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Technological Opportunism and Radical Technology Adoption: An Application to E-Business

Using the resource-based view of the firm, the authors hypothesize that differences in adoption of radical technologies among firms can be attributed to a sense-and-respond capability of firms with respect to new technologies, which is termed technological opportunism. Using survey data from senior managers in business-to-business firms, the authors study the adoption of e-business, a radical technology with the potential to alter business models. The authors first establish the distinctiveness of technological opportunism from related constructs, such as organizational innovativeness, and show that it offers a significantly better explanation of technology adoption than existing constructs do. In a follow-up survey of senior managers, the authors investigate the antecedents of technological opportunism and find that organizations can develop technological opportunism by taking specific actions such as focusing on the future, by having top management advocate new technologies, and by becoming more of an adhocracy culture and less of a hierarchy culture. The proposed technological opportunism construct can inform theory development on the relative emphasis on internal (research and development) versus external (buying, licensing) development of technologies and the complementarities in technology orientation and market orientation in the firm. The results can be used by managers who seek to develop the technological opportunism capability of their firms and by those in technology vendor firms who seek to develop segmentation strategies based on the technological opportunism capabilities of their customer firms.

Business history offers many examples of industries (e.g., lighting, photography, steel, and telecommunications) in which radical technologies emerged and eventually overwhelmed established technologies (Utterback 1994).[1] In each industry, some firms did not adopt a radical technology and failed to survive in the marketplace,[2] whereas other firms leaped from one generation of technology to the next and adapted their business models on the basis of such technologies. In this article, we focus on why some firms readily adopt radical technologies whereas other firms are either unwilling or unable to do so. This issue is important for both adopter firms and firms that sell radical technologies. For adopter firms, the decision to adopt radical technologies is difficult because of the associated uncertainties, the possibility that prior investments may be rendered obsolete, and high switching costs in adopting new technologies. Yet if a new technology is promising, it will create attractive market opportunities. For seller firms, understanding how their potential customers adopt technologies can help in formulating marketing strategies.

Studying radical technology adoption is also important to researchers in marketing. The marketing literature on organizational adoption of radical technologies is sparse (Chandrashekaran and Sinha 1995; Gatignon and Robertson 1989; Robertson and Gatignon 1986). Furthermore, the adoption of radical technologies by firms is linked to their marketing strategies in the area of product design, distribution, and pricing (Capon and Glazer 1987). Although research on technology-intensive markets (Heide and Weiss 1995; Weiss and Heide 1993) provides useful insights on firms' strategic behaviors when they buy radical technologies, the area remains underresearched. For example, consider e-business, a radical technology that has been transforming business models and processes, resulting in the disruption of old industries and the creation of new ones. A casual review of the business press suggests that some organizations proactively adopt e-business to transform their business models and others adopt e-business merely for supporting functions, such as communications. Research in organization theory, information systems, economics, and technology management has contributed to the understanding of organizational adoption of innovations. However, most of the research on organizational adoption has involved

[1]A *radical technology* contains a high degree of new knowledge compared with a current technology and represents a clear departure from existing practices (Dewar and Dutton 1986). We use the terms "innovation" and "technology" interchangeably in the article.

[2]We use the terms "firm," "organization," and "strategic business unit" interchangeably in the article.

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innovations that have limited impact on the firm's business strategy. Radical innovations that have been studied in the past include production technologies in shoe manufacturing (Dewar and Dutton 1986), software engineering innovation (Fichman and Kemerer 1997), packaging innovations in the food processing industry (Ettlie, Bridges, and O'Keefe 1984), and adoption of laptops by sales executives (Gatignon and Robertson 1989). Although these innovations incorporate new technologies, their impact at the organizational level is limited. Indeed, some of these adoption decisions (e.g., production processes, sales force automation) likely took place at the functional level (e.g., manufacturing, sales and marketing, respectively).

We extend theoretical developments in the resource-based view of the firm (Wernerfelt 1984) to investigate why some firms proactively adopt radical technologies whereas others do not. We identify *technological opportunism*, a sense-and-respond capability of firms with respect to new technologies, as an important determinant of radical technology adoption. To assess the incremental contribution of technological opportunism in explaining technology adoption, we also include in our model variables identified in prior research—institutional pressures on the firm from the environment (DiMaggio and Powell 1991), complementary assets that help generate value from new technologies (Tripsas 1998), and the perceived usefulness of the technology (Venkatesh and Davis 2000). We develop and test our technology adoption model in the context of e-business adoption in business-to-business firms, a context in which e-business has the potential to radically alter the relative profitability of firms' business models.

We report the results of two studies. In Study 1, we use field interviews and national surveys of senior executives in 183 firms to develop the new construct of technological opportunism. We develop reliable measures of technological opportunism and establish its distinctiveness from the related constructs of technological orientation (Gatignon and Xuereb 1997), organizational innovativeness (Deshpandé, Farley, and Webster 1993), and market orientation (Kohli, Jaworski, and Kumar 1993). We find that technological opportunism explains significantly more variance in radical technology adoption than do constructs currently proposed in the literature. The results of Study 1 raise the question of why some firms are technologically more opportunistic than others. In Study 2, we build a model of the antecedents of technological opportunism to address the following research issues: (1) What are the organizational factors that influence technological opportunism? and (2) To what extent does a firm's environment influence its technological opportunism? We test our Study 2 model using data from a national survey of senior managers in 200 firms. Our results suggest that though the firm's technology environment influences technological opportunism, firms can become more technologically opportunistic by (1) having a future focus, (2) having a top management that advocates the use of new technologies, and (3) developing an adhocracy culture within the firm.

The article is organized as follows: In the next section, we introduce our concept of technological opportunism and describe its distinctiveness from existing constructs. We then present our conceptual framework, hypotheses, and model for technology adoption. In subsequent sections, we describe the method we use to test our model and present the results of our analyses. Following that, we present our conceptual framework, hypotheses, and model for the antecedents of technological opportunism and the results of a test of that model. We conclude by discussing the theoretical and empirical contributions of our research, summarizing the limitations of the study and identifying future research extensions.

Technological Opportunism

Importance of Sensing and Responding to New Technologies

A firm's ability to sense and respond to new technology developments is critical for several reasons. First, technological change is a principal driver of competition—destroying monopolies, creating new industries, and rendering products and markets obsolete. Second, in-house technology development, a traditional source of technical know-how for firms, is increasingly being complemented by additional sources both within and outside an industry (Pisano 1990). Third, it is difficult for firms to predict which of several technology options under development will eventually succeed commercially, and therefore it may be expedient for firms to hedge their positions with alternative new technologies (Schilling 1998).

Defining Technological Opportunism

Strategy theorists emphasize how firms build competitive advantage by developing resources and capabilities (Wernerfelt 1984). Resources include difficult-to-imitate, firm-specific know-how (e.g., patents, licenses) or assets (e.g., plant and equipment, human capital). Capabilities include skills exercised through organizational processes (e.g., market sensing) that enable firms to use their assets (Day 1994; Teece, Pisano, and Shuen 1997).

Much previous research has focused on a negative form of opportunism (e.g., opportunistic behavior by trading partners) in interorganizational relationships (John 1984; Williamson 1975). However, some researchers have explored a benign form of opportunism (Hutt, Reingen, and Ronchetto 1988; Isenberg 1987), wherein managers are proactive in responding to new opportunities in a way that does not violate principles of fairness. Our notion of technological opportunism is of the latter kind. We identify two components of technological opportunism: technology-sensing capability and technology-response capability.

Technology-sensing capability is an organization's ability to acquire knowledge about and understand new technology developments, which may be developed either internally or externally. An organization that has strong technology-sensing capability will regularly scan for information about new technological opportunities and threats (Daft and Weick 1984). It will identify, sense, and evaluate internally produced innovations and scan for external innovations through meetings with vendors, debriefings from salespeople, and discussions with competitors.

Technology-response capability is an organization's willingness and ability to respond to the new technologies it senses in its environment that may affect the organization. An organization that senses new technologies may not be willing or able to respond to these new technologies, because such technologies can cannibalize existing products, markets, and organizational relationships and result in switching costs (Chandy and Tellis 1998). Therefore, technology-response capability also includes the firm's ability to reengineer its business strategies to exploit the opportunities or stave off the threats posed by new technologies. A firm may respond to a radical technology in several ways, including ignoring the technology, monitoring it, forming alliances to exploit the technology, doing limited experimentation, and adopting the technology within the firm.

Our conceptualization of technological opportunism as a generalized firm-level capability with respect to new technologies is analogous to the treatment of consumer innovativeness as a generalized underlying disposition, distinct from the adoption of a specific innovation in consumer behavior research (Midgley and Dowling 1978; Steenkamp, Hofstede, and Wedel 1999). Just as consumer innovativeness can affect behavior in a variety of contexts (e.g., innovation adoption, creativity, variety-seeking behavior), the technologically opportunistic firm can respond in several ways to new technologies.

Technological Opportunism and Related Constructs

Technological opportunism as a firm-level capability is consistent with multiple research perspectives on organizational traits (Daft and Weick 1984; Miles and Snow 1978; Teece, Pisano, and Shuen 1997). Similar to the prospector firm in Miles and Snow's (1978) typology, a technologically opportunistic firm senses and responds proactively to capitalize on (or counter) these technology opportunities (or threats). Similarly, technologically opportunistic firms are in an enactment mode (Daft and Weick 1984) with respect to new technologies, exploring several new technologies that could be potential threats or opportunities for them. Technological opportunism is also consistent with the growing stream of research in marketing on firm-level traits including marketing capabilities (Day 1994), culture (Deshpandé, Farley, and Webster 1993; Moorman 1995), market orientation (Jaworski and Kohli 1993), and willingness to cannibalize (Chandy and Tellis 1998).

Technological opportunism differs from other, related concepts important to innovation management, including organizational innovativeness (Deshpandé, Farley, and Webster 1993) and technological orientation (Gatignon and Xuereb 1997). Organizational innovativeness is the degree to which a firm deviates from existing practices in creating new products and/or processes (Deshpandé, Farley, and Webster 1993). We also note an alternative conceptualization of innovativeness (e.g., Rogers 1995) as a dependent variable of innovation adoption. Here, we consider organizational innovativeness more broadly as a capability and not in its more restricted definition as innovation adoption. Gatignon and Xuereb (1997, p. 78) define technological orientation as "the ability and the will to acquire a substantial technological background and use it in the development of new products."

Technological opportunism is distinct from both organizational innovativeness and technological orientation in an important way. As conceptualized and measured, both organizational innovativeness and technological orientation refer to the capability of the organization to develop new technologies, products, and processes. In contrast, technological opportunism is the capability of the organization to sense and respond to new technologies, regardless of whether those technologies are developed externally or internally or are used in developing new products. If an organization has the foresight and the will to invest in an in-house research facility to develop a radically new production process, the organization is both innovative and technologically oriented but not necessarily technologically opportunistic. For example, Xerox Corporation's Palo Alto Research Center produced various revolutionary technologies in the 1970s, including the laser printer, the mouse, and graphical user interface. Xerox was both innovative and technologically oriented, but it was not technologically opportunistic because it did not sense and respond to its own technologies. Indeed, other (technologically opportunistic) companies including Hewlett-Packard (laser printer) and Apple (graphical user interface) commercialized these new technologies. In contrast, when IBM approached Microsoft in 1980 for an operating system for IBM's forthcoming personal computer, Microsoft was aware of another software QDOS (Quick and Dirty Operating System) developed by Seattle Computer Products that might work for this purpose, bought the rights to it, and developed MS-DOS based on QDOS. Microsoft was technologically opportunistic, innovative, and technologically oriented. Thus, technological opportunism pertains to a sense-and-respond capability of the organization with respect to new technologies (whether developed internally or externally), whereas organizational innovativeness and technological orientation pertain to the creation of new technologies, products, and processes within the organization.

As a sense-and-respond capability, technological opportunism is conceptually similar to market orientation. Jaworski and Kohli (1993) define *market orientation* as organization-wide gathering of market intelligence pertaining to customer needs, dissemination of intelligence among departments, and organization-wide responsiveness to it. Market orientation researchers have focused on the sense-and-response capabilities with respect to a firm's market environment of customers and competitors. Technological opportunism differs from market orientation in two ways: First, new technologies can arise from many other sources outside the market environment (e.g., suppliers, universities, other industries). Thus, the substantive sensing domain of technological opportunism is distinct from that of market orientation. Indeed, research suggests that some market-oriented firms are unable to adopt new technologies because their current customers do not find them useful (Christensen 1997). Second, market responsiveness is a strategic imperative with tangible rewards, whereas responsiveness to new technologies is risky because it may not be clear a priori whether the new technology will benefit the organization. Thus, market responsiveness need not imply technology responsiveness. We provide empirical support for the distinctiveness of these constructs subsequently. We next

develop a model that relates technological opportunism to radical technology adoption.

Technology Adoption: Conceptual Framework and Hypotheses

Several strategy researchers (Bourgeois 1984; Child 1972) have proposed that organizations proactively manipulate their environments to achieve their objectives. Consistent with this line of reasoning, we suggest that firms that are technologically opportunistic proactively seek and adopt new technologies. We incorporate this basic idea in a model to explain radical technology adoption that includes technological opportunism, institutional pressures on the firm to adopt the technology, and complementary assets that help the firm generate value from new technologies. In addition, consistent with prior research, we include perceived usefulness of the technology as an explanatory variable (Venkatesh and Davis 2000). Previous researchers have used multiple definitions of technology adoption, including time to adopt, the dichotomous measure of adopt/not adopt, and the extent of technology adoption. When the technology is amorphous and variations in the form of adoption are high, as is the case in e-business, it is appropriate to assess the extent of technology adoption. Therefore, we measure the extent to which firms adopt the radical technology (in this case, e-business).

Technological Opportunism

Firms that are aware of changes in their environment are likely to create pressures for change. We expect technologically opportunistic firms to be aware of technology developments and be more likely to invest resources in adopting new technologies. Strategy research suggests that when an organization's decision makers perceive a strategic issue as an opportunity (compared with when they perceive it as a threat), they consider that situation to be positive and perceive greater control over the outcomes (Dutton and Duncan 1987). In such cases, managers are likely to take proactive measures. Technologically opportunistic firms will perceive technology developments as potential sources of growth for the firm and will respond proactively to adopt radical technologies. Therefore,

H_1: The greater a firm's technological opportunism, the greater is its extent of technology adoption.

Institutional Pressures

Organizational sociologists have long argued that firms adopt technologies because of institutional pressures from constituencies in their environments. We consider two components of institutional pressures: stakeholder pressures and competitive pressures. *Stakeholder pressures* are forces on the firm from its customers, trading partners, investors, bankers, suppliers, general public, media, and employees to adopt a technology. Some resource-dependency theorists (Pfeffer and Salancik 1978) have argued that managers lack the power to do anything beyond allocating resources to developments and actions that customers require. Neoinstitutional theorists have proposed that an organization will conform to the social expectations of its stakeholders, because such conformity gives it access to the scarce resources it needs to survive and succeed (DiMaggio and Powell 1991). *Competitive pressures* force a firm to adopt a technology or risk losing competitive advantage (Abrahamson and Rosenkopf 1993). When these arguments are applied to e-business technologies, an organization's early and extensive adoption signals its technological astuteness and gives it social legitimacy with its stakeholders. In addition, fear of being left behind competitors also results in technology adoption. Therefore,

H_2: The greater the institutional pressures on a firm to adopt the technology, the greater is its extent of technology adoption.

Complementary Assets

Complementary assets help the firm derive value from new technologies. Prior research indicates that complementary assets positively affect the technology adoption process (Rogers 1995; Tripsas 1998). Personal computers initially diffused more rapidly among consumers and firms that had prior experience with mainframes or minicomputers than among those that did not. Tripsas (1998) finds that specialized complementary assets buffer incumbents from the effects of destruction by invading radical technologies. The costs of learning new technologies will be affected by the extent to which the new technology is related to the preexisting knowledge base or its absorptive capacity (Cohen and Levinthal 1990). Therefore,

H_3: The greater a firm's ownership of assets complementary to a radical technology, the greater is its extent of technology adoption.

Method: Technology Adoption Model (Study 1)

Field Interviews, Sample, and Procedure

We conducted field interviews with 18 senior managers in 15 organizations to obtain initial insights into the technology adoption process. We then acquired a mailing list of business-to-business firms from Corptech for the formal surveys. To improve the generalizability of our findings, we surveyed a cross-industry sample of executives in firms covering six industry groups: computer hardware, computer software, chemicals, heavy manufacturing, light manufacturing, and telecommunications. Of the 630 surveys we mailed out, 22 surveys were returned because of incorrect addresses, and 10 managers returned the surveys because they were not qualified to respond. We received 183 completed surveys (of 598 surveys remaining), which yielded an effective response rate of 30.6%. Table 1 contains the descriptive statistics of the sample and indicates that our sample represents a broad range of firms in terms of size and industries. We used a senior marketing executive as the key informant because our field interviews indicated that marketing executives were frequently responsible for e-business adoption decisions in business-to-business firms. Most

TABLE 1
Profile of Firms in Sample

Size	Number of Respondents (% of Sample)	Number of Respondents (% of Sample)
Study	**Study 1 (n = 183)**	**Study 2 (n = 200)**
Industry Groups		
Computer hardware	40 (21.9)	32 (16.0)
Computer software	22 (12.0)	14 (7.0)
Chemicals	40 (21.9)	22 (11.0)
Heavy manufacturing	33 (18.0)	88 (44.0)
Light manufacturing	38 (20.8)	16 (8.0)
Telecommunications	10 (5.5)	28 (14.0)
Total	**183 (100)**	**200 (100)**
Sales Turnover		
<$100 million	70 (38.3)	87 (43.5)
$101 million–$499 million	67 (36.6)	72 (36.0)
$500 million–$999 million	18 (9.7)	14 (7.0)
$1 billion–$4.99 billion	14 (7.7)	17 (8.5)
>$5 billion	14 (7.7)	10 (5.0)
Total	**183 (100)**	**200 (100)**
Number of Employees		
<500	55 (30.1)	8 (4.0)
500–999	42 (23.0)	70 (35.0)
1000–4999	54 (29.5)	59 (29.5)
5000–10,000	17 (9.3)	43 (21.5)
>10,000	15 (8.1)	20 (10.0)
Total	**183 (100)**	**200 (100)**

(70%) of the managers in our sample were at the level of director and above, which suggests that they were knowledgeable about their firms' capabilities and actions.

Measure Development

We measured all constructs at the level of the strategic business unit (SBU). Because scales for the key constructs in our research were not available, we developed them when necessary, using an appropriate refinement procedure (Churchill 1979). Table 2 contains the measures used in the study.

E-business adoption ranges from simply using e-mail to communicate within the organization to developing entirely new business models. To account for this range of adoption behavior, we defined technology adoption as the breadth and depth of e-business usage in a firm's business processes and measured it using a four-item interval scale (TECADOPT). Because of the centrality of technology adoption to our research, we also measured the scope of a firm's e-business adoption using specific applications (the eADOPT scale in Table 2). The two dependent variable measures, TECADOPT and eADOPT, correlate well ($r = .68$, $p < .01$). We use TECADOPT as the dependent variable for our analysis.

We measured technological opportunism (TECHOPP) using an eight-item scale. Consistent with the idea that capability includes organizational processes (Day 1994), we measured technological opportunism on the basis of behaviors related to organization-wide sense-and-respond capabilities with respect to new technologies. Four of the eight items pertain to technology-sensing capability and four to technology-response capability. For institutional pressures (INPRES), we developed an eight-item scale specific to e-business. We provided a detailed definition of the term "stakeholders" for our respondents. Six items pertain to stakeholder pressures and two items to competitive pressures. Our field interviews indicated that for e-business adoption, the firm's information technology (IT) capability was the most important complementary asset. Therefore, for complementary assets (CASSETS), we used a three-item scale to measure the existing IT of the firm. For perceived usefulness, we used a five-item scale. For organizational innovativeness, we modified Deshpandé, Farley, and Webster's (1993) scale to include timeliness in the development of new products, processes, and markets and modified the response mode to a Likert scale to be consistent with the measurement of the other constructs.

Validity of Measures

We constructed equally weighted additive measures for all constructs and took several precautions to ensure their validity. We asked informants to report their confidence levels about the information provided (Kumar, Stern, and Anderson 1993). The final sample showed mean scores (on a scale of 1 to 7) of 5.99 (standard deviation [S.D.] = .95) and 5.27 (S.D. = 1.14) for confidence levels about the accuracy of information on firms' characteristics and e-business adoption, respectively. We obtained information on an appropri-

TABLE 2
Items of Multi-item Scales

Measure	Items
Technology adoption[a] (TECADOPT) (α = .77)	1. We have implemented e-business in all our business processes. 2. E-business has had a very limited impact on our business operations. (R) 3. Relative to the potential of e-business for our business, our e-business implementation is extensive. 4. E-business has substantially changed our business processes
Technology adoption[b] (eADOPT, an alternative measure)	1. *External communications*: We use e-business as a tool to communicate with our trading partners and stakeholders. (*Trading partners* include customers, suppliers, and such third parties as banks and distributors; *stakeholders* include shareholders, financial analysts, employees, media, and general public.) *Typical applications*: corporate communications, statutory reports, marketing communications, recruiting. 2. *Transaction-based support*: We use e-business with transaction capabilities to support our firm's traditional commercial activities but not to conduct commercial transactions electronically. *Typical applications*: presales support, product catalogs, pricing information, order status tracking and returns, and so forth. Similar applications would exist for other trading partners, such as suppliers and bankers. 3. *Fully e-commerce enabled*: We use e-business to conduct commercial transactions. *Typical applications*: presales support, product catalogs, pricing information, order status tracking, returns, and electronic ordering and payment systems.
Technological opportunism (TECHOPP) (α = .89)	Technology-sensing capability (TS) (α = .77) 1. We are often one of the first in our industry to detect technological developments that may potentially affect our business. 2. We actively seek intelligence on technological changes in the environment that are likely to affect our business. 3. We are often slow to detect changes in technologies that might affect our business. (R) 4. We periodically review the likely effect of changes in technology on our business. Technology-response capability (TR) (α = .83) 5. We generally respond very quickly to technological changes in the environment. 6. This business unit lags behind the industry in responding to new technologies. (R) 7. For one reason or another, we are slow to respond to new technologies. (R) 8. We tend to resist new technologies that cause our current investments to lose value. (R)
Institutional pressures (INPRES) (α = .88)	1. Satisfying the needs of our major customers was an important factor in implementing our e-business initiative. 2. Some of our major customers demanded that we implemented e-business in our relationships with them. 3. Our relationships with our major customers would have suffered if we had not implemented e-business initiatives. 4. Our customers' needs did not influence the design of our e-business initiative. (R) 5. Having a state-of-the art e-business confers status for our business unit with our stakeholders. 6. Our stakeholders would have perceived our business unit as being technologically backward if we had not implemented e-business. 7. If we had not undertaken e-business, we might have lost our edge over competitors. 8. Being ahead of our competitors' e-business capabilities is a key factor in our e-business initiative.
Complementary assets (CASSETS) (α = .86)	1. Our business unit lags behind industry in the implementation of information technology (IT) systems. (R) 2. Our business unit uses state-of-the-art IT systems. 3. Relative to major competitors, our IT implementation is very advanced.
Perceived usefulness (USE) (α = .85)	We implemented e-business to •Streamline business processes. •Reduce costs. •Improve service quality to our customers. •Open new distribution. •Develop new markets.

TABLE 2
Continued

Measure	Items
Organizational innovativeness (adapted from Deshpandé, Farley, and Webster 1993) (α = .91)	Compared to others in our industry, our firm tends to be 1. First to market with innovative new products and services. 2. First to develop a new process technology. 3. First to recognize and develop new markets. 4. At the leading edge of technological innovation.
Future focus (FUTURE) (α = .79)	1. This firm's planning activities are more oriented toward the future than the present. 2. This firm's future plans are based more on past performance rather than on future potential. (R) 3. Our firm plans actively for the future instead of resting on past successes.
Top management's advocacy of new technologies (TOPADV) (α = .87)	1. Top managers keep telling managers that this firm must gear up now to meet changing technology trends. 2. Top managers make an effort to convince managers of the benefits of a new technology. 3. Top managers encourage employees to develop and implement new technologies. 4. Top managers in this firm are frequently the most ardent champions of new technologies.

[a]We provided the following definition of e-business at the beginning of the survey: "For the purpose of this research, we define e-business as the use of Internet-based systems to share business information, maintain business relationships, and/or conduct business transactions."
[b]This is a formative measure, and therefore we do not report its reliability.
Notes: The unit of analysis was the SBU. All items were scored using a seven-point scale, where 1 corresponds to "strongly disagree" and 7 to "strongly agree." (R) indicates an item that is reverse-coded. All scales are new except the organizational innovativeness scale, which was adapted from Deshpandé, Farley, and Webster (1993).

ate second informant (the information technology manager) from our mailing list for 130 of the 183 firms in our sample. We received 28 responses, too small a sample for a formal multitrait, multimethod assessment. However, t-tests of the difference in means of the key variables between the two informants' reports indicated that these means were not statistically different (K = key informant and S = second informant): technological opportunism (K = 35.62, S = 35.29, not significant [n.s.]), institutional pressures (K = 36.13, S = 35.68, n.s.), perceived usefulness (K = 22.40, S = 21.86, n.s.), complementary assets (K = 12.62, S = 13.86, n.s.), and technology adoption (K = 13.76, S = 12.86, n.s.). To assess the threat from nonresponse bias, we performed a test using the extrapolation procedure suggested by Armstrong and Overton (1977) and found no significant difference between early and late respondents on the key variables. We estimated the reliability of each scale by computing its Cronbach's alpha. The reliabilities range from .77 to .91, which exceed the .70 recommended for exploratory research (Nunnally 1978). Table 3 provides descriptive statistics, the pairwise correlations, and the reliabilities of the multi-item scales.

Results: Technology Adoption (Study 1)

Distinctiveness of Technological Opportunism

In our first round of data collection from 183 firms, we collected measures only of the most closely related construct of organizational innovativeness. To establish the discriminant validity of technological opportunism from other related constructs, we subsequently mailed a survey containing organizational innovativeness, technological orientation, and market orientation measures to 400 firms. That sample included 190 firms from the sample described previously and 210 firms from a second sample of firms used in the second study. We received completed surveys from 130 of these 400 firms, which we use to establish the discriminant validity of technological opportunism from the related constructs.

Cronbach's alpha (α) for the technological opportunism scale is good (α = .89). The descriptive statistics indicate that the firms in our sample rated themselves as rather technologically opportunistic, with a mean score of 34.93 and a standard deviation of 9.49 (n = 130). The scale exhibited good variance and ranged from 12 to 54 (of a possible range of 8 to 56). We performed a confirmatory factor analysis to check for the distinctiveness of technological opportunism from organizational innovativeness, technological orientation, and market orientation. All factor loadings are large and significant ($p < .01$), indicating that the items display good measurement properties. Our model yields nonnormed fit index (NNFI) = .84, comparative fit index (CFI) = .85, root mean square error of approximation (RMSEA) = .07, and standardized root mean square residual (SRMR) = .08. Although the NNFI and the CFI indices are below the desirable level of .90, RMSEA and SRMR are less than .10, indicating a reasonable fit of data to the model. The complexity of the model (20 items in the market orientation scale load onto one factor) may be lowering the fit indices. Our indices compare well with those obtained by Kohli, Jaworski, and Kumar (1993).

Next, we examined the convergent and discriminant validity of technological opportunism (Fornell and Larcker 1981). The composite reliability (CR) and average variance

TABLE 3
Correlation Matrix of Constructs in the Technology Adoption Model (n = 183)

	Range	Means (S.D.)	1	2	3	4	5	6
1. Technological opportunism (TECHOPP)	8–56	35.62 (9.62)	*.89*					
2. Institutional pressures (INPRES)	8–56	36.13 (10.34)	.19*	*.88*				
3. Perceived usefulness of technology (USE)	5–35	22.40 (7.03)	.27	.63	*.85*			
4. Complementary assets (CASSETS)	3–21	12.62 (4.20)	.52	.19*	.16*	*.86*		
5. Technology adoption (TECADOPT)	4–28	13.76 (4.94)	.39	.44	.44	.31	*.77*	
6. Organizational innovativeness (OI)	4–28	17.80 (5.39)	.55	.17*	.26	.41	.28	*.91*

Notes: Reliabilities of measures are on the diagonal in italics. All correlations are significant at $p < .001$, except that * indicates correlation significant at $p < .05$.

extracted (AVE) are as follows: technological opportunism: CR = .91, AVE = .56; organizational innovativeness: CR = .93, AVE = .76; technological orientation: CR = .93, AVE = .59; market orientation: CR = .92, AVE = .56. Overall, the results indicate that the four constructs demonstrate satisfactory levels of internal consistency and convergent validity. Regarding discriminant validity, the 95% confidence intervals of the correlation between the constructs are well below 1.00 ($p < .05$). The AVEs of technological opportunism (.56), organizational innovativeness (.76), technological orientation (.59), and market orientation (.56) exceed the squared correlations between them. Therefore, technological opportunism is empirically distinct from innovativeness, technological orientation, and market orientation.

Model Fit and Hypothesis Tests

We tested our hypotheses using regression analysis. In addition to variables corresponding to hypotheses H_1–H_3, we included the perceived usefulness of the technology to the firm (Venkatesh and Davis 2000), firm size (measured by the number of employees), and industry variables as controls in the adoption model. Before testing our hypotheses, we established the discriminant validity of the constructs in our technology adoption model by examining the distinctiveness of technological opportunism, perceived usefulness, complementary assets, and technology adoption. All factor loadings are positive and significant. The model fit is as follows: NNFI = .89, CFI = .91, RMSEA = .08, and SRMR = .06. The CR and AVE are as follows: technological opportunism: CR = .89, AVE = .51; perceived usefulness: CR = .85, AVE = .53; IT: CR = .86, AVE = .67; technology adoption: CR = .77, AVE = .47. Therefore, except for technology adoption, for which AVE (.47) is less than the recommended .50, the other conditions for convergent and discriminant validity are satisfied.

Table 4 summarizes the standardized estimates of the technology adoption model. The model for technology adoption has a good fit, with $R^2 = .37$ ($F_{(13, 169)} = 7.55$, $p < .01$). Size and industry dummy variables have no main or moderating effects on the relationship between technological opportunism and technology adoption, which indicates that our results may be generalized to firms of different sizes and in different industries. In support of H_1, H_2, and H_3, respectively, technological opportunism (b = .24, $p < .01$), institutional pressures (b = .29, $p < .01$), and complementary assets (b = .10, $p < .10$) are positively related to technology adoption. Consistent with prior research, we also find that perceived usefulness positively influences technology adoption (b = .19, $p < .05$).

TABLE 4
Model for Technology Adoption, Showing the Effects of Technological Opportunism on Radical Technology Adoption (Study 1)

Variables	Standardized Parameter Estimates (Standard Error)
Technological opportunism (TECHOPP) (H_1)	.24 (.08)***
Institutional pressures (INPRES) (H_2)	.29 (.08)***
Complementary assets (CASSETS) (H_3)	.10 (.08)*
Perceived usefulness (USE)	.19 (.09)**
Size1 (500–999 employees)[a]	−.08 (.08)
Size2 (1000–4999 employees)	.00 (.00)
Size3 (5000–10,000 employees)	−.06 (.07)
Size4 (>10,000 employees)	−.08 (.08)
Industry dummy 1 (computer software)[b]	−.02 (.02)
Industry dummy 2 (chemicals)	−.12 (.08)*
Industry dummy 3 (heavy manufacturing)	.10 (.08)
Industry dummy 4 (light manufacturing)	−.01 (.08)
Industry dummy 5 (telecommunications)	.05 (.06)

*$p < .10$.
**$p < .05$.
***$p < .01$.
[a]Size dummies have been coded so that <500 employees serves as the base relative to which the effects of the other dummies are measured.
[b]Industry dummies have been coded so that the computer hardware industry serves as the base relative to which the effects of the other dummies are measured.
Notes: $R^2 = .37$ ($F_{(13, 169)} = 7.55$, $p < .01$).

Model Comparisons and Implications

We next assessed how well technological opportunism, compared with existing constructs, explains radical technology adoption. From the data we used to examine the discriminant validity of technological opportunism (n = 130), we find that technological opportunism is correlated with organizational innovativeness (.52, $p < .01$) but not with technological orientation (−.10, n.s.) and market orientation (.05, n.s.). Therefore, we examine the explanatory power of technological opportunism, after accounting for organizational innovativeness's role in radical technology adoption. We compared the model of technology adoption, which

included technological opportunism, organizational innovativeness, and institutional pressures, with a model that excluded technological opportunism. When both technological opportunism and organizational innovativeness are included, we find that technological opportunism has a significant, positive effect on adoption ($b = .31$, $p < .01$), but organizational innovativeness has no effect on adoption ($b = -.01$, n.s.). In addition, we find that the R^2 for a model that includes both technological opportunism and organizational innovativeness is .37 ($F_{(14,168)} = 6.97$, $p < .001$), whereas the R^2 for a model that includes organizational innovativeness ($b = .12$, $p < .10$) but excludes technological opportunism is .34 ($F_{(13, 169)} = 6.73$, $p < .001$). The F-test of the difference in R^2 between the two models is significant ($F_{(1, 169)} = 8.00$, $p < .01$), indicating that technological opportunism provides a significant incremental explanation of technology adoption over a model that includes institutional pressures and organizational innovativeness.

Our results suggest that the extent of radical technology adoption is influenced by a firm's technological opportunism. The next question is why some firms are technologically opportunistic and others are not. In Study 2, we explore the following two questions: (1) What are the organizational drivers of technological opportunism? and (2) To what extent does a firm's environment influence its technological opportunism?

The Antecedents of Technological Opportunism (Study 2)

Because technological opportunism is a new construct, we used a discovery-oriented approach (Deshpandé 1983) to identify the factors influencing technological opportunism. Our field interviews with 15 managers in six industries indicated that (1) firms in technologically turbulent environments (e.g., telecommunications) were more technologically opportunistic than firms in less turbulent environments (e.g., chemicals) and (2) firms within the same industry differed substantially in their technological opportunism. These findings suggest that the technological opportunism capability is influenced by both organizational and environmental factors. On the basis of these field interviews, we develop a conceptual model with three organizational factors that influence technological opportunism: (1) the firm's future focus, (2) top management's advocacy of new technologies, and (3) organizational culture; we also include one environmental factor: technological turbulence.

Future Focus

Firms differ in the extent to which they focus on developing capabilities for their future relative to their past and current capabilities. Hamel and Prahalad (1994) stress the importance of "unlearning the past" and "learning to forget" in developing strategies for competing in today's business environments. Dominant firms in the disk drive, copier, tire, minicomputer, and mainframe computer markets stayed too close to existing customers (thereby lacking future focus) and consequently lost their market positions to new, emerging technologies (Christensen 1997). Similarly, Chandy and Tellis (1998) find that radically innovative firms pay closer attention to future markets than to current markets. Our field interviews suggested that technologically opportunistic firms focus more on developing capabilities for managing their future than the present. We term this orientation *future focus* and define it as the extent to which a firm emphasizes its future opportunities and capabilities relative to its current capabilities. Future-focused firms review their current technology options and actively monitor new technologies to assess how these technologies may advance or hinder the achievement of their objectives. In addition, because of their focus on the firm's future rather than on the past or the present, these firms are also willing to cannibalize existing investments in responding to new technologies. Therefore,

H_4: The greater the firm's future focus, the greater is its technological opportunism.

Top Management's Advocacy of New Technologies

The critical role of top management in championing the development of firm-level capabilities is reflected in diverse branches of literature. Top management advocacy is important in mobilizing the resources for internal corporate venturing (Burgelman 1983) and new product development (Howell and Higgins 1990). Top management emphasis on market orientation plays an important role in fostering market orientation throughout the organization (Jaworski and Kohli 1993). Consistent with the literature, our field interviews indicated that senior management support was an important factor in fostering technological opportunism. We define *top management's advocacy of new technologies* as the efforts of the top management team to emphasize the importance of organizational responsiveness to new technologies. Top management's role is important because new technologies may entail destruction of existing assets for which management's approval will be required. If top managers advocate new technologies, middle and junior managers will devote the resources necessary for sensing and responding to new technologies. Therefore,

H_5: The greater a firm's top management's advocacy of new technologies, the greater is its technological opportunism.

Organizational Culture

Organizational culture is the pattern of shared values and beliefs that help individuals understand organizational functioning and provide norms for behavior in the organization (Deshpandé, Farley, and Webster 1993; Moorman 1995). Consistent with this perspective, our field interviews indicated that technologically opportunistic firms differed systematically in organizational culture from firms that were less technologically opportunistic. We use the typology of organizational culture based on the competing values model (Deshpandé, Farley, and Webster 1993)—which proposes four types of organizational cultures: adhocracy, market, hierarchy, and clan—to develop hypotheses of the effects of organizational culture on technological opportunism (Moorman 1995).

Adhocracy culture values flexibility and emphasizes entrepreneurship, creativity, and adaptability. Moorman (1995) notes that entrepreneurial cultures, such as adhocracy, thrive on information acquisition and that such firms are likely to be informed about new technology developments. Furthermore, because adhocracy cultures foster risk taking, managers in these firms are willing to experiment with new technologies. Therefore, we hypothesize that adhocracy culture will be positively related to technological opportunism.

Market culture emphasizes customer focus, goal achievement, productivity, and efficiency. Firms with market culture are focused on acquiring market information to improve their performance (Moorman 1995). Given the focus of market culture on efficiency, we expect a reduced focus on exploring new technology opportunities. Furthermore, the emphasis on efficiency in market culture may result in an aversion to experimenting with new technologies. Therefore, we hypothesize that market culture will be negatively related to technological opportunism.

Hierarchy culture emphasizes order, efficiency, stability, and control, reflecting internally oriented and formalized values. Hierarchy cultures do not support transmission of market information (Jaworski and Kohli 1993). Therefore, firms with hierarchy culture may not generate and share information about new technologies. Furthermore, the rigidity of the hierarchy culture may hinder responsiveness to emerging technologies. We hypothesize that hierarchy culture will be negatively related to technological opportunism.

Clan culture stresses participation, teamwork, and cohesiveness. The emphasis is on the development of shared organizational understanding through participative processes. Clan culture is positively related to market information transmission (Moorman 1995). Thus, firms with clan culture are likely to share information about emerging technologies. However, the consensual nature of clan culture may inhibit rapid adaptation. In summary, we hypothesize a positive relationship between clan culture and technological opportunism. Therefore,

H_6: The greater the adhocracy culture of a firm, the higher is its technological opportunism.

H_7: The greater the market culture of a firm, the lower is its technological opportunism.

H_8: The greater the hierarchy culture of a firm, the lower is its technological opportunism.

H_9: The greater the clan culture of a firm, the higher is its technological opportunism.

Technological Turbulence

Organizational learning depends on the setting in which the organization operates. In technologically turbulent environments, the value and impact of prior stored learning deteriorates with environmental change. As Weiss and Heide (1993, p. 221) note, "a rapid pace of technological change creates uncertainty that can be competency destroying." Rapidly changing technological environments will require constant surveillance of markets and technologies and create a need to experiment with new technologies. Firms in such environments will, over time, gain experience in sensing and responding to emerging technologies. Therefore,

H_{10}: The greater the technological turbulence in the firm's environment, the higher is its technological opportunism.

Method: A Model of the Antecedents of Technological Opportunism (Study 2)

Procedure

Using the mailing list described previously, we collected data from a survey of senior managers using a cross-industry sample of firms covering the same six industry groups as in the first study. We mailed 798 surveys and received 200 completed surveys, which yielded an effective response rate of 25.1%.

Instrument Development and Refinement

We used previously published scales to measure our constructs when possible, and when scales were not available, we developed new ones (Table 2). For technological opportunism, we used the same eight-item scale that we developed for the first study. For future focus, we used a three-item scale adapted from Chandy and Tellis (1998). For top management's advocacy of new technologies, we used a new four-item scale. We measured the four types of organizational culture using the scales developed by Moorman (1995). For technological turbulence, we used the five-item scale for pace of technological change developed by Jaworski and Kohli (1993). We measured all constructs at the level of the SBU.

Validity of Measures

We use key informants as our data source. The person responsible for technology management may have been the ideal key informant, but only 5% of the firms in our sample frame had senior-level titles that indicated responsibility for technology management. Therefore, we used senior marketing executives as key informants. Our field interviews indicated that senior marketing executives in the selected industries are closely involved in developing the technology strategies of their firms. We ensured the validity of our key informant reports by including self-reports on the informants' knowledge of the technology area (Kumar, Stern, and Anderson 1993). The respondents in our sample (n = 200) show mean scores (on a scale of 1 to 7) of 5.62, (S.D. = 1.05), 5.80 (S.D. = 1.03), and 5.87 (S.D. = .98) for confidence levels about the accuracy of information provided about the firm's technology strategies, characteristics, and the environment, respectively. To assess the threat from nonresponse bias, we performed a test using the extrapolation procedure suggested by Armstrong and Overton (1977) and found no significant difference between early and late respondents on the key variables. Table 5 provides descriptive statistics, pairwise correlations, and reliabilities of the scales.

Results: Antecedents of Technological Opportunism (Study 2)

We first established the discriminant validity of the constructs using confirmatory factor analysis. All factor loadings are positive and significant. The model fit was as fol-

TABLE 5
Correlation Matrix of Constructs in the Model of Factors Influencing Technological Opportunism (n = 200)

	Range	Means (S.D.)	1	2	3	4	5	6	7	8
1. Technological opportunism (TECHOPP)	8–56	34.93 (9.49)	*.89*							
2. Future focus (FUTURE)	3–21	13.24 (3.78)	.63	*.79*						
3. Top management advocacy of new technologies (TOPADV)	4–28	18.16 (4.93)	.61	.66	*.87*					
4. Adhocracy culture (AD)	4–28	16.38 (5.29)	.57	.57	.62	*.82*				
5. Market culture (MKT)	4–28	18.65 (3.37)	.08 (n.s.)	.17*	.22	.14*	*.44*			
6. Hierarchy culture (HY)	3–21	12.93 (3.31)	−.04 (n.s.)	.17*	.08 (n.s.)	−.04 (n.s.)	.24	*.61*		
7. Clan culture (CLAN)	4–28	16.78 (4.95)	.43	.43	.42	.61	−.02 (n.s.)	.21	*.76*	
8. Technological turbulence (TT)	5–35	24.24 (6.58)	.18*	.06 (n.s.)	.18*	.15*	0	−.02 (n.s.)	.10 (n.s.)	*.86*

Notes: Reliabilities of measures are on the diagonal in italics. All correlations are significant at $p < .01$, except that * indicates correlations significant at $p < .05$ and n.s. = not significant.

lows: NNFI = .86, CFI = .88, RMSEA = .07, and SRMR = .08. The CR and AVE are as follows: technological opportunism: CR = .90, AVE = .54; future focus: CR = .79, AVE = .56; top management's advocacy of new technologies: CR = .87, AVE = .67; adhocracy culture: CR= .62, AVE = .54; market culture: CR = .70, AVE = .46; hierarchy culture: CR = .73, AVE = .52; and clan culture: CR = .76, AVE = .47. Therefore, except for clan and market culture, for which the AVE is less than the recommended .50, the other conditions for convergent and discriminant validity are satisfied. We first examined a model with only technological turbulence. Technological turbulence has a significant effect (b = .18, $p < .01$) on technological opportunism. However, the low R^2 of .03 for this model suggests that technological turbulence alone does not adequately explain technological opportunism.

Table 6 presents the standardized estimates for the factors that influence technological opportunism. The model has a good fit, with $R^2 = .54$ ($F_{(16, 183)} = 13.50$, $p < .01$). In support of H_4 and H_5, respectively, future focus (b = .36, $p < .01$) and top management's advocacy of new technologies (b = .25, $p < .01$) have a positive impact on technological opportunism. We find partial support for the effects of organizational culture on technological opportunism: (1) An adhocracy culture (H_6) is positively related to technological opportunism (b = .15, $p < .05$), and (2) a hierarchy culture (H_8) is negatively related to technological opportunism (b = −.08, $p < .10$), but we find no significant effects for the other culture forms (H_7 and H_9). Even though we find no relationship between technological turbulence (H_{10}) and technological opportunism (b = .05, n.s.), three of the five industry variables have a positive, significant effect. When we removed the industry control variables from the model, technological turbulence has a significant, positive effect (b = .10, $p < .05$). Thus, technological turbulence influences technological opportunism, and its effect can be detected either directly or through industry-specific indicators.

Discussion

Theoretical Contributions

We cite four theoretical contributions of this article: The first contribution is the development of the technological opportunism construct. Although the existence of a sense-and-respond technological capability has been alluded to in prior strategy research (Teece, Pisano, and Shuen 1997), we develop the domain of the construct, measure it reliably, and demonstrate its distinctiveness from innovativeness. In doing so, we extend prior research (Deshpandé, Farley, and Webster 1993; Gatignon and Xuereb 1997) by showing that the organizational capability to sense and respond to new technologies is distinct from a firm's capability for creating new products. The new construct of technological opportunism can inform theory development on important strategic issues in technology strategy. For example, what are the trade-offs in emphasizing internal technology development (research and development) versus purchasing or licensing externally (Pisano 1990)? Researchers can use technological opportunism to examine such issues as resource allocation

TABLE 6
Model of Factors Influencing Technological Opportunism (Study 2)

Variables	Standardized Parameter Estimates (Standard Error)
Future focus (FUTURE) (H_4)	.36 (.07)***
Top management's advocacy of new technologies (TOPADV) (H_5)	.25 (.07)***
Adhocracy culture (AD) (H_6)	.15 (.07)**
Market culture (MKT) (H_7)	−.03 (.05)
Hierarchy culture (HY) (H_8)	−.08 (.05)*
Clan culture (CLAN) (H_9)	.08 (.07)
Technological turbulence (TT) (H_{10})	.05 (.07)
Size1 (500–999 employees)[a]	−.01 (.10)
Size2 (1000–4999 employees)	−.05 (.06)
Size3 (5000–10,000 employees)	.01 (.10)*
Size4 (>10,000 employees)	.06 (.06)*
Industry dummy 1 (computer software)[b]	.02 (.06)
Industry dummy 2 (chemicals)	.03 (.07)
Industry dummy 3 (heavy manufacturing)	.14 (.08)*
Industry dummy 4 (light manufacturing)	.15 (.08)*
Industry dummy 5 (telecommunications)	.20 (.07)***

*$p < .10$.
**$p < .05$.
***$p < .01$.
[a]Size dummies have been coded so that <500 employees serves as the base relative to which the effects of the other dummies are measured.
[b]Industry dummies have been coded so that the computer hardware industry serves as the base relative to which the effects of the other dummies are measured.
Notes: $R^2 = .54$ ($F_{(16, 183)} = 13.50$, $p < .01$).

for internally based capabilities (organizational innovativeness, technological orientation) and externally based capabilities (technological opportunism) and their effects on new product development and performance outcomes for the firm.

A second contribution is that by testing a model of the drivers of radical technology adoption by organizations, we extend the marketing literature on buyer behavior in high technology markets, which has focused primarily on preadoption strategic behaviors including information search (Weiss and Heide 1993) and vendor consideration and switching (Heide and Weiss 1995).

A third contribution is our extension of the existing literature on organizational adoption of innovations. A factor not emphasized in that literature is the notion that firms proactively seek and respond to technologies of their own volition, even in the absence of external pressures. Our results of the role of technological opportunism on e-business adoption suggest that such a perspective is misleading. An integrated model of technology adoption that includes a proactive driver (technological opportunism) and a reactive driver (institutional pressures) provides a more complete depiction of the adoption process.

Finally, our substantive domain, e-business, is a new radical technology, which has substantially influenced and, in some industries, even changed marketing practice. Therefore, e-business merits investigation in its own right. Despite its wide-reaching effects on marketing practice, there is limited academic research in marketing on e-business. By using e-business as a context for testing our proposed theory, this article also contributes to the limited academic literature in marketing on this important radical technology.

Managerial Contributions

Technology is no longer just an enabler of business processes but is increasingly becoming the core of the firm's business strategy. Our results on the domain and distinctiveness of technological opportunism indicate that the capabilities to produce new technologies and sense and respond to new technologies are distinct. Managers may want to emphasize different strategies for managing innovativeness compared with sensing and responding to new technologies. In addition, our results are useful to firms that are seeking to develop the technological opportunism capability. Specifically, we identified two actionable drivers of technological opportunism capabilities: top management's advocacy of new technologies and its enabling of certain types of organizational cultures.

Our insights on the role of technological opportunism in technology adoption are useful to managers in technology vendor firms for developing segmentation strategies based on the technological opportunism capabilities of their customer firms. Specifically, we have shown that the extent of e-business adoption depends on both technological opportunism and institutional pressures (consistent with our framework). In addition, e-business vendors can improve their success rates by focusing on companies that are technologically opportunistic and likely to feel institutional pressures (e.g., other firms in their industry adopting e-business).

Limitations and Possible Extensions

Our research has several limitations that qualify our findings and present opportunities for further research. Because we used a cross-sectional method focused on technology adoption, we do not explore the effect of technological opportunism on other strategic behaviors (e.g., alliances, technology commercialization). In addition, there may be specific conditions that influence the effects of technological opportunism on the technology choices made by the firm.

We used a cross-sectional study design to generate exploratory insights, which raises possible concerns about retrospective justification bias. Furthermore, our cross-sectional design precluded an investigation of the evolutionary effects of factors (e.g., competitive intensity, institutional pressures) on technological opportunism. Further research could use a multiple-informant, longitudinal methodology that may capture the time-dependent dynamics of the adoption process. Even though we establish the discriminant validity of technological opportunism in this study, an important area for further research is the refinement of the technological opportunism measure with consideration of the psychometric properties of the scale.

Because we did not collect data on the antecedents of technological opportunism and the technology adoption process in the same round of data collection, we were unable to determine the extent to which technological opportunism

mediates the effects of its antecedent variables on technology adoption. We focused on only a few organizational antecedents of technological opportunism in this study, and further research could explore the effects of other organizational antecedents. We also did not examine how technological opportunism affects firm performance. Studying the *effect of* technological opportunism on performance in conjunction with other factors, such as organizational culture and market orientation, promises to be an important area for further research. Specifically, it may be useful in investigating the complementarity of market orientation and technological opportunism on different firm outcomes, including new product development and financial performance.

In summary, we believe that both researchers and practitioners will find the technological opportunism construct useful and that much more research remains to be done to refine and extend the construct, explore its drivers, and quantify its impact on organizational outcomes.

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