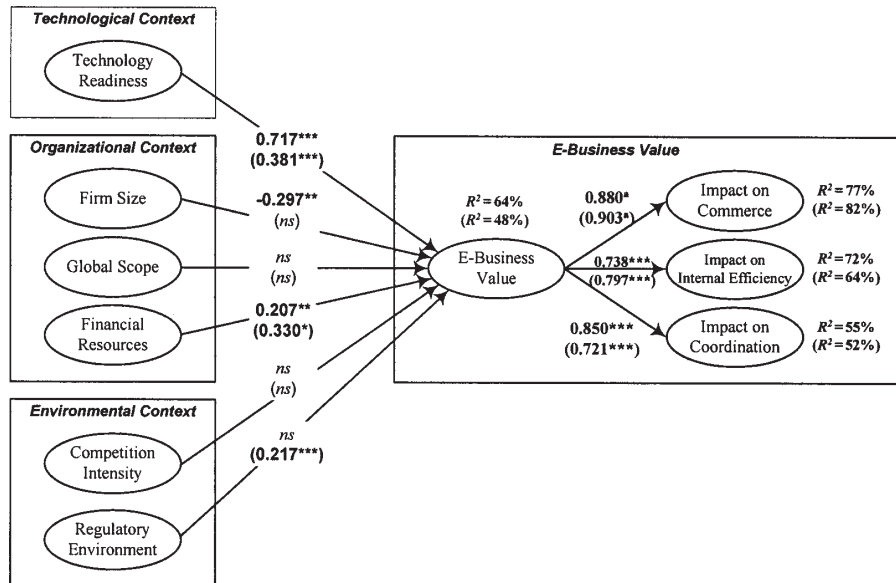


Figure 4. Empirical Results—Sample Split (estimates on the subsample of developing countries and NICs are listed in parentheses). Notes: \*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.10$ . Developed countries: normed  $\chi^2 = 2.289$ ; NFI = 0.957; RFI = 0.944; IFI = 0.975; TLI = 0.968; CFI = 0.975; RMSEA = 0.056. Developing countries and NICs: normed  $\chi^2 = 2.340$ ; NFI = 0.958; RFI = 0.945; IFI = 0.976; TLI = 0.967; CFI = 0.976; RMSEA = 0.069. <sup>a</sup> Loadings are specified as fixed to make the model identified; ns:  $p > 0.10$ .

(below 3.0), incremental fit indices (all above 0.9), and acceptable RMSEA; (2) we calculated the RMSEA-based statistical power, with a value over the suggested cut-off of 0.8 in each subsample [3]; and (3) the  $R^2$  was deemed significant ( $R^2$  for e-business value is 64 percent in the developed-country subsample and 48 percent in the developing-country subsample).

In the developed-country subsample, three of the six TOE factors were found to be significant (technology readiness, firm size, and financial resources). Thus, only H1, H2, and H4 are supported. Global scope and regulatory environment, which are significant in the full sample, turn out to be insignificant ( $p > 0.10$ ). Competition intensity remains insignificant.

In the developing-country subsample, three of the six TOE factors were found to be significant (technology readiness, financial resources, and regulatory environment), while firm size, global scope, and competition intensity are insignificant ( $p > 0.10$ ). It is surprising that global scope, which is a significant factor in the full sample, becomes insignificant in each subsample, and that competition intensity is not significant in the full sample and in each subsample.

We summarize these results of hypotheses testing in Table 7. Explanations for these results and their implications are discussed in the next section.



Table 7. Summary of Hypotheses Testing

Hypotheses	Sample split			Explanations/implications
	Full sample	Developed countries	Developing countries and NICs	
H1—Technology readiness	Yes	Yes	Yes	Technology readiness—infrastructure, Web site functionality, and information integration—is a critical factor for e-business value, and the importance is increasing as e-business evolves.
H2—Firm size	Yes	Yes	No	Large firms have to employ more effort and costs in e-business transformation; but in developing countries, resource advantages associated with firm size may moderate the impact of inertia.
H3—Global scope	Yes	No	No	Subsamples lack data variation for global scope.
H4—Financial resources	Yes	Yes	Yes	Financial resources are important for e-business implementation in each subsample, but more important in developing countries.
H5—Competition intensity	No	No	No	E-business value originates more from internal resources than from external pressure.
H6—Regulatory environment	Yes	No	Yes	In developing countries, successful e-business is more dependent on a supportive regulatory environment.

Notes: Yes = hypothesis supported; No = hypothesis not supported.

## Discussion

To understand e-business value (i.e., its impact on firm performance) and contextual factors, we have empirically tested the TOE framework, as well as six hypotheses within that framework, in the full sample and two subsamples across developed and developing countries. Empirical analysis demonstrated several key findings, which are discussed below.

### Major Findings and Interpretations

*Finding 1: Within the TOE framework, technology readiness emerges as the strongest factor for e-business value, while financial resources, global scope, and regulatory environment also significantly contribute to e-business value.*

As shown by the empirical results in Figure 3, four factors within the TOE framework—technology readiness, global scope, financial resources, and regulatory environment—are significant facilitators of e-business value. Among these, technology readiness appears to be the strongest factor, as indicated by the magnitude and significance of its path loading (0.552,  $p < 0.01$ ). This suggests that financial firms with stronger technological capability and greater devotion of financial resources to IT are more likely to realize e-business value. Moreover, wider scope allows financial firms to capture more benefits from the connectivity of the Internet. Finally, regulatory support is an environmental factor facilitating value creation in e-business.

*Finding 2: Large firms are less likely to realize the impact of e-business on their performance than small firms, which seems to suggest that structural inertia associated with large firms may retard e-business value creation.*

The significant but negative path ( $-0.274$ ,  $p < 0.01$ ) suggests that firm size has a negative effect on e-business value creation. Previous research on insurance companies suggested that large firms were not leaders in realizing the full potential of the economic benefits of IT investments [33]. Our findings with regard to e-business are consistent with these findings. In the financial services industry, e-business value creation demands timely responses to market changes, and necessitates tighter integration of IT applications within and across firm boundaries so as to provide integrated financial services [59]. This may also require transformation of a firm's business processes and organizational structure [11]. Although our data did not provide enough details, we suspect that large firms may have more fragmented IT legacy systems (built over a long period of time), and change is often further complicated by complex business processes, entrenched organizational structure, and hierarchical decision-making [53]. These factors translate into structural inertia that may slow down the digital transformation of large firms.

*Finding 3: Competitive pressure often drives firms to adopt e-business, but e-business value is associated more with technological integration and organizational resources than with external competition.*

Previous literature has shown that competitive pressure is an important factor driving firms to adopt a new technology in order to avoid competitive decline [36, 67]. It is even more so in the e-business domain, as many firms jump onto the Internet bandwagon driven by competitive pressure [41]. Yet it is somewhat surprising to see that competition intensity turns out to be an insignificant factor in all of our samples (the full sample and the two subsamples). The extent to which e-business actually improves firm performance tends to be less tied to competition intensity. This seems to suggest that e-business value originates more from internal organizational resources and technological capability than from external pressure. This finding demonstrates the different role of competitive pressure in the two stages of e-business transformation—adoption and value realization.

*Finding 4: While financial resources are an important factor in developing countries, technological capabilities become far more important in developed countries. This seems to suggest that, as firms move into deeper stages of e-business transformation, the key determinant for e-business value shifts from monetary spending to real capabilities.*

The empirical results on sample splits shown in Figure 4 demonstrate the differing significance of various e-business resources across developed versus developing countries. In developing countries, technology readiness and financial resources have similar importance, as suggested by path magnitude (0.381 versus 0.330); whereas in developed countries, technology readiness emerges as a far more important factor than financial resources (0.717 versus 0.207). Developed countries and developing countries seem to be at different stages of e-business development [71]. The difference across the two subsamples seems to suggest that, as e-business evolves, the key determinant of its value shifts from monetary spending to organizational capabilities (especially technology readiness that helps to leverage existing IS and databases).<sup>15</sup>

*Finding 5: The importance of firm size and regulatory environment differs across developed versus developing countries. In developing countries, problems with structural inertia associated with size tend to be offset by the resource advantages associated with large firms. Also, in developing countries, government regulation plays a more significant role than in developed countries.*

This result might be explained as follows. First, in developed countries, firm size has been shown to retard e-business value, reflecting the negative effect of structural inertia associated with large firms. This negative effect of structural inertia, in contrast, seems to be neutralized by the resource advantages associated with large firms in developing countries. Large firms tend to enjoy a pronounced advantage over small firms in developing countries, where human and financial resources are more limited and likely to be concentrated in larger firms [71]. Drawing upon our earlier argument that size effect is a mix of resource advantages and structural inertia, this result implies that in developing countries these two effects seem to cancel each other out; hence we see the insignificant path from firm size to e-business value in the developing-country subsample. However, as e-business develops, more sophisticated e-business resources

and capabilities are required (e.g., technological integration tailored to strategic contexts), which large firms seem slow to develop. As a consequence, the impact of structural inertia outweighs resource advantages and negatively affects e-business value, as shown by the developed-country results.

Second, regulatory environment is a significant factor in developing countries, but not in developed countries. Such differences could be explained by the distinct market environments of developed and developing countries. Markets in most developing countries are characterized by information asymmetry and immature institutional structure [20]. Thus, government regulation (e.g., regulating monopoly power and dealing with e-business fraud) tends to play a greater role in developing countries. Furthermore, government interventions are in general more frequent in developing countries and NICs, such as China, Singapore, and Brazil [77], which makes financial firms in these countries regard government regulation as a more important factor.

Together, Findings 4 and 5 demonstrate the significant role that economic environments play in shaping e-business value. These findings further confirm the usefulness of the proposed research framework for assessing e-business value, as economic environment is an important factor within the environmental context of the TOE framework.

## Managerial Implications

These results have several important implications for management. First, they offer a useful framework for managers to assess the *technological* conditions under which e-business is launched to better pursue business value. Our study sheds light on ways to achieve such benefits—customer-facing Web functionalities on the front end, and tight integration on the back end. Meanwhile, successful launching of online functionality and back-end integration relies on necessary organizational reconfiguration and business processes reengineering [18]. As Internet technologies diffuse and become necessities, these organizational and industry-specific capabilities become even more critical. This urges executives to put a high priority on integrating fragmented technologies and linking those “islands of automation” built over time in many enterprises. This is especially important in the financial services industry, where firms have been building various legacy systems and using multiple platforms.

Second, managers in financial firms need to assess the appropriateness of e-business to certain *organizational* characteristics (e.g., firm size, scope) as suggested by our empirical findings. This implies that the potential value of e-business investment could be affected by structural differences. Therefore, managers in financial firms with wider scope should pursue e-business transformation more proactively, given the greater potential for such firms to achieve benefits from e-business. This implication should be of special interest for firms seeking geographic expansion (into different regions and market segments) and product diversification (e.g., banking, trading, loan, mortgage, and credit cards). Such diversification means that firms would face greater coordination tasks, and could leverage e-business initiatives to facilitate coordination and achieve resource integration.

Third, many financial services firms jump onto the Internet bandwagon driven by *environmental* factors such as competitive pressure. Yet our results show that e-business value originates more from internal organizational resources and technological capability than from external pressure. As financial firms move into deeper stages of e-business transformation, the key determinant of e-business value will further shift from IT spending to organizational capabilities. This urges managers to convert investments to real capabilities in their organizations by leveraging existing IS and databases and improving technology readiness.

Our study also offers implications for *policy-makers*. The regulatory environment has emerged as an important factor shaping e-business value. It is even more important in developing countries. Companies frequently cite significant obstacles of doing e-business, including inadequate legal protection for online business activities, unclear business laws, and security concerns. This points to the need for establishing a legal and institutional framework supporting e-business and online transactions. Governments, therefore, could accelerate e-business transformation by establishing supportive business and tax laws to make the Internet a trustworthy business platform (e.g., dealing with transaction fraud, promoting credit card use, and protecting sensitive financial data). This is particularly important at the early stages of e-business development in an economy.

### Limitations and Future Research

Our methodology required tradeoffs that may limit the use of the data and interpretation of the results. We believe that the key limitations of this study are as follows. First, because our data set is cross-sectional in nature, we can only show associations, not causality, and we cannot analyze longitudinal processes, such as the evolution of e-business functionalities and their business value in a dynamic context. Second, this study focuses on one industry—the financial services industry. While concentrating on one industry allows us to control for extraneous industry factors that could confound the analysis, we do not know whether these results would carry over to other industries. Especially, given that the financial service industry tends to be an early adopter of e-business, it is possible that the impact of e-business in this industry is higher than in other industries. Third, like many survey studies in the IS literature, measurement instruments are not “set in stone.” Instead, developing solid instruments in the e-business domain is still an ongoing procedure of development, testing, and refinement [64]. Although reliability, convergent validity, and discriminant validity were empirically tested in our data set, further confirmatory studies are necessary to determine the external validity of the results. Particularly, as discussed earlier, the construct global scope in our study mainly captures geographic scope, which needs to be enriched in further research to include product scope and functional scope.

These limitations suggest avenues for further research. We plan to refine our measures of key variables (e.g., technology readiness, scope) in the next round of data collection. We will ask more specific questions about how a firm integrates the Internet with its existing internal IS (such as ERP and customer relationship management

[CRM]). To capture more characteristics of a firm's scope, we plan to use entropy measures [21]. Apparently, this requires a different research design involving the merging of subjective survey results with firm-level accounting data. More importantly, e-business is a dynamic capability [75] that requires firms to build and then dynamically reconfigure in order to align with changing technology and business environments. To investigate the dynamic nature of e-business adoption and impact, we plan to enhance the database over time to pave the way for a longitudinal study. In addition, it would be valuable to conduct a study comparing the subsectors within financial services (i.e., banking, brokerage, insurance, and real estate), as they may be heterogenous and, consequently, value creation could be different. We were unable to examine this question in the current study, as the subsector codes were not retained in data collection. Finally, we also plan to expand our study into other industry sectors (e.g., retail and manufacturing). We expect that the longitudinal and cross-sectional research designs may enable us to cross-check the external validity of the findings in the current study. While this study provides a base upon which future research can build, there is clearly much more work to be done.

We hope this study offers implications for other researchers as well. First, our study has developed a conceptual model that advanced the theoretical basis of the TOE framework. Our results demonstrated the usefulness of this conceptual model for identifying factors affecting e-business value. This framework could be used by other researchers for studying IS impact in the Internet domain (such as Web services and wireless mobile commerce). Second, we have developed several multi-item constructs, including technology readiness and e-business value. These instruments have passed various reliability and validity tests, and they could be used in future studies. Third, grounded in theory and empirical data, we demonstrated varying relationships between the TOE factors and e-business value in different economic environments. These associations found in our large-scale survey might be useful for other researchers to develop their own models and hypotheses.

## Concluding Remarks

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THE RECENT HIGHS AND LOWS OF THE E-COMMERCE phenomenon have renewed and increased the urgency for understanding the relationship between IT spending, e-business, and firm performance. With the recent poor performance of IT firms and the burst of the dot-com bubble, there has been a trend toward downplaying the effect of IT and e-business, as evidenced by a recent report stating that IT investments have no positive effect on economic productivity [51]. This conclusion may have far-reaching implications for firms' investment decisions in new generations of IT and e-business.

Our study finds that IT investment has a positive contribution to firm performance, as evidenced by the significant path loadings from IT spending to e-business value. Although our variable for IT and Web spending did not capture full details of e-business investment, it does show that there is a relationship between investment and e-business value. More important, this relationship should not be considered in isolation. It

would have to be understood in a bigger picture incorporating the contextual factors related to the technology, the organization, and the environment. Our results show that some of these factors indeed positively contribute to e-business value creation. On the other hand, the relationships are not uniform, indicating that the relationships are indeed moderated by organizational and environmental contexts.

Based on data collected from a multicountry survey, this study has developed and empirically tested a theoretical model for assessing the impacts of technological, organizational, and environmental factors on e-business value at the firm level. Through instrument development and hypothesis testing, our study has identified six factors within the TOE framework. Some of these factors (e.g., firm size and regulatory environment) play different roles across different economic environments. This finding shows that economic environment may shape e-business transformation. In addition, the empirical results highlight the importance of technological integration. Linking this to the ongoing debate over sources of value creation of e-business, our results provide empirical evidence that points to innovative front-end functionality and tight back-end integration as such sources.

Unlike most of the studies in the literature, our data were not limited to a single country. The broad data set of 612 firms from 10 countries allowed us to examine how economic environments influence the impact of e-business on firm performance. Because the sample included developed, developing, and newly industrialized countries, the generalizability of our model and findings is strengthened. As far as we are aware, this is the first time that such a rich database has been assembled for assessing factors affecting e-business value. We see this research as but a first step toward understanding the complex relationships among IT, business environments, and organizational performance. We hope that these initial results will stimulate others to engage in more research in this important area.

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*Acknowledgments:* This research is a part of the Globalization and E-Commerce project of the Center for Research on Information Technology and Organizations (CRITO) at the University of California, Irvine. This material is based upon work supported by the National Science Foundation (CISE/IIS/DST) under Grant No. 0085852. Industry sponsors include Boeing, IBM, IDC, Intel, Microsoft, TSC, and the U.S. Department of Defense. Any opinions, findings, and conclusions or recommendations expressed in this material are the authors' and do not necessarily reflect the views of the National Science Foundation. A shorter version of this paper was presented at the Twenty-Fourth International Conference on Information Systems (ICIS) and received the Best Theme Paper Award. The research has benefited from the comments of Sanjeev Dewan, Jennifer Gibbs, Rob Kauffman, John Mooney, Paul Tallon, Bruce Weber, and participants at the CRITO seminar and ICIS 2003 conference. The comments from three anonymous reviewers and the guest editors have helped improve the paper. Dr. Debora Dunkle provided excellent support for database management.

## NOTES

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1. Drawing upon the existing literature [82, 79], we define e-business as conducting business transactions, offering customer services, sharing information, and coordinating processes with business partners by using the Internet in combination with other ITs.

2. The TOE framework was actually developed by DiPietro, Wiarda, and Fleischer in chapter 7 of Tornatzky and Fleischer [70], but in keeping with other papers that utilize the model, we cite Tornatzky and Fleischer [70].

3. Rob Kauffman, personal communication, 2003.

4. Bruce Weber, personal communication, 2003.

5. Sato et al. [59] refer to studies that show the cost per transaction of Internet banking to be \$0.01 versus \$1.07 for branch banking.

6. Strictly speaking, our sample contains nine countries, because China and Taiwan belong to one country [71]. We initially believed that there might be some differences in their IT infrastructure and economic environments, yet the differences turned out to be statistically insignificant.

7. The questionnaire was administered in English for the United States and Singapore, where English is the language of business. The questionnaire was administered in Chinese for China and Taiwan, in German for Germany, in French for France, in Spanish for Mexico, in Portuguese for Brazil, in Danish for Denmark, and in Japanese for Japan. The questionnaires were translated into the local language by a translation service institution, which worked with IDC (the survey firm) for many previous IT surveys. The translations were sent to IDC's experts in each country to check whether the translations were accurate. In addition, we sent the translations to the academics (country experts) working with our project from each country (two to four persons depending on the country) to check the translation. All of the comments were collected and sent to the translation service that produced the final questionnaires. These were reviewed again by national experts associated with IDC and our project to further ensure the translation accuracy.

8. Dun & Bradstreet was used for the United States, Denmark, France, and Germany. Kompas was used for Brazil, Mexico, Taiwan, and Singapore. The Census of Enterprises and Yellow Pages was used for China. The Teikoku Data Bank was used for Japan.

9. After we received the data set, which contained 695 cases, we used a two-step approach to identify and exclude outliers whose values diverge sharply from the mean of all data points, as suggested by West et al. [74]. Univariately, the exclusion of outliers was accomplished by visual examination of histograms of variables that represent key firm characteristics (including sales, number of employees, and financial resources), identifying cases that are severely deviated from the mean of the distribution and not close to others. Multivariately, a leverage statistic, Mahalanobis distance, was utilized to identify extreme cases in multivariate space. The Mahalanobis distance was computed based on all variables used in our measurement. These two steps resulted in the final sample of 612 observations, after 83 deviant cases were excluded.

10. In order to test the robustness of our measurement model, we also ran exploratory factor analysis on all indicators. Principal component analysis with equamax rotation yielded a consistent grouping with CFA.

11. We also used an alternative method to check discriminant validity: average variance extracted (AVE) for each construct should be greater than the squared correlation between constructs [25]. All of our constructs met this criterion.

12. Similar results were found in prior studies. For instance, in Chau and Tam's [8] study, respondents also included both IS and non-IS managers, and no apparent statistical difference between the two groups was found. In addition, Tallon et al. [66] suggested that both senior executives' and IT executives' perceptions of IT payoffs tend to be highly correlated with each other.

13. To avoid a crowded graph, we did not show indicators for each construct in Figures 3 and 4, but listed them in the Appendix.

14. To test whether the removal of outliers changed the results, we also fitted the structural model on the original sample ( $N = 695$ ). It turns out that all relationships remain qualitatively the same: no paths gain or lose statistical significance, and no significant paths change in sign. Yet the normed  $\chi^2$  is 3.612, greater than the normed  $\chi^2$  of 3.377 based on the final sample with outliers dropped. Thus, excluding outliers did not affect the relationships estimated among model constructs, but helped to improve the overall model fit. The results based on the original sample are available upon request.

15. An unexpected result is that global scope, which is significant in the full sample, turns out to be insignificant in each subsample. This may be due to the reduced data variation in subsamples. We found that firms in developed countries tended to have greater scope than



their counterparts in developing countries. Consequently, data variation in each subsample would shrink when these two clusters were separated. The reduced data variation, to a certain extent, blurs the effect of scope on e-business value.

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## Appendix. Constructs and Indicators

Constructs	Indicators	Literature support
Technological context Technology readiness	<p>TR1 Technologies in use, measured by the number of items the establishment has in the following list (#):</p> <ul style="list-style-type: none"> <li>Use of e-mail (Y/N)</li> <li>Web site accessible by public (Y/N)</li> <li>Use of intranet (Y/N)</li> <li>Use of extranet (Y/N)</li> <li>Use of electronic data interchange (EDI) (Y/N)</li> <li>Use of electronic fund transfer (EFT) (Y/N)</li> <li>Use of call center (Y/N)</li> </ul> <p>TR2 Front-end functionality, measured by the number of items the establishment has in the following list (#):</p> <ul style="list-style-type: none"> <li>Web site supports online services (filing applications, claims) (Y/N)</li> <li>Web site supports online transactions (payment, transfer) (Y/N)</li> <li>Web site supports account management (Y/N)</li> <li>Web site provides online tools such as research, planning (Y/N)</li> </ul> <p>TR3 Extent Web applications electronically integrated with back-office systems (1~5)</p> <p>TR4 Extent company databases electronically integrated with suppliers and partners (1~5)</p>	[10, 12, 28, 41, 57, 78, 79]

(continues)

## Appendix. Continued.

Constructs	Indicators	Literature support
Organizational context		
Firm size		[58]
Global scope	GS1 Number of employees, logarithm-transformed (#) GS2 Multi-establishment (Y/N) GS3 Establishment outside of country (Y/N) GS4 Headquarters located outside of country (Y/N) GS5 Percent of sales from outside country (#)	[30, 79]
Financial resources	FR1 Percent of purchases from outside country (#) FR2 IT spending, as percentage of total revenue (#) FR3 Web-based spending, as percentage of total revenue (#)	[48]
Environmental context		
Competition intensity	CI1 Degree affected by competitors in the local market (1~5) CI2 Degree affected by competitors nationwide (1~5) CI3 Degree affected by competitors worldwide (1~5)	[22, 55, 69]
Regulatory environment	RE1 Government provided incentive (1~5) RE2 Required for government purchase (1~5) RE3 Business laws support electronic business (1~5) RE4 Legal protection for consumer purchase on the Internet (1~5)	[42, 43, 59]
E-business value		
Impact on commerce	IC1 Sales increased (1~5) IC2 Sales area widened (1~5) IC3 Customer service improved (1~5) IC4 International sales increased (1~5)	[49, 55, 66]
Impact on internal efficiency	IIE1 Internal processes more efficient (1~5) IIE2 Staff productivity increased (1~5)	[49, 55, 66]
Impact on coordination	ICO1 Transaction costs with business partners decreased (1~5) ICO2 Coordination with business partners or suppliers improved (1~5)	[49, 55, 66]

Notes: Coding in parentheses is as follows: #—continuous variable; Y/N—dummy variable; 1~5—five-point Likert scale.