

An Analysis of E-Business Adoption and Its Impact on Business Performance

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Across industries, firms have adopted e-business initiatives to better manage their internal business processes as well as their interfaces with the environment. In this study, a unified framework that captures the antecedents of e-business adoption, adoption intensity, and performance outcomes is proposed and empirically tested using data collected from senior managers in four technology-intensive industries. Applying a framework that captures the intensity of e-business adoption across four business process domains, the authors find that the antecedents and performance outcomes of e-business adoption are best studied in a process-specific context. They find, for example, that while the communication and internal administration aspects of e-business positively affect performance outcomes, the more high-profile activities related to online order taking and e-procurement do not. The authors' findings provide the foundation for a more rigorous study of e-business.

Keywords: *e-business; technology adoption; radical innovation; innovation adoption; IT business value; marketing strategy*

The e-business phenomenon has frequently been written up in the popular press and discussed in articles and books (e.g., Fisher and Reibstein 2001; Sawhney and Zabin 2001). Despite this interest, there is a growing acknowledgment that a theoretically rigorous focus is required in the study of e-business. For example, few reliable scales are available to measure the various facets of e-business adoption. Furthermore, little is known about the antecedents that drive the patterns of such adoption across organizations and about the differential implications of these patterns for business performance.

To address these knowledge gaps, we pursue three research questions in this article. First, how should e-business adoption be conceptualized and measured? Here, we propose a multidimensional conceptualization of e-business adoption across business processes, with a set of validated scales. Second, what antecedents influence the intensity of e-business adoption across business processes? Here, we theoretically motivate and empirically establish the relevant antecedents at a process level. Finally, how does e-business adoption affect business performance? Here, we examine the implications of e-business adoption across business processes for multiple dimensions of performance, including efficiency, sales performance, customer satisfaction, and relationship development.^{1,2}

We define e-business as "the use of Internet technologies to link customers, suppliers, business partners, and employees using at least one of the following: (a) e-commerce

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websites that offer sales transactions, (b) customer-service websites, (c) intranets and enterprise information portals, (d) extranets and supply chains, and (e) IP electronic data interchange" ("Information Week research survey" 1999). This definition is broadly consistent with that of Sawhney and Zabin (2001): "the use of electronic networks and associated technologies to enable, improve, enhance, transform or invent a business process or business system to create superior value for current or potential customers" (p. 15). Both definitions recognize that, by helping to build and manage relationships with customers, suppliers, employees, and partners, e-business can potentially transform a firm into a networked entity with seamless supply chains and value creation processes (Sawhney and Zabin 2001). Correspondingly, e-business has a pervasive impact across the entire span of the organization's structure (from the procurement department to the field sales force) and across a range of its business processes (from internal administration to supply-chain coordination). Our conceptual and operational treatment of e-business is consistent with this perspective.

Our approach differs from existing research in multiple ways. First, we pursue a process-based conceptualization of e-business adoption. As Westphal, Gulati, and Shortell (1997) noted,

While some innovations are inherently discrete (e.g., specific accounting practices or executive compensation plans), most can vary appreciably in form. When the particular definition or content of an innovation is open to interpretation, as in the case of such innovations as reengineering, matrix management, zero-based budgeting, or total quality management (TQM), variation in the form of adoption may be especially high, such that classifying adoption as an either-or proposition becomes somewhat arbitrary. In such cases, it may be more appropriate to explore how organizations define and implement an innovation, rather than simply to predict whether organizations adopt at all. (P. 367)

The adoption of e-business is of a continuous nature in the sense that the extent of its adoption across business processes may change with time (as opposed to, say, a hospital's acquisition of a computerized axial tomography [CAT] scanner). Consistent with this view, we conceptualize e-business adoption intensity along dual dimensions—the *process domains* within which e-business is adopted and the *degree of implementation* of e-business within specific process domains.

Such a conceptualization is important because, first, not all aspects of e-business adoption may proceed in tandem—for example, a business may implement online sales, but not e-procurement. Furthermore, certain e-business initiatives are easy to adopt, whereas others may require substantial resources and/or organizational

restructuring. For example, e-procurement can call for compatible electronic data generation and exchange interfaces across businesses, substantial systems redesign and integration within those businesses, personnel training, and significant commitment from top management. Second, our conceptualization allows us to demonstrate that not all antecedents are equally relevant to each business process domain. Finally, none of the existing studies study the entire chain of e-business adoption constituted by the antecedents of adoption, adoption intensity, and performance outcomes. By doing so at a business process level, we provide a deeper understanding of whether and why the adoption of e-business within specific processes positively affects selected aspects of business performance.

We next review existing research on innovation adoption. Second, a conceptualization of e-business adoption intensity is proposed. Third, a framework that links the e-business adoption antecedents, intensity, and performance outcomes is presented. Fourth, the survey methodology is described and empirical findings are discussed. Fifth, the limitations of this study are detailed.

INNOVATION ADOPTION: AN OVERVIEW

Issues related to e-business adoption and performance outcomes can be broadly viewed from the perspective of the consumer and of the business itself (the latter perspective is more relevant here).

The Consumer Perspective

Existing research on the virtual business environment in marketing has focused largely on its implications for consumers. Specific research foci include, but are not limited to, the role of the Internet as a direct channel to reach end consumers (e.g., Balasubramanian 1998), the study of online consumers using click-stream data (e.g., Moe and Fader 2001), information flow in computer-mediated environments (e.g., Hoffman and Novak 1996), consumer demographics and Internet usage (e.g., Hoffman, Novak, and Schlosser 2000), customer value delivery using the Internet (Keeney 1999), and customer satisfaction in online environments (e.g., Balasubramanian, Konana, and Menon 2003).

Researchers have also studied the broader strategic implications of Internet for consumer markets. In an early conceptual study, Glazer (1991) examined the role of information and knowledge in the design of marketing strategy. More recently, Alba et al. (1997) examined the implications of electronic marketplaces for consumers, retailers, and manufacturers by comparing interactive home shopping with traditional retail formats. Likewise, Peterson, Balasubramanian, and Bronnenberg (1997) classified the potential impact of the Internet across

different products and services and analyzed multiple channel environments where consumers may navigate conventional and electronic channels.

The Business Perspective

The organizational adoption of an innovation has been defined as the adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization (Daft 1982). Researchers have examined innovation adoption antecedents both within and outside the business unit (e.g., Chandy and Tellis 1998; Gatignon and Robertson 1989; Robertson and Gatignon 1986). Broadly speaking, the antecedents of innovation adoption can be classified as relating to either (a) the economic motivations or characteristics of the business or (b) to its external environment.

Business-related factors. Consistent with the “often unwritten assumption” that innovations benefit their adopters, businesses frequently adopt innovations to gain competitive advantages or capabilities (Abrahamson and Rosenkopf 1993). The literature on the organizational adoption of innovations has delineated specific business characteristics and conditions that facilitate such adoption (Kimberly and Evanisko 1981). These include, but are not limited to, functional differentiation (Baldrige and Burnham 1975), administrative intensity (Damanpour 1987), external and internal communication (Miller and Friesen 1982), and vertical integration (Hull and Hage 1982). Likewise, Rogers (1995) studied “authority innovation decisions,” where individuals who possess power, status, or expertise decide on adoption.

Researchers have also examined the adoption of innovations that specifically relate to information technology (e.g., Swanson 1994). Antecedents considered here include top management support, the catalyzing role of operational crises, and information and organizational architectures.

Environment-related factors. An organization may adopt an innovation because it fears being left behind by other organizations that do so (Abrahamson and Rosenkopf 1993; DiMaggio and Powell 1983). During innovation diffusion, early adopters are more likely to seek efficiency and profit gains, whereas later adoptions may reflect the pursuit of legitimacy (Westphal, Gulati, and Shortell 1997). Since such institution-driven adoption (or “bandwagon effects”) are driven by the perceived need to “keep up,” such adoption may yield few benefits to the adopting organization, at least in the short run.

Apart from responding to such normative pressures, the organization may also adopt innovations on account of powerful constituencies in its environment. Specifically, powerful customers and suppliers may demand the adoption of innovative processes that they perceive will either

reduce their costs of, or increase their benefits from, dealing with the focal organization.

Research in Marketing on E-Business Adoption

Researchers in marketing have focused on both capability-driven and institution-driven factors in studying innovation adoption (e.g., Gatignon and Robertson 1989; Robertson and Gatignon 1986). For example, Gatignon and Robertson (1989) explained the (discrete) adoption or rejection of laptop computers using explanatory variables that capture the characteristics of the innovation seller (e.g., provided incentives), the (potential) adopter’s industry (e.g., demand uncertainty, competitive intensity), the adopting organization (e.g., centralization), and the adoption decision maker (e.g., preferences for various kinds of information related to the innovation). Grewal, Comer, and Mehta (2001) found that motivations related to efficiency and the quest for legitimacy (an institution-driven factor), together with the organization’s abilities related to learning and information technology, affect the degree of organizational participation in business-to-business electronic markets. Srinivasan, Lilien, and Rangaswamy (2002) studied the antecedents and implications of technological opportunism, defined as an organization’s ability to sense and respond to new technologies, in the context of e-business adoption.

The tension between the organization’s economic motivations and normative pressures to adopt innovations is particularly relevant in the context of e-business. There was much hype and hope regarding e-business during the late 1990s and the early 2000s, and e-business adoption during this period was driven by a strong proinnovation bias. From theoretical and practical perspectives, it is interesting to study whether aspects of e-business adoption that were driven more by normative pressures had weaker implications for business performance. We are able to examine this issue at depth because we focus on a process-level adoption of e-business and consider the entire chain constituted by the antecedents of e-business adoption, adoption intensity, and performance outcomes. To facilitate such examination, we ensured that our antecedents reflected both economic motivations and normative pressures.

INTENSITY OF E-BUSINESS ADOPTION

As a first step we conducted in-depth, in-person interviews with eight managers in the computer hardware, semiconductor, telecommunications, and manufacturing equipment sectors. These interviews helped ground the research, confirm the variables of importance, and provide a practical perspective on e-business adoption. We focused

on these four sectors primarily to enhance the comparability of the results across business units. We avoided pure “dot-coms” because, by definition, a substantial part of their operations were built around the e-business context. We focused, instead, on a set of allied industries that rely on tangible production-related assets. This allows us to explain the variance in e-business adoption using theoretically relevant antecedents without being overly distracted by whether the nature of the organization’s business itself constitutes the major source of this variance. Furthermore, while the business units in the studied industries would likely have a higher average intensity of e-business adoption than those in less-technology-intensive industries, our central focus is on the covariation of e-business adoption with various antecedents and outcomes, rather than adoption levels themselves. Therefore, although other industries may deserve separate study, our results provide a baseline for such efforts.

We relied on a combination of theoretical insights and field research to conceptualize the intensity of e-business adoption. From a theoretical perspective, Porter’s (1985) value chain framework suggests that value creation within a business unit can be traced through distinct stages—beginning with the inbound interface (where supplier-related processes are concentrated), through the business itself, and culminating at the outbound interface (where customer-related processes are concentrated). Consistent with this view, it emerged from our interviews that managers cognitively clustered e-business activities as pertaining to suppliers, the internal operations of the business, and to customers. This perspective revealed the *loci* at which e-business adoption may be measured. In parallel, managers distinguished between various business processes that could be enabled by electronic technologies. Specifically, discussions with the managers revealed that e-business adoption patterns centered on four distinct processes, namely, communication, internal administration, order taking, and procurement.

The framework that represents our conceptualization of e-business adoption, as derived from the perspectives encountered in field research, is presented in Figure 1. The rows in Figure 1 correspond to the business processes within which e-business initiatives could be introduced, and the columns describe the loci of the business where the processes are relevant. *Communications processes* (i.e., the flow or exchange of information) can occur in any of the three loci—within the business unit, with customers, and with suppliers. *Internal administration processes* (i.e., conducting or facilitating a range of activities pertaining to financial and managerial accounting, human resource and employee benefit management, travel reimbursement, and the like) occur within the boundaries of the business unit. *Order-taking processes* (i.e., the facilitation of customer-related transactions, either to consumers or to other

FIGURE 1
Intensity of E-Business Adoption in Firms:
A Business Process Perspective

	Within-Firm	Customer Interface	Supplier Interface
<i>Communication processes</i>	Electronic communication within firm	Electronic communication with customers	Electronic communication with suppliers
<i>Administrative processes</i>	Electronic internal administration	--	--
<i>Order-taking processes</i>	--	Online order taking	--
<i>Procurement processes</i>	--	--	E-procurement

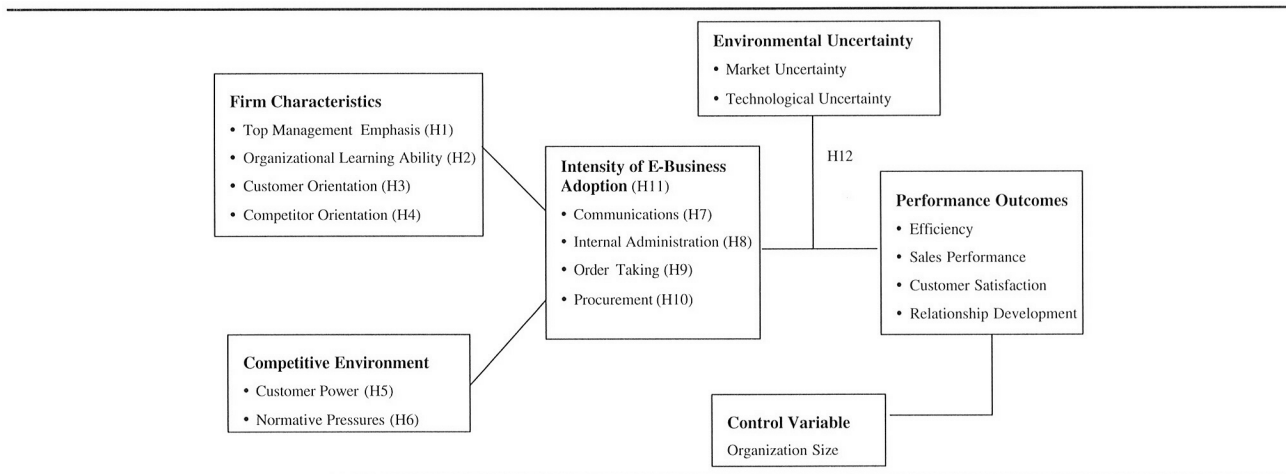
businesses) occur at the *customer interface*. Finally, *procurement processes* (i.e., linking with suppliers to purchase input materials) occur at the *supplier interface*. Our business process-focused conceptualization of e-business adoption is consistent with the argument of Sawhney and Zabin (2001) that e-business makes possible “enterprise applications targeted at building and managing relationships with key constituencies” (p. 18), including customers, suppliers, employees, and partners.

The four business processes delineated in Figure 1 are not exhaustive in terms of the potential e-business application domains. However, they together constitute the key set of processes required to establish seamless links between various internal and external constituencies. Note also that some of these processes can be integrated in the context of larger activity sets such as customer relationship management and supply chain management. However, e-business initiatives can be applied to selected processes within these larger activity sets. Therefore, in the interests of cleaner conceptualization and more precise measurement, we pursue a process-level perspective.

CONCEPTUAL FRAMEWORK

Figure 2 describes a conceptual framework that links the antecedents of e-business adoption, adoption intensity, and performance outcomes. We adopted a two-stage process to select the antecedents for this study. First, we recognized that e-business adoption differed from the adoption of most other innovations in terms of the potential impact on multiple business processes, the boundary-spanning nature of e-business initiatives, the strong environmental influences related to adoption, and the degree of interdepartmental coordination required for successful adoption. With this understanding, we culled the antecedents of greatest relevance from the existing literature. At the second stage, these antecedents were tested for

FIGURE 2
Antecedents and Performance Outcomes of E-Business Adoption: A Conceptual Model



relevance and refined based on detailed field interviews with managers. Two categories of antecedents are proposed—those related to the business and to its environment. Performance outcomes are captured in terms of improvements in efficiency, sales performance, customer satisfaction, and relationship development. Specific hypotheses are now developed.

Business-Related Antecedents of E-Business Adoption

Top management emphasis on e-business. Top management attitude toward change significantly influences adoption decisions (Damanpour 1991; Dewar and Dutton 1986). E-business initiatives now constitute a core component of the strategic planning process in many businesses. Since top management plays a central role in shaping organizational strategies (Kohli and Jaworski 1990), the role of top management in the e-business context is likely to be significant. Specifically, top management has the power to reduce interdepartmental conflict and facilitate rapid e-business implementation by building an organization-wide strategic consensus related to e-business adoption (cf. Dess and Origer 1987). Moreover, the intensive adoption of e-business can call for substantial financial commitment and managerial attention. Such investments are unlikely to be made without the buy-in of top management.

While top management emphasis is likely to affect the overall intensity of e-business adoption, we expect that certain business processes will be affected more than others. First, in the context of communication processes, e-business tools facilitate information and knowledge flow within and across the boundaries of the business unit and can help integrate previously truncated information flows into a streamlined knowledge management system

(Sawhney and Zabin 2001). However, knowledge is power, and managers both within and across departments tend to hoard rather than share information, thereby hindering the treatment of information as a shared, corporate asset (Brancheau and Wetherbe 1987). In this context, top management has the ability to reduce interdepartmental conflict and resistance to information sharing. Likewise, implementing e-business tools in order taking and the procurement process may call for the restructuring and realignment of external relationships with customer and suppliers, both in terms of information-sharing networks and other organizational arrangements. For example, numerous businesses that sell online have had to restructure their existing partnerships with distributors to avoid a serious backlash. Such changes that disturb the existing equilibrium in a major way will likely proceed only with top management support. Building on these arguments, we hypothesize the following:

Hypothesis 1: The greater the top management emphasis on e-business, the greater the overall intensity of e-business adoption.

Hypothesis 1a: At the business process level, the greater the top management emphasis on e-business, the greater the intensity of e-business adoption in (1) communications, (2) order taking, and (3) procurement.

Organizational learning ability. The organization's learning ability (or absorptive capacity) describes its ability to evaluate, adopt, and exploit external knowledge, or equivalently, its ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Cohen and Levinthal 1990). The implications of such learning ability for innovation adoption have been studied in the organizational behavior and marketing literatures (e.g., Gatignon and Robertson 1989; Huber 1991; Sinkula, Baker, and Noordewier 1997; Slater and Narver 1995).

A high learning ability can facilitate e-business adoption in multiple ways. First, e-business adoption cannot be characterized in terms of a well-defined, clearly structured event that follows an established procedural pattern—rather, it represents an ongoing process of assimilation and transformation. Therefore, a mere willingness to adopt may not in itself lead to high levels of e-business implementation. Such willingness must be backed by an adequate absorptive capacity that facilitates (a) the quick recognition of new developments in the e-business arena, (b) an understanding of how e-business initiatives can augment existing operations, and (c) a continuous scanning of the environment for successful implementation stories that can be replicated. Moreover, an important component of learning is the organization-wide dissemination of information that leads to a shared understanding and interpretation of external phenomena and internal strategies (Sinkula et al. 1997).

At the business process level, first, a higher organizational learning ability will motivate more intense adoption of e-business initiatives in communications processes both within the business and at its interface with its environment. Since organizational learning reflects the ability to evaluate, adopt, and exploit external knowledge, the exchange and capture of information related to external entities such as customers and suppliers are crucial components of such learning. Moving communications with these entities into the electronic realm greatly improves the richness and timeliness of such communications. Such initiatives can provide the basis for vendor-managed inventory (VMI) systems on the supply side and information-intensive models of relationship marketing on the demand side (Duncan and Moriarty 1998). In the context of internal communications, as noted by Cohen and Levinthal (1990):

An organization's absorptive capacity does not simply depend on its direct interface with the external environment. It also depends on transfers of knowledge across and within sub-units that may be quite removed from the original point of entry (of such knowledge). (P. 131)

A high organizational learning ability will facilitate the capture and interpretation of information flows both within and across the boundaries of the business once e-business initiatives are implemented in its communication processes.

Implementing e-business initiatives in order-taking and procurement processes, on the other hand, calls for technologically complex systems that link multiple parts of the business unit to each other and with outside entities. These initiatives require support from various subunits within the business unit and from customers and suppliers. Busi-

nesses with a higher organizational learning ability are more likely to successfully manage this transition by allocating their resources to update their systems, dealing with the technological and organizational complexities involved, and working with their customers and suppliers to accomplish these boundary-spanning tasks. Building on these arguments, we hypothesize the following:

Hypothesis 2: The higher the organizational learning ability of a business, the greater the overall intensity of e-business adoption.

Hypothesis 2a: At the business process level, the higher the organizational learning ability, the greater the intensity of e-business adoption in (1) communications, (2) order taking, and (3) procurement.

Customer orientation. Customer orientation has been defined as an organization's ability to sufficiently understand target buyers in order to continuously create superior value for them (Narver and Slater 1990). Alternatively, it has been defined as the adoption of a continuous, proactive disposition toward meeting customers' needs (Deshpande, Farley, and Webster 1993; Han, Kim, and Srivastava 1998). An important component of customer orientation is sensitivity to and foresight regarding the underlying forces that shape a market and industry. A customer-oriented business is more likely to anticipate future customer needs and have a long-term vision. Correspondingly, such a business is likely to have a more proactive approach toward the adoption of new technologies, including those related to e-business.

At the process level, a higher customer orientation is likely to influence e-business adoption in three specific areas. First, a customer-oriented business would seek to frequently exchange information with its customers in order to better understand their needs and provide superior service. Likewise, such a business would seek to coordinate and communicate better with suppliers toward developing a supply chain that is responsive in all parts to feedback from the marketplace. Since customer orientation places a high priority on continuously finding ways to deliver superior customer value, an increased customer orientation should, in turn, lead to increased boundary-spanning activity within the business (Han et al. 1998). Effectively, a higher customer orientation should lead to more intensive adoption of e-business initiatives in communication processes. Likewise, a customer-oriented business is more likely to focus efforts and resources to satisfy customer needs and to adopt a proactive disposition toward innovations that facilitate efficient customer transactions and robust customer relationships. Thus, such a business is more likely to implement online order taking.

Finally, as argued by Han et al. (1998), a business with a high degree of customer orientation will likely facilitate innovation in administrative areas as well. To serve their

customers better, customer-oriented businesses are likely to implement e-business initiatives in internal administration processes so that activities such as invoicing and accounting can handle customer needs more efficiently and effectively. Building on these arguments, we hypothesize the following:

Hypothesis 3: The higher the customer orientation of a business, the greater the overall intensity of e-business adoption.

Hypothesis 3a: At the business process level, the higher the customer orientation of a business, the greater the intensity of e-business adoption in the areas of (1) communication, (2) internal administration, and (3) order taking.

Competitor orientation. Competitor orientation refers to the ability and the will to identify, analyze, and respond to competitors' actions (Gatignon and Xuereb 1997; Narver and Slater 1990). Using the target rivals as a frame of reference, competitor-oriented businesses constantly seek to identify their own strengths and weaknesses (Han et al. 1998). Such attention to competitive factors will provide a business with a proactive disposition toward shaping the competitive environment and its own strategy (Day and Wensley 1988). Businesses engaged in continuous environmental scanning and adaptation are therefore more likely to lead the industry in terms of adopting and implementing e-business initiatives and will exhibit a higher overall intensity of e-business adoption.

At the process level, first, a competitor-oriented business will implement e-business tools in its communication processes. Customer orientation and competitor orientation have been held to "include all of the activities involved in acquiring information about the buyers and competitors in the target market and disseminating it throughout the business" (Narver and Slater 1990:21). Through communications with external parties on both the supply and demand sides, and within itself, a business will better understand its current position in the marketplace and be better prepared to take on new challenges.

E-business initiatives in order-taking and procurement processes can call for substantial financial commitment. However, increased sensitivity to competition can in and of itself hasten innovation adoption, provided the industry is not so competitive that either the returns to adoption are low or the required resources for investment in innovation adoption are low (Gatignon and Robertson 1989; Utterback 1974). Given that e-business adoption is yet in its early stages, businesses that are sensitive to competitors' initiatives would invest more intensively in order taking and procurement process and prepare to take advantage of their investments at the proper time. Building on these arguments, we hypothesize the following:

Hypothesis 4: The higher the competitor orientation of a business, the greater the overall intensity of e-business adoption.

Hypothesis 4a: At the business process level, the higher the competitor orientation of a business, the greater the intensity of e-business adoption in the areas of (1) communications, (2) order taking, and (3) procurement.

Environmental Antecedents of E-Business Adoption

Customer power. A customer-oriented business tends to be forward-looking, proactively responding to and even shaping customer needs (Jaworski and Kohli 1996). Customer power, in contrast, refers to exogenous customer demands on the business to implement certain practices. Therefore, responses to customer power tend to be of a reactive, rather than proactive, nature.

Christensen and Bower (1996) examined the effect of customer power in forcing businesses to invest in improved technologies. They noted, "When significant customers demand it, sufficient impetus may develop so that large, bureaucratic firms can embark upon and successfully execute technologically difficult innovations—even those that require very different competencies than they initially possessed" (p. 199). Historical studies of technological innovation have supported this view of a constrained management that largely bends to the will of powerful external constituencies in deciding on innovation adoption (Foster 1986). Similarly, we argue that when customers wield substantial power, they will leverage this power to pressure the business to adopt new technologies. As an aside, unlike proactive initiatives, investments undertaken largely on account of pressures from customers and other external entities may have adverse effects on performance outcomes, at least in the short run.

At the process level, customers will apply the greatest pressures in areas where they directly interface with the business. First, with the advent of the Internet, customers can control their interaction with the business, and they have grown accustomed to features such as online customer service and order tracking, and updates via electronic mail. Correspondingly, increased customer power will force businesses to adopt new technologies that enable streamlined communications at all points of the supply chain. Second, powerful customers in search of convenience and lower transaction costs will pressurize businesses to implement online order taking. In particular, such pressure is likely to be applied by large customers who buy a range of products, and in large quantities—these customers will gain the most from online order placement. Building on these arguments, we hypothesize the following:

Hypothesis 5: The greater the customer power exercised in the context of e-business adoption, the greater the overall intensity of e-business adoption.

Hypothesis 5a: At the business process level, the greater the customer power in the context of e-business adoption, the greater the intensity of e-business adoption in the areas of (1) communications and (2) order taking.

Normative pressures. Normative pressures arise from the threat of lost legitimacy. When normative pressures are high, organizations adopt innovations *not* on account of their assessments of the innovation's potential efficiency and returns but on account of institutional pressure caused by the sheer number of businesses that have already done so (Abrahamson and Rosenkopf 1990). Homburg, Workman, and Krohmer (1999) highlighted the role of institutional factors in shaping the influence of marketing within an organization. They argued that the pressures for conformity and legitimacy that arise from entities in the external environment such as customers, suppliers, or the general public often play a key role in affecting marketing's role within an organization. In the context of e-business, normative pressures are particularly relevant because the early growth stage of e-business was characterized by popular hype of great volume and intensity. Numerous comments in the popular press (and to a lesser extent, in academic fora) forecasted that businesses would be left hopelessly behind if they did not accelerate their movement into the e-business arena.

Normative pressures can potentially hasten e-business adoption across business processes, depending on the specific kinds of pressures exercised by entities within the business environment. For example, institutional pressures play a role in inducing upstream suppliers and downstream channel members to embrace socially accepted norms and behaviors (Grewal and Dharwadkar 2002; Selznick 1984). This, in turn, may exert pressures on the business to conform in terms of adopting e-business initiatives in communication processes with outside parties and in order-taking and procurement processes. Likewise, administrative and human resource managers may feel normative pressures to adopt e-business initiatives in internal administration and communication processes when they see other managers in competing businesses doing the same. Building on these arguments, we hypothesize the following:

Hypothesis 6: The higher the normative pressures from the competitive environment, the greater the overall intensity of e-business adoption.

Hypothesis 6a: At the business process level, the higher the normative pressures from the competitive environment, the greater the intensity of e-business adoption in the areas of (1) communications,

(2) internal administration, (3) order taking, and (4) procurement.³

Impact of E-Business on Business (Strategic Business Unit [SBU]) Performance

Effects of e-business adoption in communications on specific aspects of performance. Online communication can enhance *efficiency* in many ways. During the field interviews, managers frequently claimed that electronic communications reduced the time to reach customers and speeded up responses to customer inquiries. The managers also indicated that e-business processes helped reduce the cost of material and personnel involved in paper-based communications both within and outside the business unit. The chief information officer of a *Fortune* 100 company has noted that paper is much like inventory: "There are costs in printing paper, in managing it, in shipping it" (Vogelstein and Hjelt 2001:142).

In the context of *sales performance* and *customer satisfaction*, information flows facilitated by e-business can help increase the sales volume by reaching customers directly and promptly whenever a new product is introduced and by tapping into markets that were hitherto inaccessible on account of distribution or other infrastructural constraints. The business can also enhance customer satisfaction by providing information about products, troubleshooting, and service online. Furthermore, interested consumers who were not a part of the business unit's active customer set can invoke a relationship with the unit on their own accord. Both sales performance and customer satisfaction can benefit on these accounts.

In the context of *relationship development*, online communications can help a business increase the intensity of, and enrich the quality of, its interactions with partners and suppliers. In addition, important product planning and inventory information can be shared on a regular, or even real-time, basis, leading to more productive relationships. Also, when the business unit's systems and online information repositories are integrated with those of its partners and suppliers, these parties are likely to exhibit a greater commitment to their mutual relationships. Building on these arguments, we hypothesize the following:

Hypothesis 7: The intensity of e-business adoption in the area of communications is positively associated with (a) increased efficiency, (b) improved sales performance, (c) greater customer satisfaction, and (d) enhanced relationship development.

Effects of e-business adoption in internal administration on specific aspects of performance. Internal administration covers processes related to financial and managerial accounting, travel reimbursement, payroll, and employee benefits processing. For many such processes, e-business initiatives can reduce the incidence of

errors and the expenditure of employee time and other resources, and can greatly simplify associated procedures. These outcomes can enhance the *efficiency* of internal operations.

The application of e-business initiatives to internal administration tasks can affect *customer satisfaction* in multiple ways. First, such application has the potential to indirectly influence customer satisfaction by providing employees with a comfortable, supportive, and efficient working environment to better deal with customer needs. In addition, a major task for any business in information-intensive environments is the collection and coordination of various pieces of information related to each customer. For example, in a leading hotel chain, information on the “value” of each customer to the chain is available to the check-in staff, so that appropriate levels of compensation can be extended on the spot if the customer is not entirely satisfied with the arrangements or if the hotel has been overbooked. Such initiatives related to the customer interface can provide customers with the reassuring signal that the business is indeed at the cutting edge of technology and will likely lead to more satisfied customers.

Finally, in the context of *relationship development*, e-business initiatives in internal administration can help a business build stronger relationships with its partners and suppliers by sharing information on a continuous basis and by implementing accounting/financial management practices that enable quicker, more transparent transactions. For example, General Electric (GE) implemented an Internet-based system to handle supplier payments. GE traditionally took 60 days or more after delivery to pay suppliers—meanwhile, the suppliers would sell the corresponding IOU to a factoring company for a stiff commission. GE’s payment system cut the payment period to 15 days. This enabled the supplier to cut out the factoring middleman and split the savings with GE, resulting in a 12 percent reduction in annual accounts payable from GE’s perspective (Murray and Sapsford 2001). Building on these arguments, we hypothesize the following:

Hypothesis 8: The intensity of e-business adoption in the area of internal administration is positively associated with (a) increased efficiency, (b) greater customer satisfaction, and (c) enhanced relationship development.

Effects of e-business adoption in order taking on specific aspects of performance. Order taking refers to processes associated with order placement, order monitoring, and payment submission by customers. E-business adoption in order taking can influence multiple performance outcomes. First, it can enhance *efficiency* by reducing transaction costs and other intermediary-related costs. Second, it can improve *sales performance* by allowing customers to easily access offered products and services in

an intermediary-free environment. Moreover, customers can track and inquire about their orders electronically and can shop without the conventional restraints of time and/or place associated with nonvirtual market settings. It also allows customers to monitor their orders closely to avoid mistakes and delays, leading to greater *customer satisfaction*. Building on these arguments, we hypothesize the following:

Hypothesis 9: The intensity of e-business adoption in the area of order taking is positively associated with (a) increased efficiency, (b) improved sales performance, and (c) greater customer satisfaction.

Effects of e-business adoption in procurement on specific aspects of performance. E-procurement refers to processes associated with online supplier search and qualification, online order placement and monitoring (by the business with its suppliers), online bid submission by suppliers, and the like. Since e-procurement is not directly associated with customer interface of the business, we do not expect it to influence *sales performance* and *customer satisfaction*. However, e-procurement can be expected to increase *efficiency* by enabling a tighter balancing of demand and supply and by reducing the costs of both finding the right suppliers and transacting with them. E-procurement can also help businesses in the context of *relationship development*. An important precursor to e-procurement is the commitment of resources by the business and its suppliers (and/or partners) to ensure that their business processes and systems are mutually compatible. Such commitment can foster trusting, lasting relationships and can credibly signal the parties’ intentions to ensure the long-term success of their business relationship (Holm, Eriksson, and Johanson 1996). Building on these arguments, we hypothesize the following:

Hypothesis 10: The intensity of e-business adoption in the area of procurement is positively associated with (a) increased efficiency and (b) enhanced relationship development.

Effects of overall e-business adoption on specific aspects of performance. We have argued in the previous hypotheses that e-business adoption in various business processes will positively affect specific aspects of performance. Note that adoption on account of external pressures, such as customer power and normative pressures, may adversely affect performance in the short run. However, such pressures may nevertheless cause the business unit to take actions that are fruitful in the long run. Furthermore, the adoption of e-business in any process may be simultaneously driven by proactive influences (e.g., customer orientation) and reactive influences (e.g., customer power and normative pressure). Only when the drivers of e-business adoption in any process are primarily of a

reactive nature would we expect to find that the (short-run) performance outcomes due to e-business adoption are unfavorable.

In Hypotheses 7 to 10, we explain the benefits that can result from e-business adoption across business processes on performance outcomes including efficiency, sales performance, customer satisfaction, and relationship development. These hypotheses are particularly insightful when we can demonstrate that considering these impacts at the process level yields qualitatively different insights than when e-business adoption is treated with a monolithic construct. To set the stage for such a demonstration, we draw from the support for Hypotheses 7 to 10 to hypothesize the impact of the overall intensity of e-business adoption:

Hypothesis 11: The greater the overall intensity of e-business adoption, the greater its impact on (a) efficiency, (b) sales performance, (c) customer satisfaction, and (d) relationship development.

Moderating Effects of Environmental Uncertainty

Environmental turbulence can affect innovation-related performance. For example, such turbulence can affect organizational innovativeness (Han et al. 1998) and new product performance (Moorman and Miner 1998). We focus here on two aspects of environmental uncertainty: (a) market uncertainty, which refers to rate of change in the composition of customers and their preferences (Jaworski and Kohli 1993), and (b) technological uncertainty, which refers to the rate of technological change in the product or in value addition processes (Jaworski and Kohli 1993; Menon, Bharadwaj, Adidam, and Edison 1999).

A business unit that undertakes e-business initiatives can cope better with environmental changes in information-intensive environments (Weiss and Heide 1993). When market-related uncertainty is high, customer-facing e-business systems (that include communication and order-taking processes) can help the business gather market information and adjust strategy accordingly. When market uncertainty is high, businesses tend to gather more information from the marketplace in order to better predict future market trends and to better coordinate their channel members in anticipation of these trends. Superior prediction and coordination would enable the businesses to react quickly and efficiently to changes in customer preferences and demand. In addition, in such environments, e-business initiatives in communications and order taking will help businesses serve customers better and may result in higher revenues. Thus, the posited positive relationship between the intensity of e-business adoption in communication and order-taking processes and the market-related performance indicators (i.e., sales performance and customer

satisfaction) will be stronger when market uncertainty is high.

On the other hand, when technological uncertainty is high, it is often hard to predict whether the newly adopted e-business applications will have an immediate effect on performance outcomes. This is particularly the case where e-business applications are complex (e.g., order-taking or procurement systems) and when the applications span the business unit's boundaries and involve the participation of outside parties. First, when technological uncertainty is high, customers and suppliers may be less willing to use systems that promote information sharing. Distrust of technology can significantly hinder the willingness of parties to engage in open sharing of information. Second, even if the focal business itself adopts e-business tools to assist order taking and procurement, customers and suppliers may not be ready to keep pace and adopt corresponding technologies themselves. Instead, they may expect the business to keep up with changing technology trends, while they themselves adopt a wait-and-see attitude. Finally, when technological uncertainty is high, the focal business may itself be unsure about what specific e-business technologies must be adopted and how they must be implemented in order to yield adequate returns. Building on these arguments, we hypothesize the following:

Hypothesis 12a: When market uncertainty is high, the positive effect of the intensity of e-business adoption in communication on (a) sales performance and (b) customer satisfaction is strengthened.

Hypothesis 12b: When market uncertainty is high, the positive effect of the intensity of e-business adoption in order taking on (a) sales performance and (b) customer satisfaction is strengthened.

Hypothesis 12c: When technological uncertainty is high, the positive effect of the intensity of e-business adoption in communication on (a) sales performance and (b) customer satisfaction is weakened.

Hypothesis 12d: When technological uncertainty is high, the positive effect of the intensity of e-business adoption in order taking on (a) sales performance and (b) customer satisfaction is weakened.

Hypothesis 12e: When technological uncertainty is high, the positive effect of the intensity of e-business adoption in procurement on relationship development is weakened.

Control for Business Unit Size

E-business adoption can impart greater scalability (defined as the ability to increase output without corresponding increases in the variable costs of achieving that output) to business processes. Therefore, larger business units could, *ceteris paribus*, derive greater returns from e-business investments. The SBU size variable (measured by

the total number of SBU employees) is included to control for this effect (e.g., see Chandy and Tellis 1998).

METHOD

Data Collection

To constrain this study to a set of technology-intensive industries, senior executives of SBUs in four industries (i.e., the telecommunications, computer hardware, semiconductor, and manufacturing equipment industries) were included in the survey frame. Pure virtual businesses (i.e., the “dot-coms”) were not considered, given the turbulence associated with that sector and our intention to focus on e-business adoption by businesses with significant tangible assets. From our field interviews, the appropriate key informants were determined to be senior executives responsible for e-business strategy and/or information technology in the SBU, for example, the vice president of information technology or chief technology officer. Where appropriate, measures were adopted or adapted from the existing literature. Some measures were developed anew for this study. The survey was subject to review and feedback from researchers and Ph.D. students and was pretested with 60 managers. Based on the feedback, some items were modified, and a final survey instrument was prepared. (Further details are provided below.)

A random sample of 1,021 U.S. technology firms/SBUs in the four industries was drawn from the Corporate Technology Information Services database. The survey elicited information at the SBU level. (In a single division firm, the SBU corresponds to the firm—hence, the data always pertain to the SBU.)

We used two established criteria to select informants in this study (e.g., Li and Calantone 1998). First, following Seidler (1974), was the informant in a position to generalize “about patterns of (relevant) behavior, after summarizing either observed or expected organizational relations” (p. 817)? Of the respondents, 72 percent were at the level of director or higher, and 28 percent were managers below that level. This suggests that, on average, the respondents could offer an adequate overview of e-business adoption. Second, was the informant knowledgeable about the content of the inquiry? Following Kumar, Stern, and Anderson (1993), we asked informants to provide a self-assessment of knowledgeability. On a 5-point scale with 5 = *very confident*, the mean response was 4.60, suggesting adequate knowledgeability.

The mailed package included a personalized letter highlighting the academic nature of the study and a business return envelope. A reminder letter was sent 1 week after the initial mailing, and a second reminder letter with a replacement copy of the survey was mailed 2 weeks after the first reminder. Respondents were assured of

confidentiality. The data collection was completed during spring 2001.

Responses

Twenty-nine surveys were returned because of an incorrect address or addressee. Managers in 17 SBUs expressed an inability to participate. The final usable sample contained 144 responses (response rate 14.1%), with the following industry-wise distribution: telecommunications—23 percent, computer hardware—13 percent, semiconductor—52 percent, and manufacturing equipment—11 percent. In terms of size, 40 percent of the responding SBUs had less than 500 employees, 25 percent had between 500 and 1,000 employees, 26 percent had between 1,000 and 5,000 employees, and 9 percent had more than 5,000 employees. The minimum annual sales volume of the responding SBU was \$3 million, and the maximum was \$18 billion.

To test for nonresponse bias, we first compared the industry-wise distribution of the responses with the distribution of potential respondents in the sampling frame. A chi-square test ruled out any industry-level bias in response rates. Second, we compared early and late respondents (Li and Calantone 1998). The first 75 percent of returned surveys were classified as “early respondents” ($n = 108$). The last 25 percent were considered as “late respondents” ($n = 36$). We found no significant differences in responses across the two groups. Thus, we are reasonably confident that nonresponse bias does not pose a major problem.

Measurement, Reliability, and Validity

Measures were developed in stages (broadly along the lines outlined in Churchill 1979). Following Anderson and Gerbing (1988), we purified the measures by assessing the reliability and unidimensionality of each construct. We first examined item-to-total correlations within each construct and deleted items with low correlations. The items were then subject to principal components analysis (PCA) and confirmatory factor analysis (CFA). Due to the large number of constructs and measures, these refinement efforts were conducted within the sets of measures related to adoption (1) antecedents, (2) intensity, and (3) performance outcomes (e.g., Menon et al. 1999; Moorman and Miner 1997). Items that did not load heavily on the primary factor or had high cross-loadings were dropped. For antecedents, 4 out of 33 items were dropped; for the intensity of e-business measure, 7 out of 32 items were dropped; for outcomes, 2 out of 17 items were dropped.

The final subgroup CFA yields adequate model fit for the proposed factor structure. (For *antecedents*, $\chi^2 = 528.886$ with $df = 363$, Comparative Fit Index [CFI] = .92, Bentler-Bonett Non-Normed Fit Index [NNFI] = .91, Bollen Incremental Fit Index [IFI] = .923, root mean

TABLE 1
Descriptive Statistics and Correlations

Variable	M (Sum)	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Top management emphasis	30.00	8.13	1.00													
2. Organizational learning ability	18.19	4.68	.57	1.00												
3. Customer orientation	32.42	6.21	.21	.43	1.00											
4. Competitor orientation	20.51	4.40	.27	.38	.40	1.00										
5. Customer power	18.06	5.32	.45	.16	.18	.09	1.00									
6. Normative pressures	25.01	5.50	.45	.25	.14	.63	.14	1.00								
7. Communication	53.13	15.24	.52	.46	.31	.49	.22	.49	1.00							
8. Internal administration	11.01	4.91	.22	.30	.32	.20	.15	.23	.40	1.00						
9. Order taking	8.01	4.66	.37	.23	.14	.36	.16	.38	.50	.20	1.00					
10. Procurement	11.96	5.22	.30	.34	.16	.28	.12	.35	.54	.43	.47	1.00				
11. Efficiency	18.92	4.86	.20	.30	.26	.21	.15	.19	.41	.27	.20	.31	1.00			
12. Sales performance	20.55	5.75	.35	.26	.17	.28	.37	.29	.35	.20	.19	.26	.42	1.00		
13. Customer satisfaction	13.13	2.97	.39	.30	.38	.30	.32	.27	.36	.26	.15	.23	.48	.64	1.00	
14. Relationship development	8.83	2.39	.28	.23	.28	.23	.15	.20	.26	.31	.18	.26	.46	.51	.54	1.00

square error of approximation [RMSEA] = .057; for *intensity of e-business adoption*, $\chi^2 = 389.415$ with $df = 256$, CFI = .91, NNFI = .90, IFI = .91, RMSEA = .061; for *performance outcomes*, $\chi^2 = 160.704$ with $df = 77$, CFI = .92, NNFI = .90, IFI = .92, RMSEA = .087). All the items that loaded on their respective constructs were statistically significant. Furthermore, Cronbach's alpha for each construct was above the .7 level suggested by Nunnally (1978), indicating adequate reliability. The appendix describes the measures. Descriptive statistics and correlations are in Table 1. Construct measures are now discussed.

Measures of the Antecedents of E-Business Adoption

All items were measured using a Likert-type scale ranging from *strongly disagree* to *strongly agree*. Measures for top management emphasis on e-business, customer orientation, and competitor orientation were adapted from Jaworski and Kohli (1993) and Han et al. (1998). Note that the items that we adapted differ in terms of wording from the original items used by Narver and Slater (1990).⁴ Measures for learning ability were developed from field interviews and from the concept of "absorptive capacity" (Cohen and Levinthal 1990). Two items that measure customer power were developed from field interviews, and the other two were adapted from Narver and Slater (1990). The measures for normative pressures were developed based on both field interviews and the extant literature (Abrahamson and Rosenkopf 1993; DiMaggio and Powell 1983; Srinivasan et al. 2002).

A PCA of the items indicated that each antecedent construct loads on a single dimension (see Table 2).

To further assess the discriminant validity between certain pairs of constructs that could potentially overlap, we adopted a procedure recommended by Bagozzi, Yi, and Phillips (1991). We examined pairs of related constructs in a two-factor confirmatory analysis, once constraining the correlations between the two constructs to unity and once freeing this parameter. Then a chi-square difference test was conducted. For customer orientation and customer power, the chi-square difference was 226.109. For competitor orientation and normative pressures, the chi-square difference was 208.589. The chi-square values were significantly lower for the unconstrained models (at $p = .01$), suggesting adequate discriminant validity.

Measures of the Intensity of E-Business Adoption

We employed 15 items to measure e-business adoption in communications processes (including internal, outbound, and inbound communications), 3 items to measure e-business adoption in internal administration processes, 3 items to measure e-business adoption in order-taking processes, and 4 items to measure e-business adoption in procurement processes. E-business adoption in communications is a second-order construct, measured by pooling three first-order constructs that relate to internal, outbound, and inbound communications. A second-order CFA analysis indicated adequate model fit for treating communications as a second-order construct ($\chi^2 = 123.36$ with 86 df , CFI = .96, NNFI = .95, IFI = .96, RMSEA =

TABLE 2
Rotated Component Matrix of Factor Loadings^a

Measure	Factor Loadings					
	1	2	3	4	5	6
Measures of antecedents of e-business adoption						
1. Top Management Emphasis						
Item 1	.80	.09	.16	.20	.17	.08
Item 2	.78	-.03	.13	.06	.17	.07
Item 3	.83	.03	.14	.04	.16	.19
Item 4	.74	.09	.03	.05	.24	.33
Item 5	.70	.09	.16	.17	-.09	.22
Item 6	.83	.10	.23	.07	.16	.01
2. Customer Orientation						
Item 1	.11	.75	.14	.05	-.11	-.02
Item 2	.06	.81	.04	.15	.06	.21
Item 3	.03	.73	.11	.25	.06	-.00
Item 4	.20	.75	.08	.12	.00	-.02
Item 5	.03	.70	-.19	.07	.29	.27
Item 6	-.17	.58	-.08	.24	.19	.44
3. Normative Pressures						
Item 1	.12	.03	.70	-.03	.11	.18
Item 2	.22	.03	.75	.07	.15	-.02
Item 3	.23	-.07	.67	-.02	.43	-.06
Item 4	.29	.11	.61	.04	.19	.14
Item 5	-.01	.08	.64	.12	.34	-.02
4. Competitor Orientation						
Item 1	.16	.03	-.01	.82	-.01	.05
Item 2	.05	.22	.03	.79	.04	.21
Item 3	.17	.14	-.01	.86	.04	.08
Item 4	.05	.29	.18	.66	-.03	-.02
5. Customer Power						
Item 1	.40	.10	.20	-.06	.58	.12
Item 2	.28	.09	.25	.02	.77	.00
Item 3	.17	.02	.43	.03	.66	-.16
Item 4	.10	.09	.36	.04	.76	.03
6. Organizational Learning Ability						
Item 1	.33	.18	.34	.11	-.19	.54
Item 2	.28	.19	-.04	.29	.01	.44
Item 3	.37	.08	.07	.11	.02	.66
Item 4	.32	.19	.09	.09	-.00	.67
Measures of intensity of e-business adoption						
1. Outbound Communications						
Item 1	.57	.09	-.05	.20	-.28	.16
Item 2	.62	.26	.02	.22	-.12	.06
Item 3	.68	-.02	.25	.06	.23	.17
Item 4	.77	.19	.19	-.01	.15	.06
Item 5	.68	.06	.11	.32	.23	.05
Item 6	.72	.24	.18	.17	-.00	-.00
2. Internal Communications						
Item 1	.08	.71	-.06	.09	.28	-.01
Item 2	.14	.75	-.03	.05	.12	.24
Item 3	.19	.79	.04	-.00	.06	.29
Item 4	.16	.70	.15	.04	.33	-.01
Item 5	.18	.65	.41	.16	.04	-.06
3. Inbound Communications						
Item 1	.29	.06	.75	.06	-.03	.30
Item 2	.25	.03	.75	-.09	-.02	.19
Item 3	-.01	.08	.80	.29	.20	.04
Item 4	.09	.07	.63	.55	.15	-.07

(continued)

TABLE 2 (continued)

Measure	Factor Loadings					
	1	2	3	4	5	6
4. Order taking						
Item 1	.21	.01	.15	.78	.02	.10
Item 2	.06	.13	.15	.65	.24	.28
Item 3	.38	.07	-.03	.68	-.02	.03
5. Internal administration						
Item 1	-.02	.31	-.02	.01	.72	.24
Item 2	.06	.18	.09	.10	.87	.13
Item 3	.11	.36	.14	.17	.57	.07
6. Procurement						
Item 1	.32	.00	.07	-.03	.23	.66
Item 2	.15	.15	.26	.39	.30	.58
Item 3	.05	.29	.34	.37	.02	.54
Item 4	.08	.15	.12	.14	.06	.80
Measures of performance outcomes						
1. Sales performance						
Item 1	.65	.32	.29	.12	.18	
Item 2	.75	.29	.24	-.10	.21	
Item 3	.71	-.10	.01	.42	-.25	
Item 4	.80	.14	.21	.06	.29	
Item 5	.64	.25	.46	.11	.04	
2. Relationship development						
Item 1	.22	.87	.16	.22	.04	
Item 2	.23	.86	.17	.20	.12	
3. Customer satisfaction						
Item 1	.18	.16	.76	.15	.14	
Item 2	.39	.06	.78	.13	.05	
Item 3	.14	.52	.63	.23	.07	
4. Efficiency 1						
Item 1	.24	.17	.05	.73	.15	
Item 2	.03	.07	.25	.76	.28	
Item 3	-.02	.40	.16	.69	.06	
5. Efficiency 2						
Item 4	.07	-.05	.10	.23	.83	
Item 5	.19	.21	.08	.12	.77	

NOTE: Factor loadings that correspond to the constructs in the first column are in italics.

a. Extraction method: principal components analysis with varimax rotation and Kaiser normalization.

.056). E-business adoption in internal administration was measured with a 3-item scale that assessed the application of e-business for financial accounting, reimbursement, and employee benefit management. E-business adoption in order taking was measured with a 3-item scale that assessed online ordering, online payment, and online tracking of orders. E-business adoption in procurement was measured with a 4-item scale that assessed online search for suppliers, online order placement with suppliers, online bidding, and participation in online supply-side marketplaces.

The results for the corresponding PCA are presented in Table 2. The establishment of three dimensions within the communication construct justifies our more detailed measurement, although we treat communication as a single



construct for purposes of empirical analysis. Each of the remaining three measures that relate to e-business adoption in internal administration, order taking, and procurement loads cleanly on a single dimension. Overall, these findings support our view that the e-business adoption must be measured at a process level rather than as a single construct.

Measures of Performance

Efficiency was measured with a five-item scale from Sethi and King (1994)—this scale assessed improvements in production and marketing efficiency. Sales performance was measured with a five-item scale adapted from Venkatraman and Ramanujam (1986)—this scale assessed increases in market share, sales volume, customer acquisition, and customer retention. Customer satisfaction was measured with a three-item scale adapted from Zeithaml, Berry, and Parasuraman (1996)—this scale assessed the change in overall customer satisfaction, customer word of mouth, and (lack of) customer switching. Relationship development was measured with a two-item scale that assessed the improvements in the strength and length of relationships with partners and suppliers, based on the discussion in Morgan and Hunt (1994).

A PCA indicated that the sales performance, relationship development, and customer satisfaction components of performance each loaded on separate factors (see Table 2). Three items related to efficiency load on one factor—this factor appears to reflect production efficiency. The two other items load on a separate factor—this factor appears to reflect marketing efficiency. Since both factors are clearly related to efficiency, all five items are used together to capture a single notion of efficiency. A second-order CFA analysis was conducted by pooling the two first-order factors. The results suggested that efficiency could be treated as a second-order construct ($\chi^2 = 9.78$ with 4 *df*, CFI = .96, NNFI = .91, IFI = .97, RMSEA = .10).

Our reliance on managerial perceptions and on detailed process-level measures can be justified on multiple accounts. First, managerial assessments of market performance have been shown to be generally consistent with objective measures (e.g., Hart and Banbury 1994). Second, as argued by Barua, Kriebel, and Mukhopadhyay (1995), measuring the impact of technology adoption at aggregate levels (e.g., using firm-level financial performance measures) often yields inconclusive results, and measuring such impact at more disaggregate, process-oriented levels is often a more appropriate and useful way to proceed. Finally, the process-level measures are consistent with our earlier arguments that researchers must move beyond a generic characterization of e-business and instead adopt a more discriminating view of its antecedents, adoption intensity, and performance outcomes.

Model Estimation

The hypotheses (main effects) are represented by the following set of equations:

$$\text{Communications} = \alpha_1 + \beta_{11}X_1 + \beta_{21}X_2 + \beta_{31}X_3 + \beta_{41}X_4 + \beta_{51}X_5 + \beta_{61}X_6 + \varepsilon_1 \quad (1)$$

$$\text{Internal Administration} = \alpha_2 + \beta_{32}X_3 + \beta_{62}X_6 + \varepsilon_2 \quad (2)$$

$$\text{Order taking} = \alpha_3 + \beta_{13}X_1 + \beta_{23}X_2 + \beta_{33}X_3 + \beta_{43}X_4 + \beta_{53}X_5 + \beta_{63}X_6 + \varepsilon_3 \quad (3)$$

$$\text{Procurement} = \alpha_4 + \beta_{14}X_1 + \beta_{24}X_2 + \beta_{44}X_4 + \beta_{64}X_6 + \varepsilon_4 \quad (4)$$

$$\begin{aligned} \text{Efficiency} = & \alpha_5 + \beta_{15}\text{Communications} \\ & + \beta_{25}\text{Internal Administration} \\ & + \beta_{35}\text{Order taking} \\ & + \beta_{45}\text{Procurement} \\ & + \beta_{55}\text{size} + \varepsilon_5 \end{aligned} \quad (5)$$

$$\begin{aligned} \text{Sales Performance} = & \alpha_6 + \beta_{16}\text{Communications} \\ & + \beta_{36}\text{Order Taking} + \beta_{56}\text{size} + \varepsilon_6 \end{aligned} \quad (6)$$

$$\begin{aligned} \text{Customer Satisfaction} = & \alpha_7 + \beta_{17}\text{Communications} \\ & + \beta_{27}\text{Internal Administration} \\ & + \beta_{37}\text{Order Taking} + \beta_{57}\text{size} + \varepsilon_7 \end{aligned} \quad (7)$$

$$\begin{aligned} \text{Relationship Development} = & \alpha_8 + \beta_{18}\text{Communications} \\ & + \beta_{28}\text{Internal Administration} \\ & + \beta_{48}\text{Procurement} + \beta_{58}\text{size} + \varepsilon_8. \end{aligned} \quad (8)$$

Here, X_1 = top management emphasis on e-business, X_2 = organizational learning ability, X_3 = customer orientation, X_4 = competitor orientation, X_5 = customer power, X_6 = normative pressures, and ε_i represents the error term. Each construct was represented by its summary score.

Given the nature of the linkages between the antecedents, adoption intensity, and performance outcomes, error terms corresponding to some of the equations could be correlated. In this case, a seemingly unrelated regression (SUR) constitutes the appropriate estimation approach. At the conceptual level, it is possible that some common unobserved variables affect the set of equations described above in a similar way. As argued by Ramanathan (2002), a common problem with the ordinary least squares approach is that common events that occur in any economy (e.g., changes in interests rates, money supply, tax policies, political events, etc.) often affect the different cross-sectional errors in a similar way so that they are contemporaneously correlated. Similarly, Johnston and DiNardo (1997) noted, "One possible reason (for using SUR) . . . is that there might be some common factors influencing the disturbances in the different equations that have not been specified explicitly in the matrices of explanatory

TABLE 3
Regression (SUR) Results for the Relationship
Between Antecedents and Intensity of E-Business Adoption

Measure	Overall	Internal			
	Intensity	Communications	Administration	Order Taking	Procurement
Top Management Emphasis	.53**	.38**		.11*	.03
Organizational Learning Ability	.80*	.49**		.01	.22**
Customer Orientation	.54*	.27	.24**	.01	
Competitor Orientation	.38	.12		.09	-.01
Customer Power	.88**	.51**		.08	
Normative Pressures	.61*	.54**	.15**	.18**	.23**
R^2	.37**	.40**	.13**	.20**	.18**
Adjusted R^2	.34	.37	.11	.16	.15

NOTE: SUR = seemingly unrelated regression.

* $p < .10$. ** $p < .05$.

variables" (p. 318). In the context of e-business adoption, there are multiple factors that may affect the errors in a similar way. For example, a strong pro-innovation bias related to e-business that existed during the late 1990s and the early 2000s may bias respondents' perceptions of e-business adoption intensity and performance outcomes in the same direction. As we discuss in the Limitations section, our main respondents were IT executives. This specific emphasis may affect the overall perception of e-business adoption and the resulting outcomes in a similar way.

On the basis of this reasoning, we tested for error correlations across the equations. The test revealed that nine pairs of error terms were significantly correlated, of which three pairs were correlated *across* the antecedent-adoption and adoption-performance linkages. The hypotheses were therefore tested through a set of eight SUR models. SUR uses the correlation in errors across equations to yield more efficient regression estimates (Johnston and DiNardo 1997; Menon et al. 1999; Zellner 1962).⁵ A check of the identification conditions for a system of equations indicated that the model was identified (e.g., Johnston and DiNardo 1997). Similarly, to examine the overall intensity of e-business adoption, we jointly estimated another set of five SUR models using a single summary score that represented the overall e-business adoption intensity.

To test for moderating effects, we performed a dummy variable analysis by classifying the data set into high and low levels of market uncertainty and technological uncertainty (e.g., Han et al. 1998; Jaworski and Kohli 1993). For ease of interpretation of the slope, following Kennedy (1998), we then conducted a Chow (1960) test to determine the significant differences between high versus low environmental uncertainty groups.

RESULTS

The results from the SUR estimation are presented in Tables 3 and 4. All antecedents (Hypotheses 1 to 6), except

TABLE 4
Regression (SUR) Results for the
Relationship Between Intensity
of E-Business Adoption and Performance

	Sales	Customer	Relationship	
	Efficiency	Performance	Satisfaction	Development
Overall intensity of adoption	.09**	.11**	.06**	.04**
Size (control)	.12	.28	.17	.04
R^2	.15**	.12**	.10**	.07**
Adjusted R^2	.14	.11	.09	.06
System weighted $R^2 = .20$				
Process-level adoption				
Communications	.11**	.15**	.08**	.03**
Internal				
Administration	.11		.10**	.11**
Order Taking	-.05	.07	-.01	
Procurement	.11			.04
Size (control)	.12	.28	.19	.02
R^2	.18**	.12**	.14**	.12**
Adjusted R^2	.15	.09	.11	.09
System weighted $R^2 = .17$				

NOTE: SUR = seemingly unrelated regression.

** $p = .05$.

for competitor orientation (Hypothesis 4), significantly influenced the *overall* intensity of adoption (Table 3). However, the influences of the antecedents differed across the four processes (Hypothesis 1a-Hypothesis 6a). Specifically, top management emphasis, organizational learning ability, customer power, and normative pressures significantly influenced e-business adoption in communications. Both customer orientation and normative pressures significantly influenced e-business adoption in internal administration. E-business adoption in order taking, on the other hand, is significantly influenced by top management emphasis and by normative pressures. E-business adoption in procurement is influenced by the organization's learning ability and by normative pressures. Except for

competitor orientation, which did not have a significant influence on e-business adoption in any process, other antecedents were significant for at least one process. Overall, top management emphasis, the organization's learning ability, and normative pressures emerged as the most consistent antecedents of e-business adoption.

Results related to performance are presented in Table 4. The overall intensity of e-business adoption had a significant influence ($p < .01$) on all measures of performance (i.e., efficiency, sales performance, customer satisfaction, and relationship development). Thus, Hypothesis 11 is supported. However, a different picture again emerges at the process level. First, e-business adoption in communications significantly influenced all performance measures, supporting Hypotheses 7a to 7d. E-business adoption in internal administration significantly influenced customer satisfaction and relationship development, supporting Hypotheses 8b and 8c. Interestingly, e-business adoption in online order taking and procurement did not significantly influence *any* measure of performance. Finally, the size of the SBU (control variable) was not significant. The findings indicate that a process-oriented perspective of e-business provides insights that are unavailable when e-business is treated as a single construct.

Chow tests for the moderating effects of market uncertainty and technological uncertainty (Hypotheses 12a to 12e) revealed that when market uncertainty was *higher*, the relationship between communications and customer satisfaction was *stronger*, $\beta_H = .62$, $p = .00$; $\beta_L = .01$, $p = .93$; $F(4, 136) = 2.74$, $p < .05$. When technological uncertainty was higher, the relationship between e-business adoption in communication and sales performance was stronger, $\beta_H = .48$, $p = .001$; $\beta_L = .11$, $p = .36$; $F(3, 138) = 4.08$, $p < .05$, as was the relationship between e-business adoption in communication and customer satisfaction, $\beta_H = .59$, $p = .00$; $\beta_L = .04$, $p = .76$; $F(4, 136) = 2.96$, $p < .05$. In addition, when technological uncertainty was higher, the relationship between e-business adoption in order taking ($\beta_H = -.29$, $p = .02$; $\beta_L = .12$, $p = .32$) and customer satisfaction was weaker. Thus, Hypotheses 12a and 12d are partially supported, but we find support for the *reverse* of the relationship proposed in Hypothesis 12c. We now describe some additional tests.

Alternative Models and Checks for Robustness

First, we attempted to estimate the model using a structural equation modeling (SEM) approach. However, we encountered difficulties related to model convergence, likely on account of the relatively low sample/parameter ratio. The model converged after several false starts. While the results from SEM model confirmed most of our hypotheses, the fit indices fell short of the acceptable levels even after several rounds of model refinement.

Second, we checked whether e-business adoption intensity mediated the effects of the antecedents on performance outcomes. The results indicated that these effects were largely mediated by the intensity of e-business adoption except in the case of customer satisfaction where most of the antecedents continued to have strong direct effects on customer satisfaction.⁶

Third, the dummy variable analysis employed to check for the moderating effects avoids overwhelming the model with multiple regressors and circumvents issues related to multicollinearity in testing interaction terms (Aiken and West 1991). However, to check for robustness, we performed additional analyses where we included the main effects of the predictor (i.e., the intensity of e-business adoption at the business process level) and the moderator variables, and interaction terms comprising the products of the predictor variables and (mean-centered) moderator variables (according to Hypotheses 12a-12e). Mean centering the interactions terms can reduce the multicollinearity often encountered in such cases (Aiken and West 1991). The results indicated that (a) for the relationship between Customer Satisfaction and (Market Uncertainty \times Communications), $\beta = .93$, $p < .05$; (b) for the relationship between Sales Performance and (Technological Uncertainty \times Communications), $\beta = .59$, $p < .10$; (c) for the relationship between Customer Satisfaction and (Technological Uncertainty \times Communications), $\beta = .61$, $p < .10$; and (d) for the relationship between Sales Performance and (Technological Uncertainty \times Order Taking), $\beta = -.19$, $p = .12$, close to 10 percent significance level. These results are broadly consistent with those obtained using the dummy variable test.

DISCUSSION AND IMPLICATIONS

Antecedents of E-Business Adoption

Five of the six proposed antecedents had a significant influence on the *overall* intensity of e-business adoption, but this influence varied significantly by process. For e-business adoption in communication, top management emphasis, learning ability, customer power, and normative pressures are all significant antecedents. Customer orientation and normative pressures are both significant antecedents to e-business adoption in internal administration. While the influence of customer orientation on e-business adoption in internal administration is not intuitive at first glance, some introspection yields a plausible explanation. Han et al. (1998) noted that "because customer orientation places the highest priority on continuously finding ways to provide superior customer value, an increased commitment to customer orientation should result in increased boundary-spanning activity" (p. 33). Furthermore, Parsons (1991) argued that organizations that are committed

to providing superior customer value tend to innovate across their administrative systems, rather than solely in products and services. Parsons posits that effective business systems reengineering, which is essentially a form of administrative innovation, is as important as product or service innovation in delivering superior customer value. Specifically, using a sample of 134 banks, Han et al. (1998) demonstrated that customer orientation had a positive impact on innovativeness in administrative areas. This finding is consistent with our result.

Top management emphasis and normative pressures are significant antecedents of online order taking. Online order taking may call for significant investments, significantly alter the existing competitive equilibrium, and invoke thorny strategic problems related to managing both channel cannibalization and partner relationships in legacy channels. Therefore, initiatives in this area are likely to proceed only in the presence of a strategic consensus backed by top management (Balasubramanian and Peterson 2003). In parallel, with the rush to e-business, numerous businesses have feared being left behind if they do not adopt online sales. The resulting normative pressure is strongly felt in the context of online order taking, which constitutes one of the most high-profile, externally visible facets of e-business.

Finally, the organization's learning ability and normative pressures are significant antecedents of e-procurement. E-procurement is challenging in both technical and organizational contexts. The technical challenges relate to database compatibility and completeness and systems integration both within the business unit and between the unit and its trading partners. Even when e-procurement takes the relatively less ambitious form of electronic coordination with existing suppliers (e.g., via electronic data interchange systems), a significant shift in the existing procurement procedures and practices may be required. These challenges call for the ability to quickly assimilate and apply knowledge related to e-procurement. An organization with a superior learning ability is more likely to successfully navigate these challenges. Furthermore, during the late 1990s and the early 2000s, firms in the enterprise relationship management area (e.g., SAP, I2, Oracle) and marketplace enablers (e.g., Ariba) aggressively marketed their services, frequently drawing from adoption stories at other businesses. Together, these influences implied that managers were faced with strong normative pressures to adopt e-procurement.

Implications of E-Business Adoption for Business Performance

The overall intensity of adoption significantly influenced all four measures of performance, supporting Hypothesis 1. However, a different picture again emerges at the process level. Neither online order taking nor

e-procurement, which constitute the highest profile e-business activities, significantly influenced *any* performance measure. In contrast, e-business adoption in communications strongly influenced all four performance measures ($p < .05$), and e-business adoption in internal administration strongly influenced customer satisfaction and relationship development ($p < .05$).

Several points are worth noting here. First, normative pressures were a significant antecedent for both online order taking and e-procurement. Therefore, initiatives in these areas may reflect attempts to quickly hop aboard the e-business bandwagon without adequate foresight into the potential performance outcomes. For example, Nike Inc. encountered serious problems after implementing a comprehensive supply chain software package to automate retail ordering and forecasting (Piller 2001). Accordingly, e-business initiatives adopted on account of such normative pressures, rather than on the basis of well-reasoned economic objectives, did not yield significant performance improvements.

Second, the raw adoption intensity scores (not presented to conserve space) suggest that both online order taking and e-procurement are currently at low levels of adoption. With time, it is possible that these activities will be implemented more intensely and more profitably. However, our findings suggest that less visible facets of e-business can be pursued more successfully by businesses and that online order taking and e-procurement should not be viewed as panacea even in the long term.

Third, the results suggest that enhancing customer satisfaction and developing stronger relationships with partners are tasks that are not constrained to the interface of the business unit with these parties. E-business initiatives in internal administration can help marshal the firm's resources toward these tasks. These resources may be located across functional areas and may be difficult to coordinate without timely information flows and streamlined administrative procedures.

Finally, in terms of moderating effects, the results suggest that e-business applications may be particularly useful in collecting and transmitting marketplace information when market uncertainty is high. Surprisingly, the positive effects of e-business adoption in communication on sales performance and customer satisfaction are strengthened when technological uncertainty is high. Possibly, this is because the technologies involved in communication are less complex than those involved in online order taking and e-procurement. Therefore, businesses that do open electronic communications channels even in the face of technological uncertainty are rewarded. In contrast, such uncertainty does negatively influence the effect of online order taking, which may involve more complex technologies, on customer satisfaction.

Overall, the results suggest that the frequent paucity of e-business during the late 1990s and the early 2000s

reflected a pro-innovation bias. In fact, since the overall intensity of e-business adoption significantly influences all four measures of performance, our own results would reflect this bias if we measured e-business adoption as a single construct. However, a different picture emerges when we conceptualize and measure e-business adoption across business processes. This suggests that researchers must explicitly seek models that avoid a pro-innovation bias (Mahajan, Sharma, and Bettis 1988).

Our results must not be interpreted as a broad criticism of e-business adoption in either order taking or procurement. However, consistent with Sawhney and Zabin (2001), our results do suggest that businesses must carefully plan their path to e-business adoption. First, our results suggest that managers should begin to think small and think creatively about e-business adoption. Whereas online order taking and e-procurement have received much attention, our findings reveal that the most effective transformations are currently occurring in the less high-profile realms of communication and internal administration. This finding is illustrated by the experience of GE. In 1999, GE launched a business plan to convert itself into a massive "dot-com," with as much of 30 percent of its total sales online. When this effort did not yield the expected returns, the company turned inward, focusing on a highly successful, intensive "digitization" of internal business processes that curtailed engagement with external intermediaries and reduced bureaucracy and paperwork (Murray and Sapsford 2001).

Implications for Research

This article presents a new conceptualization of e-business adoption intensity, demonstrates how e-business adoption across processes can be empirically distinguished, and provides the corresponding scales for measurement. Our findings suggest that e-business is one of those constructs that "have been better understood as limited aspects of their total meaning have been measured" (Cameron and Whetten 1983:276). Our results with the process-based measures of e-business vary sharply from those obtained when e-business adoption is measured as a unitary construct (e.g., Srinivasan et al. 2002). This suggests that future research on e-business adoption must ideally employ the process perspective.

A second theoretical implication of our study is that institutional pressures may account for variance in innovation adoption to an extent beyond what is explained by the market orientation and organizational learning literatures, which have been embedded more in contingency theories, rather than in institutional theories of the firm (cf. Homburg et al. 1999). Moreover, because we study the entire

chain constituted by e-business adoption antecedents, adoption intensity, and performance implications, we are able to explain why (or why not) the adoption of e-business within certain process domains led to improved performance. Specifically, we find that adoption decisions driven by institutional and customer pressures did *not* yield substantial improvements in business performance.

These findings also suggest that research on innovation adoption must ideally consider both adoption antecedents and performance outcomes in a single context. In addition, such research must consider factors drawn from both contingency and institutional perspectives of the firm—the latter may include influences of a regulatory, normative, and cognitive nature (Grewal and Dharwadkar 2002).

Limitations

This study has certain limitations that can be addressed in future research. First, while this study presents a cross-sectional picture of e-business adoption, a longitudinal study could enrich the findings. Second, the measurement techniques can be further developed. For example, the adoption measures can be expanded to include the virtual codevelopment of offerings with partner firms and customers, and the performance measures could include financial measures such as return on e-business investments. Third, 65 percent of our sampled SBUs have fewer than 1,000 employees. Hence, while we control for size in measuring the performance outcomes related to e-business adoption, our results may yet be overly representative of relatively small business units. In addition, information technology executives responsible for e-business strategy constituted our primary survey respondents. These respondents may be less aware of the performance implications of e-business adoption in order-taking and procurement processes, as opposed to communications and internal administration processes. Future research can compare survey results obtained from managers across the IT, marketing, and operations functions. Fourth, new antecedents can be considered, and the study can be replicated across industries and cultural contexts (e.g., crossnationally). This study could also be replicated a few years down the road to identify how environmental and technological changes affect the antecedents, adoption patterns, and performance implications related to e-business. Such efforts can, over time, develop into a rigorous body of theory specifically related to e-business. Varadarajan and Yadav (2002) delineated the nature and scope of strategy in a marketplace that is both physical and virtual. Their organizing framework can serve as a model for such theory development. Finally, in networked environments, businesses frequently leverage the assets of their partners and

complementors. Future research can investigate how businesses employ such “distributed” assets in the context of e-business.

In many ways, the e-business phenomenon has only begun—there is much yet to happen and much to be learned. We hope that this study catalyzes further research in the area.

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APPENDIX Measurement

Measures of the Intensity of E-Business Adoption

Note: All items are measured using 7-point Likert-type scales with 1 = *not used at all* and 7 = *used very extensively*.

We use e-business tools to _____

<i>Scale and Scale Items</i>	<i>Coefficient Alpha</i>
Internal Communications	
1. Facilitate internal communication between employees in different departments and different locations.	
2. Regularly update employees about developments within the strategic business unit (SBU).	
3. Facilitate discussions and feedback on various issues of importance to our SBU.	
4. Manage projects within the SBU.	
5. Coordinate new product development teams.	.83
Outbound Communications	
1. Provide customers with general information about our SBU (e.g., via Web sites and information boards).	
2. Allow customers to locate and send information to appropriate contacts within the SBU (e.g., via accessible online directories/databases).	
3. Send customers regular updates about new products and other developments within our SBU (e.g., via e-mail).	
4. Provide solutions to customer problems (e.g., via Web-based service solutions).	
5. Provide after-sales service to our customers (e.g., via online information about installation and troubleshooting).	
6. Provide information in response to consumer questions or requests (e.g., via searchable online databases).	.83
Inbound Communications	
1. Send suppliers regular updates about new product plans and other new developments within our SBU (e.g., via e-mail).	
2. Provide specific online information about product specifications that our suppliers must meet.	
3. Share product and inventory planning information with our suppliers.	
4. Permit suppliers to directly link up to our databases (e.g., via Enterprise Resource Planning/ERP systems).	.82
Internal Administration	
1. Perform financial and managerial accounting.	
2. Provide reimbursements and manage payrolls.	
3. Manage employee benefits (e.g., life and medical insurance).	.78
Order Taking	
1. Accept orders electronically from customers (e.g., online ordering).	
2. Accept payments electronically from customers (e.g., online payment).	
3. Allow customers to track and inquire about their orders electronically.	.75
Procurement	
1. Search and locate potential suppliers online.	
2. Place and track orders with suppliers electronically (e.g., online order placement).	
3. Allow suppliers to submit bids online.	
4. Use online marketplaces to source supplies (e.g., Ariba.com, Commerceone.com)	.77

(continued)

APPENDIX (continued)

Measures of Antecedents

All items are measured using 7-point Likert-type scales with 1 = *strongly disagree* and 7 = *strongly agree*.

Scale and Scale Items

*Coefficient
Alpha*

Top Management Emphasis

1. Top managers in our SBU continuously emphasize that our SBU must adapt to the Internet-related market trends.
2. Top managers in our SBU often advise employees to be sensitive to competitors' initiatives with regard to e-business.
3. Top managers in our SBU keep telling people that they must bring more of their business practices online in order to meet customers' future needs.
4. Top managers are willing to try to provide the necessary resources for implementing e-business practices.
5. Top managers in our SBU often advise employees to keep track of the latest developments in Internet technology and Internet-related business practices.
6. According to top managers in our SBU, incorporating e-business practices is a very important task. .91

Organizational Learning Ability

1. Our SBU is quick to learn about new technologies.
2. Various departments and people in our SBU exchange information freely and frequently.
3. Our SBU invests substantially in advanced business and technical training for our managers and other personnel.
4. Our SBU invests substantially in R&D and knowledge acquisition. .77

Customer Orientation

1. Our business objectives are driven by customer satisfaction.
2. We closely monitor and assess our level of commitment in serving customers' needs.
3. Our competitive advantage is based on understanding customers' needs.
4. Business strategies are driven by the goal of increasing customer value.
5. We frequently measure customer satisfaction.
6. We pay close attention to after-sales service. .86

Competitor Orientation

1. The managers in our SBU often exchange information and views about our competitors.
2. We respond rapidly to competitive actions.
3. Our top management regularly discusses competitors' strengths and weaknesses.
4. We believe that analyzing and responding to competitors' actions is crucial to maintain our competitive advantage. .84

Customer Power

1. Many of our customers are keen that our SBU should implement e-business practices.
2. Our relationship with our major customers would have suffered if we had not implemented e-business practices.
3. Our customers may consider us as backward if we do not implement e-business initiatives.
4. Our major customers demand that we establish strong e-business relationships with them. .84

Normative Pressures

1. A large number of our competitors and business partners have already adopted e-business practices.
2. In our industry, firms that do not readily adopt new technologies will be left behind.
3. We would be considered technology-deficient if we do not implement e-business practices.
4. It is important that we are seen as a cutting edge business that adopts innovative technologies.
5. In our industry, most firms will ultimately end up adopting a wide range of e-business practices. .81

Measures of SBU Performance

All items are measured using 7-point Likert-type scales with 1 = *strongly disagree* and 7 = *strongly agree*.

After implementing e-business practices, _____

Scale and Scale Items

*Coefficient
Alpha*

Efficiency

1. The costs of production and transaction (e.g., raw material, order processing, warehousing, and scheduling costs) in this SBU have been substantially reduced.
2. The costs of general management activities (e.g., planning and accounting costs) have been substantially reduced.
3. The costs of coordinating with suppliers, customers, and business partners have been substantially reduced.
4. The costs of marketing the product (e.g., advertising and promotion costs) have been substantially reduced.
5. The costs of acquiring new customers have been substantially reduced. .74

(continued)

APPENDIX (continued)

Sales Performance

1. The market share of our products has increased.
2. The sales volume of our products has increased.
3. The prices of our products have changed.
4. The number of new customers that we are able to acquire has increased.
5. The number of existing customers that we are able to retain has increased. .84

Customer Satisfaction

1. Overall, our customers are more satisfied with our SBU.
2. Our customers encourage other people to do business with our SBU.
3. Our customers are more loyal to us than before. .78

Relationship Development

1. Our SBU has been able to strengthen its existing business relationships with partners and suppliers.
2. The relationships between our SBU and its suppliers and business partners are likely to last longer. .92

NOTES

1. All measurements are at the level of the strategic business unit.
2. These research questions are consistent with the 2002-2004 Top Tier research priorities of the Marketing Science Institute, that is, the development of marketing metrics and the assessment of marketing productivity.
3. Hypotheses 6 and 6a are not identical hypotheses. For example, Hypothesis 6 may hold even when normative pressures drive adoption in only a proper subset of the four process areas where we measure adoption intensity.
4. The scale items for the customer orientation and competitor orientation constructs used in Narver and Slater (1990) were published in Narver, Jacobsen, and Slater (1993). Those items have been variously adapted over time by different scholars. For example, some of the scale items used by Narver and Slater (1990) include the following: "We constantly monitor our level of commitment to serving customers' needs"; "Our business strategies are driven by our beliefs about how we can create greater value for customers"; and "Our salespeople regularly share information within our business concerning competitors' strategies." These items differ in wording from those employed for measuring essentially the same constructs by other researchers in subsequent work and in this article. For future empirical research that employs these constructs, it is advisable to use the original items in Narver et al. (1993). We thank an anonymous reviewer for pointing out this discrepancy.
5. An initial set of seemingly unrelated regression models was estimated with dummies to capture industry effects. The industry effects were not significant. Consequently, the data were pooled for the final analysis.
6. For efficiency, the effects of all six antecedents are fully mediated by the intensity of e-business adoption. For sales performance, the effects of four antecedents are fully mediated, and those of two (top management emphasis and competitor orientation) are partially mediated by the intensity of e-business adoption. For customer satisfaction, five of the antecedents have a strong direct effect on performance outcome except for normative pressure, which is fully mediated by the intensity of e-business adoption. For relationship development, the effects of four antecedents are fully mediated, and two (top management emphasis and customer orientation) are partially mediated by the intensity of e-business adoption.

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