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Can Incumbents Introduce Radical and Disruptive Innovations?

Vijay Govindarajan and Praveen K. Kopalle

In complex environments, firms must target emerging as well as mainstream customer needs. This survey of 138 SBUs in 23 Fortune 500 corporations finds that the two customer orientations are not at odds—it's possible for firms to excel at both radical and disruptive innovation.

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Report Summary

Incumbents are better at fostering certain kinds of innovation than others. Specifically, they are better at radical innovations, which incorporate new technologies into extant products to add value, and worse at disruptive innovations, which initially are not valued by the firm's mainstream customers but only by a small, emerging customer segment, and only later become desirable to the mainstream.

Failure to recognize and respond to the needs of small, emerging customer segments through the development of disruptive innovations can put a company at risk, if these disruptive innovations later encroach upon the company's mainstream business. In this report, Govindarajan and Kopalle investigate what abilities a strategic business unit (SBU) needs in order to foster the development of both radical and disruptive innovations.

The effects upon radicalness and disruptiveness of four SBU-level abilities (mainstream-customer orientation, emerging-customer-segment orientation, willingness to cannibalize, and technological opportunism) are analyzed. The authors hypothesize and later show, through a survey of 138 SBUs in 23 Fortune 500 corporations, that

radicalness of innovation springs from a firm's technological opportunism and mainstream-customer orientation, while disruptiveness is fostered by a firm's willingness to cannibalize and emerging-customer-segment orientation and inhibited by mainstream-customer orientation. Govindarajan and Kopalle provide a scale to measure the disruptiveness of innovations, identify the key role of an SBU's emerging-customer-segment orientation, and establish that it is a distinct construct from the other three SBU-level abilities.

A near-zero correlation is found between an SBU's mainstream-customer and emerging-customer-segment orientations, suggesting that these dimensions of customer orientation are not two ends of a continuum but independent of each other, which means that firms do not necessarily have to choose between radical and disruptive innovation—it is possible to do both. The authors also hypothesize and show that SBUs can develop an emerging-customer-segment orientation via long-term-oriented, subjective-based incentive mechanisms, fostering an adhocracy culture, and creating separate organizational units for innovation. Incumbents can learn to foster disruptive innovations. ■

Introduction

Scholars in such diverse fields as strategy, marketing, technology, and economics have long explored the broad topic of product, process, and service [1] innovations, a cornerstone in creating competitive advantage. A review of this literature points to two important dimensions of innovations. One is technology-based, i.e., radicalness of innovations, which refers to the extent to which an innovation is based on a substantially new technology relative to existing practice (e.g., Ettlie, Bridges, and O'Keefe 1984; Dewar and Dutton 1986). The other is market-based, i.e., disruptiveness of innovations, which refers to the extent to which an innovation is valued by an emerging customer segment, and not the mainstream customer segment, at the time of introduction, and then over time effectively competes with the products that mainstream customers use (Abernathy and Clark 1985; Adner 2002; Benner and Tushman 2003; Christensen 1997). Prior research suggests that incumbents are able to introduce radical innovations (for examples, see Ahuja and Lampert 2001; Chandy and Tellis 2000; Christensen 1997; Hill and Rothaermel 2003; Srinivasan, Lilien, and Rangaswamy 2002) but find it quite difficult to introduce disruptive innovations (for examples, see Christensen 1997; Christensen and Bower 1996; Tripsas and Gavetti 2000). This raises the question of how incumbents can foster the development of both radical and disruptive innovations, i.e., what strategic-business-unit (SBU)-level abilities are required for such innovations? Consider the following two examples.

In the mid-1980s, AT&T engaged McKinsey for advice on a potential entry into the cell-phone market after investing in initial research and developmental work. The consulting firm conducted in-depth market research and concluded that the cell-phone market would not be profitable for AT&T to enter, as the worldwide market potential was only around 900,000. AT&T's mainstream market still preferred the land-line phone because of its reli-ability, cost, and coverage, and the consultants recommended AT&T back out of its potential entry into the cell-phone market (*Economist* 1999). Accordingly, AT&T continued to focus on its land-line phone business, introducing several radical product innovations, including the cordless phone. Over time, however, further developments in cellular technology, primarily by Nokia (Häikiö 2002), allowed cell phones to offer reliable coverage at a reasonable price point, and these developments could potentially disrupt the land-line phone market. At present, there are on average 900,000 new mobile-phone subscribers worldwide every three days, and 64% of adults in the U.S. own a cell phone, compared to .02% of U.S. adults 20 years ago (*USA Today* 2002).

In contrast to AT&T, consider the case of New York Times Company (NYT), which developed a disruptive innovation using the Web: a Web-based news service. Although the emerging base of Internet-savvy customers who would want to receive news services electronically was not a mainstream market for NYT, and despite the potential of a Web-based news service to cannibalize the circulation and advertising revenue of the company's print media, NYT successfully leveraged the Web technology because NYT is oriented toward emerging customer segments, creating separate organizational units for them, maintaining a highly innovative culture, and developing a compensation mechanism that is long-term oriented for key executives (Govindarajan and Trimble 2002).

While the AT&T example supports the thesis of Christensen and Bower (1996) and of Christensen (1997) that well-entrenched incumbents are effective at developing radical but not disruptive innovations, the NYT example shows that incumbents can indeed introduce disruptive innovations. These two examples exemplify the fundamental tension that incumbents face, i.e., how to develop innovations targeted at their mainstream customers as well as innovations that meet the needs of small but emerging customer segments that

have the potential to disrupt the products that mainstream customers use. The goal of this paper is to shed light on this issue.

Background

Prior research suggests that an SBU's technology and customer-related abilities have an impact on innovations (Danneels 2002). This notion is consistent with both the marketing literature that considers an SBU's customer orientation as an underlying ability (Jaworski and Kohli 1993) and with the resource-based view that recognizes the importance of organizational abilities in developing innovations (Eisenhardt and Martin 2000). In particular, earlier research has identified three SBU-level technology- and/or customer-related abilities that affect the introduction of radical innovations. These are: (1) mainstream-customer orientation, i.e., the ability of an organization to gather market intelligence pertaining to the needs of mainstream customers and to respond to such needs (Deshpandé, Farley, and Webster 1993; Jaworski and Kohli 1993), (2) willingness to cannibalize, i.e., an SBU's ability to withstand cannibalization of sales of existing products, technological investments, and routines and procedures (Chandy and Tellis 1998), and (3) technological opportunism, i.e., an SBU's ability to acquire knowledge about new technologies and respond to such technologies (Srinivasan, Lilien, and Rangaswamy 2002). While there has been ample research on the measurement and the antecedents of these three SBU-level abilities, the impact of these variables on the disruptiveness dimension of innovations has not been examined. Abernathy and Clark's (1985) and Christensen and Bower's (1996) case examples of firms that failed to recognize the emergence of new customer segments suggest that an SBU's emerging-customer-segment orientation itself may be an ability that could drive disruptive innovations. The notion of emerging-customer-segment orientation is related to Danneels's (2003) concept of loose coupling with customers and

Slater and Narver's (1998) long-term, proactive focus. However, as Danneels (2003) points out, "Extant definition and scales of market orientation [which includes customer and competition orientation] do not distinguish between current [mainstream] and potential [emerging-customer-segment] customers." (p. 574) To our knowledge, so far, there has not been a rigorous analysis of an SBU's emerging-customer-segment orientation with respect to (1) measurement, (2) impact on key innovation dimensions, and (3) antecedents.

Research on disruptiveness of innovations shows that incumbents may miss emerging customer segments perhaps due to a continued focus on mainstream customers (Adner 2002; Christensen and Bower 1996; Tripsas and Gavetti 2000). The corresponding recommendations tend to focus on organizational design, i.e., either to create a new company through a spinoff (Christensen 1997) or to develop an "ambidextrous organization" that can work toward different goals simultaneously within a single business unit (Tushman et al. 2002) or form strategic alliances (Rothaermel 2001). However, extant research has not examined the internal abilities an incumbent should develop in order to foster the development of disruptive innovations. On the other hand, research on radical innovations and customer orientation has typically focused on SBU-level abilities such as mainstream-customer orientation (e.g., Han, Kim, and Srivastava 1998), technological opportunism (Srinivasan, Lilien, and Rangaswamy 2002), and willingness to cannibalize (Chandy and Tellis 1998). In summary, the disruptiveness literature has not focused on the required SBU capabilities, while research into customer orientation and radical innovation has largely ignored (1) disruptiveness of innovations and (2) an SBU's orientation toward small, emerging customer segments. We address this gap in this paper and make the following contributions.

First, we provide a theoretical and an empirical analysis of the differential impact of SBU-level abilities (such as mainstream-customer orienta-

tion, emerging-customer-segment orientation, willingness to cannibalize, and technological opportunism) on the radicalness and disruptiveness dimensions of innovation, thus linking the research streams of customer orientation and radical innovation with that of disruptive innovation. In this regard, we develop a scale to measure the disruptiveness of innovations and empirically demonstrate that radicalness and disruptiveness are two distinct innovation dimensions. Second, we distinguish the combinations of SBU-level abilities that are required to foster the development of disruptive and radical innovations. Third, we identify the key role played by an SBU's emerging-customer-segment orientation in developing disruptive innovations. We establish that it is a distinct construct from other SBU-level abilities such as mainstream-customer orientation, willingness to cannibalize, and technological opportunism. Finally, we examine the antecedents of an SBU's emerging-customer-segment orientation, i.e., the organizational factors such as incentives, culture, and structure that promote such an orientation.

In the next section, we present our hypotheses and model with respect to the SBU abilities that determine the radicalness and disruptiveness of innovations, followed by our method, measures, and results. We then focus on the mediating role of an SBU's orientation toward emerging customer segments and examine its antecedents. Finally, we provide a discussion of our results and future research directions.

Impact of SBU Capabilities on Radicalness and Disruptiveness of Innovations

In keeping with the tradition in the innovation literature (for example, Damanpour 1991; Dewar and Dutton 1986; Ettlie, Bridges, and O'Keefe 1984; Hill and Rothaermel 2003), we consider the radicalness of an innovation as a continuous variable and define it as follows: A radical innovation is a new product that is based on a substantially new technology relative to what already exists in the industry. For example, cordless telephones are a radical innovation because they were based on a substantially new technology relative to wired phones. On the other hand, incorporating a speaker feature into the base of a cordless phone is a less radical innovation.

Following Abernathy and Clark (1985), Benner and Tushman (2003), and Christensen and Bower (1996), we conceptualize the disruptiveness of an innovation as a continuous variable and define it as follows: A disruptive innovation introduces a different set of features, performance, and price attributes relative to the existing product—a combination that is unattractive to mainstream customers at the time of product introduction (due to inferior performance on the attributes that mainstream customers value and/or a high price), although a different customer segment may value the new attributes more. Subsequent developments over time, however, raise the quality of the new product's attributes to a level that is sufficient to satisfy mainstream customers, attracting more of the mainstream market.

Cellular phones provide an example of disruptive innovation. The cellular phone initially was accepted by corporate executives, who appreciated its convenience and portability. At the time it was introduced, the mainstream market still preferred land-line phones because of their greater reliability, lower cost, and better coverage. However, over time, further developments in cellular technology allowed cell phones to offer reliable coverage at a price point that satisfied the needs of mainstream consumers, which attracted more of the mainstream market. The earlier example of the cordless phone is an illustration of a radical but less disruptive innovation, because it began adding value to the mainstream market as soon as it was introduced.

Thus, radicalness and disruptiveness are two distinct dimensions of innovations—one technology-based and the other market-based. The following examples illustrate that all four

combinations of innovations are possible (Bower and Christensen 1995; Christensen and Overdorf 2000): low on disruption and low on radicalness (most product-line extensions, such as Diet Coke with Lemon, orange juice with pulp), low on disruption and high on radicalness (cordless phones, DVD players, some pharmaceutical products), high on disruption and low on radicalness (disk drives; Dell Direct; Schwab's discount brokerage; low-cost, no-frills airlines such as Southwest), and high on disruption and high on radicalness (desktop computers, digital cameras, cellular phones, laptop computers, e-commerce).

Hypotheses

Technological Opportunism. Srinivasan, Lilien, and Rangaswamy (2002) identify technological opportunism as a sense-and-respond capability with respect to new technologies, a construct distinct from other related constructs such as organizational innovativeness, technological orientation, and market orientation. They find that managers in technologically opportunistic firms perceive technological developments as an opportunity for growth (rather than a threat) and thus respond proactively to incorporate new technologies into their product/market strategies. Given that the radicalness of an innovation is rooted in its technological newness, we expect technological opportunism to have a positive impact on the radicalness of innovations. Hence,

H1: The higher the technological opportunism of an SBU, the higher will be the radicalness of innovations that SBU develops.

While the radicalness of an innovation is based on "technological discontinuities," the disruptiveness of an innovation is based on "discontinuities in the market space," i.e., the emergence of a new, small customer segment whose requirements are quite different from those of mainstream customers. Further, addressing the needs of the emerging customer segment may or may not require the use of major new technologies. Therefore, it is not clear whether an

SBU's technology sense-and-respond ability would have a significant effect on the disruptiveness of innovations. Hence, while we cannot hypothesize the effect of technological opportunism on the disruptiveness of innovations of an SBU, we test for it in this study.

Willingness to Cannibalize. Chandy and Tellis (1998) found that firms that exhibit high willingness to cannibalize are more likely to be innovators of radical products. However, upon accounting for the effect of technological opportunism on the radicalness of innovations, we do not expect an SBU's willingness to cannibalize to significantly affect the radicalness of its innovations, because radical innovations need not always result in obsolescing existing investments in technology; the same skills and processes can sometimes be deployed to develop the next generation of technologies (Tushman and Anderson 1986; Gatignon et al. 2002). In other instances, radical innovations would require an SBU to cannibalize its existing technological investments. However, a firm that is technologically opportunistic, i.e., a firm that possesses technology sense-and-respond ability, would be able to realize quickly whether a new technology presents an opportunity and to seize it swiftly if it did. Thus, an SBU's technological opportunism subsumes an SBU's willingness to cannibalize its extant investments in technology.

On the other hand, it is evident that an SBU's willingness to cannibalize will have a significant, positive effect on the disruptiveness of innovations. Incumbents suffer from the "cannibalization trap" (Levinthal and March 1993; Leonard-Barton 1992)— i.e., a perception of threat to existing investments —in the context of developing and introducing disruptive innovations, for three reasons. First, as in the example of cell phones versus land-line phones at the outset of this paper, disruptive innovations in general have the potential to significantly and negatively impact sales of current products. Second, the per-unit profit margin of disruptive products is typically lower than the per-unit profit margin of current products

(Christensen 1997); this was one reason Encyclopædia Britannica found it difficult to respond to Microsoft's Encarta threat because the per-unit profit margin was lower for the CD-ROM version relative to the bound volumes. Third, established firms develop and perfect methods, routines, and processes that support efficient functioning of the core business. Disruptive innovations invariably require a distinct departure from extant routines and methods. For example, IBM, Compaq, and Hewlett-Packard could not respond fast enough to Dell Direct because they feared alienating the dealers who were their traditional method of distribution (*Forbes* 1999). Therefore, unless incumbents develop a capability to overcome the cannibalization trap, they are likely to have a disincentive to develop disruptive innovations. Thus,

H2: The higher an SBU's willingness to cannibalize, the more disruptive will be the innovations it develops.

Mainstream-Customer Orientation.
Following Deshpandé, Farley, and Webster (1993) and Jaworski and Kohli (1993), we argue that a good understanding of mainstream customers' needs would foster innovation in order to fulfill those needs and follow up on such customers' ideas. The stronger the SBU's mainstream-customer orientation, the more likely the SBU is to uncover significant mainstream customer needs. For example, market research techniques such as lead-user analyses are a good source for radical product concepts (Christensen and Bower 1996; Von Hippel 1986). Further, the literature on new product development emphasizes the need to deploy technology investments toward the articulated needs of mainstream customers (Urban and Hauser 1993). Such integration of technology with the fulfillment of future customer needs typically would result in technologically advanced/radical innovations, to the extent that the future customer needs are significant and cannot be fulfilled by the current technology.[2] For example, cordless phones, which employ a substantially more radical technology relative to

wired phones, fulfilled mainstream customers' requirements for a highly portable phone inside the house—a need that could not be fulfilled by the wired phone. Therefore, we propose,

H3: The higher the mainstream-customer orientation of an SBU, the more radical will be the innovations that the SBU develops.

On the other hand, we expect a negative relationship between the mainstream-customer orientation of an SBU and its ability to develop disruptive innovations, for two reasons. First, incumbents typically tend to suffer from "competency traps" (Levinthal and March 1993; Ghemawat 1991; Leonard-Barton 1992; also developed as "familiarity trap" by Ahuja and Lampert 2001). In other words, to address the needs of mainstream customers, incumbents specialize in a set of core competencies that are oriented toward the mainstream customer base. Disruptive innovations tend to present a significant challenge to incumbents in developing new competencies; for example, Kodak's competency in delivering paper-based pictures and Encyclopædia Britannica's core competencies in door-to-door selling did not help them in the digital world. Second, incumbents also tend to suffer from "complacency traps" (Hannan and Freeman 1984; King and Tucci 2002)—i.e., the more a firm succeeds in meeting the needs of mainstream customers, the more likely it will view such success as a validation of the past. This results in organizational inertia.

Disruptive innovations present the exact challenges posed by "competency traps" and "complacency traps." This notion is consistent with the observations of Christensen and Bower (1996) in their analysis of six case studies; all six of the firms studied were quite focused on their mainstream customers and were unable to develop disruptive innovations. Thus,

H4: The higher the mainstream-customer orientation of an SBU, the less disruptive will be the innovations it develops.

Emerging-Customer-Segment Orientation.
This customer-related ability, in contrast to mainstream-customer orientation, emphasizes an orientation toward small but emerging customer segments. Following the arguments of Christensen and Bower (1996) and Christensen (1997), an emerging-customer-segment orientation requires at least two considerations: (1) pursuit of ideas that small, emerging customer segments value, and not simply disregarding these segments as strategically unimportant (e.g., AT&T's disregard for the small cell-phone market in the early 1980s), and (2) sufficient allocation of financial and human resources toward staking out a strong position in small, emerging customer segments (e.g., Nokia's investment in cell phones). Such a managerial orientation is critical in developing disruptive innovations because it is the small, emerging segments that value disruptive innovations at the time of their introduction. Thus,

H5: The higher an SBU's emerging-customer-segment orientation, the more disruptive will be the innovations it develops.

On the other hand, solutions that create value for small, emerging customer segments may or may not require the use of new technologies. This is because the needs of emerging customer segments are evolving and, in some instances, less-radical innovations may be sufficient to meet such evolving needs. For example, as discussed in Christensen (1997), the needs of small, emerging customer segments in the disk-drive market were actually met via less-radical innovations. Therefore, while we cannot hypothesize the effect of an SBU's emerging-customer-segment orientation on the radicalness of an innovation, we do test for it in our study.

Model

Based on our hypotheses, we present two equations, one for radicalness of innovations and another for disruptiveness. It is conceivable that company-level variables could impact the two dimensions of innovations. Therefore, in order to take into consideration company-specific

effects, we specify a random effects regression model (Raudenbush and Bryk 2002, p. 23). Further, although not hypothesized, from an exploratory standpoint, we include all four SBU-level abilities in both equations.

$$RAD_{ij} = \alpha_0 + \alpha_1(TO_{ij}) + \alpha_2(WTC_{ij}) + \alpha_3(MSO_{ij}) + \alpha_4(ESO_{ij}) + \theta_{Rj} + \varepsilon_{1ij} \tag{1}$$

where
RAD_{ij} = Radicalness of innovations introduced by SBU i in company j
TO_{ij} = Technological opportunism at SBU i in company j
WTC_{ij} = Willingness to cannibalize at SBU i in company j
MSO_{ij} = Orientation toward mainstream customer segments at SBU i in company j
ESO_{ij} = Orientation toward small, emerging customer segments at SBU i in company j
θ_{Rj} = Company j's specific effect in introducing radical innovations, distributed Normal $(0, \tau_R^2)$
ε_{1ij} = Error in Equation 1, distributed Normal $(0, \sigma_1^2)$

According to H1 and H3, we expect $\alpha_1 > 0$ and $\alpha_3 > 0$ in Equation 1. Further,

$$DIS_{ij} = \beta_0 + \beta_1(WTC_{ij}) + \beta_2(MSO_{ij}) + \beta_3(ESO_{ij}) + \beta_4(TO_{ij}) + \theta_{Dj} + \varepsilon_{2ij} \tag{2}$$

where
DIS_{ij} = Disruptiveness of innovations introduced by SBU i in company j
θ_{Dj} = Company j's specific effect in introducing disruptive innovations, distributed Normal $(0, \tau_D^2)$
ε_{2ij} = error in Equation 2, distributed Normal $(0, \sigma_2^2)$

According to H2, H4, and H5, we expect $\beta_1 > 0$, $\beta_2 < 0$, and $\beta_3 > 0$ in Equation 2. We estimate the above two equations using PROC MIXED procedure in SAS, which estimates the variance component related to company-specific effects along with the corresponding error variances.

After examining the model fit, we then check the signs and significance of each of the coefficients to determine whether the hypothesized effects are supported.

Methods and Measures

Our data collection focused on the strategic business unit (SBU) within the corporation. We mailed surveys, along with self-addressed return envelopes, directly to 262 senior executives of SBUs at 23 Fortune 500 corporations that were part of a corporate sponsorship and recruiting program at a leading U.S. business school. The need to obtain access and the constraints on time and funding prevented the use of a random sample of firms from the entire Fortune 500 list. Since all respondents were at the vice-president or general-manager level, they were knowledgeable about their SBU's abilities and the nature of its innovations. Thirteen executives indicated they would not be able to complete the survey because they were not qualified to respond. Of the remaining 249 potential respondents, we received 148 surveys, a response rate of about 59.4%, relatively high considering that our respondents were senior-level executives. Of the 148 surveys, 10 had many missing values, thus reducing the effective sample size to 138.[3] Our sample covered six industry sectors: consumer nondurables (14.5% of sample), light manufacturing (18.1%), heavy manufacturing (17.4%), pharmaceuticals (19.6%), technology (18.8%), and telecommunications (11.6%). Average annual company sales ranged from $9.4 billion to $39.5 billion, average number of company employees 34,844 to 102,400, and average number of SBU employees 777 to 3,075, thus yielding a heterogeneous sample of SBUs. Given the size and range of the SBUs studied and the diversity of industries, there was no prima facie reason to expect any systematic bias in our results.

The appendix provides the various measures used along with the corresponding coefficient alphas. We reviewed previous research to locate, where possible, measures that would appropriately capture the constructs under study. There were no extant scales to measure disruptiveness of innovations or SBU orientation toward emerging customer segments. Following Churchill (1979), we used a multistage process to build the scales, first discussing the scale items with five scholars in the innovation field to assess content validity and then pilot testing the scale with a sample of 35 senior executives for clarity and relevance (these responses were not included in the analyses of our hypotheses). We used three items to measure the disruptiveness of innovations and four items to measure an SBU's orientation toward emerging customer segments. The scale for measuring an SBU's emerging-customer-segment orientation was developed based on the requirements of such an orientation discussed above. With respect to the disruptiveness construct, the respondents first read the description of a disruptive innovation, based on Abernathy and Clark (1985) and Christensen (1997) and described above, illustrated with an example, then responded to the corresponding scale items.

Similar to the disruptiveness scale, we provided the definition for the radicalness of an innovation and measured the construct using a three-item scale based on Mahajan and Wind (1992). The scale for an SBU's orientation toward mainstream customers was based on Deshpandé, Farley, and Webster (1993) and Jaworski and Kohli (1993). The three-item scale for willingness to cannibalize was adapted from Chandy and Tellis (1998). The six-item scale for technological opportunism was based on Srinivasan, Lilien, and Rangaswamy (2002). All the measures used multi-item, 7-point rating scales.

Reliability and Validity of Measures. To assess the reliability and validity of our measures, we conducted the following four types of analyses: (1) determination of the coefficient alphas and the average inter- and intraconstruct correlations, (2) exploratory factor analysis, (3) confirmatory factor analysis, and (4) second informant technique.

Table 1 presents the descriptives, Cronbach alphas, and average inter- and intraconstruct

Table 1
Reliability Measures: Cronbach Alpha and Average Intra- and Interconstruct Correlations (*n* = 138)

Variables	Number of Items	Mean (Standard Deviation)	Cronbach Alpha	Goodness of Fit Index	1 (RAD)	2 (DIS)	3 (WTC)	4 (MSO)	5 (ESO)	6 (TO)
1. Radicalness of an innovation (RAD)	3	3.72 (1.36)	.77	NA	.49					
2. Disruptiveness of an innovation (DIS)	3	3.41 (1.51)	.80	NA	.24	.56				
3. Willingness to cannibalize (WTC)	3	4.24 (1.26)	.67	NA	.13	.29	.40			
4. Mainstream-customer orientation (MSO)	4	5.50 (.96)	.79	.97	.16	−.11	.04	.41		
5. Emerging-customer-segment orientation (ESO)	4	3.53 (1.35)	.91	.95	.23	.40	.36	−.02	.67	
6. Technological opportunism (TO)	6	4.43 (1.16)	.96	.86	.31	.18	.20	.15	.32	.67

Note: The average intraconstruct (interconstruct) correlations are given by the diagonal (off-diagonal) elements.

correlations for radicalness, disruptiveness, willingness to cannibalize, mainstream-customer orientation, emerging-customer-segment orientation, and technological opportunism. The respective coefficient alphas are .77, .80, .67, .79, .91, and .96; these are greater than or close to the cutoff level of .70 (Nunnally 1978). The lower alpha for willingness to cannibalize is partly due to our choice of fewer items from Chandy and Tellis (1998).[4] As seen in Table 1, the average intraconstruct correlations (range of .40 to .67, given by the diagonal elements in Table 1) are noticeably much higher than the average interconstruct correlations (ranging from −.11 to .40, given by the off-diagonal elements in Table 1), suggesting the discriminant validity of our measures; these averages were computed based on all of the corresponding item-to-item correlations. Note that all of the intraconstruct correlations were significantly different from zero, while some of the interconstruct correlations were not significantly different from zero. Most interestingly, the average interconstruct correlation between an SBU's mainstream-customer orientation and emerging-customer-segment orientation is near zero, suggesting that these are two independent dimensions of customer orientation.

Next, we conducted an exploratory factor analysis of all 23 items. The results reinforced the expected pattern, producing six factors representing radicalness, disruptiveness, orientation toward mainstream customers, orientation toward emerging customer segments, technological opportunism, and willingness to cannibalize,[5] which further demonstrates the discriminant validity of the six scales used.

In addition, we performed two levels of confirmatory factor analysis. One is a measurement model analysis for each of the six constructs separately. The corresponding goodness of fit indices (GFIs) are satisfactory in all cases and ranged from .86 to .97 (see Table 1).[6] Further, the Bentler's Comparative Fit Indices (Bentler 1989) ranged from .89 to .96; also, all of the factor loadings were large and significant at $p < .001$. Second, to verify that the constructs are different from each other, we estimated a

Table 2
Random Effects Regression Results (*t*-values in parentheses, *n* = 136)

Independent Variables	Dependent Variables	
	Radicalness of Innovations	Disruptiveness of Innovations
Intercept	.085	1.743**
	(.13)	(2.43)
Willingness to cannibalize	.062	.274***
(WTC)	(.65)	(2.74)
Mainstream-customer orientation	.22**	−.253**
(MSO)	(1.97)	(−2.14)
Emerging-customer-segment orientation	.128	.416***
(ESO)	(1.32)	(4.08)
Technological opportunism	.375***	.092
(TO)	(3.62)	(.83)

Fit Statistics		
−2 log likelihood	435.6	452.0
AIC (Akaike information criterion)	439.6	456.0
BIC (Bayesian information criterion)	439.7	456.1
−2 log likelihood of the null model	474.1	503.0
chi-square statistic	38.5	51.0
p-value	< .001	< .001

Two-tail   *$p < .10$ **$p < .05$ *** $p < .01$

confirmatory factor analysis model for every construct pair. The resulting 15 GFIs ranged from .83 to .98, Bentler's Comparative Fit Indices ranged from .87 to .97, and Bentler and Bonett's (1980) non-normed indices ranged from .83 to .96. Except for the pairs involving technological opportunism, all of the indices in all other pairs were greater than the desirable .90 level.

Finally, we used the second-informant technique (Gupta and Govindarajan 2000; Srinivasan, Lilien, and Rangaswamy 2002) to establish the convergent validity of our measures. For the four SBU-level abilities, we obtained measures from an appropriate second informant at 58 SBUs. We found the *t*-tests of the difference in

means of these four variables between the two responses at each SBU to be insignificant. Further, the correlations between the two sets of responses for each construct ranged from .30 to .89 and were all significant at a 1% level. Thus, the above analyses establish the reliability and convergent and discriminant validity of our constructs relating to innovation dimensions and SBU abilities.

Results
We tested H1-H5 by estimating equations 1 and 2 via a random effects specification in regression analysis that took into consideration company-specific effects. Given that such an analysis does not provide an *R*-square measure, we test the model significance by constructing a

null model that only has an intercept and the company-specific effects; the corresponding log-likelihood test (chi-square test, Raudenbush and Bryk 2002, p. 58) shows that the two full models perform significantly better than the corresponding null models. The results are given in Table 2.

We find that technological opportunism has the hypothesized significant ($p < .01$, two-tailed), positive impact on the radicalness dimension, thus supporting H1. We also found that technological opportunism does not have a significant impact ($p > .25$) on the disruptiveness dimension. On the other hand, as hypothesized in H2, an SBU's willingness to cannibalize has a significant ($p < .01$), positive effect on disruptiveness. It turns out that willingness to cannibalize does not show a significant effect ($p > .25$) on the radicalness dimension of innovations. H3 and H4 refer to the impact of an SBU's orientation toward mainstream customers on the two innovation dimensions. We find support for both of these hypotheses, i.e., orientation toward mainstream customers has a significant ($p < .05$), positive effect on the radicalness of innovation, while exhibiting a significant ($p < .05$), negative effect on disruptiveness.

As hypothesized (H5), the effect of an SBU's orientation toward small, emerging customer segments on disruptiveness is positive and significant ($p < .01$). Interestingly, the effect of an SBU's orientation toward emerging customer segments on the radicalness dimension is insignificant ($p > .25$). Thus, the results support H1-H5.

Additional Model Specifications That Control for Company-Level Effects. We tested two additional specifications to control for company-level effects. One was a dummy variable regression analysis where we included 22 dummies representing 23 companies. In the second specification, we included the following four company-level variables; the data were collected from the subscription database *Research Insight:* (1) research and development

expenditures relative to sales, (2) size (log of number of employees), (3) profitability (operationalized as net operating margin and return on investment), and (4) long-term debt to equity ratio; we also controlled for SBU size. We found that our hypotheses still hold in both these specifications. Further, company-level research-and-development expenditure, relative to sales, exhibited a significant ($p < .05$), positive effect on the radicalness of an innovation. This is to be expected, since companies that spend more R&D dollars as a percent of sales produce more technology-based innovations. Other company-level variables such as size, debt-equity ratio, and overall profitability did not show a significant effect. Hence, to conserve space, we report the more general random effects specification in this paper.

Thus, our results suggest a differential impact of four SBU-level abilities on the radicalness and disruptiveness of innovations and show that an SBU's emerging-customer-segment orientation plays a significant role in introducing disruptive innovations.

Analysis of SBU Orientation Toward Emerging Customer Segments

Here, we focus on the organizational factors that are associated with an SBU's emerging-customer-segment orientation for three reasons. One, prior research has already examined the antecedents of willingness to cannibalize (Chandy and Tellis 1998), technological opportunism (Srinivasan, Lilien, and Rangaswamy 2002), and mainstream customer orientation (Deshpandé, Farley, and Webster 1993; Jaworski and Kohli 1993). Second, an SBU's emerging-customer-segment orientation, a construct distinct from an SBU's mainstream orientation, appears to play a key role in the introduction of disruptive innovations. Third is to conserve space.

Meeting the considerations of an SBU's emerging-customer-segment orientation,

discussed earlier, implies the following: First, the SBU should have the flexibility (Danneels 2003) to make investments in small, emerging customer segments and tolerate losses in the short term. Second, the SBU should be able to cope with significant uncertainties associated with the emerging customer segments (Danneels 2003; Slater and Narver 1998). This is because issues such as customer definition, the functionality such customers seek, the process for delivering customer value, and the size and profitability of such customer segments are difficult to predict. Third, fostering an emerging-customer-segment orientation may involve building new processes and routines. For example, current market research procedures may not uncover the needs of emerging customer segments (Slater and Narver 1998). Also, the resource allocation processes built to support a mainstream customer orientation may not be capable of allocating resources to support projects targeted at emerging customers (Christensen 1997).

A review of the literature suggests three instruments of organization design critical to contexts requiring flexibility, the ability to cope with uncertainty, and the creation of new processes and routines. These are: the right type of *incentives* to encourage the flexibility to make appropriate short-term/long-term trade-offs (Govindarajan 1988); an appropriate *culture* to cope with uncertainty (Deshpandé, Farley, and Webster 1993); and a suitable organizational *structure* to promote the creation of new processes and routines (Benner and Tushman, 2003). Below, we hypothesize and test how these variables impact an SBU's emerging-customer-segment orientation.

Hypotheses

Incentives. One critical question in deciding the incentive bonus of key executives at an SBU is how much subjectivity, as contrasted with prespecified formulas, should be involved in determining bonus amounts (Govindarajan 1988). Prior research has found that a more subjective approach is appropriate when the

performance measures either are difficult to quantify or become less reliable for use (Gupta and Govindarajan 2000). Given the uncertainties surrounding the evolution of emerging customer segments, a strict, ex ante reliance on performance measures such as market size, growth rate, and profitability (Urban and Hauser 1993) as a basis for deciding incentives for key executives in the SBU would be inappropriate. Consider, for example, McKinsey's low estimate—900,000—of the potential market size of cell phones. While this potential market size is a quantifiable measure, it is still highly unreliable, due to the unpredictability of the future evolution of small, emerging customer segments. Further, as discussed earlier, emerging-customer-segment orientation requires investments in the short term to reap profits in the future. This implies a reliance on more long-term-oriented, subjectively determined incentive plans rather than short-term-oriented, formula-based incentive plans. Thus,

H6: The more subjective the incentive plans are for key executives at an SBU, the higher will be that SBU's orientation toward emerging customer segments.

Culture. Due to the uncertainties surrounding emerging customer segments, developing an emerging-customer-segment orientation requires a high degree of risk taking and experimentation. Such experimentation always involves some failure, due to, for example, the emerging customer segments' lack of knowledge about their intrinsic needs, or their inability to change behavior. These arguments suggest that for an SBU to cultivate an emerging-customer-segment orientation, it is critical that the culture of the SBU value entrepreneurship, risk taking, flexibility, and creativity. It turns out that the type of culture that promotes such behavior is the adhocracy culture (Deshpandé, Farley, and Webster 1993). Thus,

H7: The higher the level of adhocracy culture of an SBU, the higher will be the orientation of that SBU toward emerging customer segments.

Structure. Based on the conceptual arguments of Benner and Tushman (2003) and Tushman et al. (2002) regarding ambidextrous organizations, we expect that the creation of separate organizational units to develop innovations will foster an emerging-customer-segment orientation. As discussed earlier, fostering an emerging-customer-segment orientation requires new processes and new routines. Creation of such autonomous units will aid in breaking from current routines and processes that are designed to sense and respond to the needs of mainstream customers rather than emerging customer segments. Also, the creation of separate organizational units for innovation implies that the current SBU is serious about pursuing innovative ideas, is willing to focus adequate energy and talent toward that goal, and places considerable emphasis on customers of the future. Thus,

H8: The higher the extent to which separate organizational units are created for innovations, the higher will be the SBU orientation toward emerging customer segments.

Model

Again, we specify and estimate a random effects regression model to test H6-H8. We then examine the signs and significance of each of the coefficients to determine whether each of the respective hypotheses is supported. Based on H6-H8, we specify the following equation, which takes into consideration company-specific effects:

$$ESO_{ij} = \gamma_0 + \gamma_1(Subjective_{ij}) + \gamma_2(Culture_{ij}) + \gamma_3(SepUnit_{ij}) + \theta_{Ej} + \varepsilon_{3ij}$$

$$(3)$$

where
$Subjective_{ij}$ = Extent of long-term versus short-term incentive plans at SBU i in company j
$Culture_{ij}$ = Extent of adhocracy culture at SBU i in company j
$SepUnit_{ij}$ = Extent of creation of new organizational units at SBU i in company j for innovation
θ_{Ej} = Company j's emerging-customer-segment

orientation, distributed Normal$(0, \tau_E^2)$
ε_{3ij} = error in Equation 3, distributed Normal $(0, \sigma_3^2)$

According to H6, H7, and H8, we expect $\gamma_1 > 0$, $\gamma_2 > 0$, and $\gamma_3 > 0$.

Method

In order to test H6-H8 and estimate Equation 3, in the survey described earlier, we asked the same set of key executives about three organizational factors at their SBUs: incentive, culture, and structure. All of the measures used a 7-point strongly disagree/ strongly agree scale. To measure the subjective/ long-term versus formula-based/short-term nature of incentives for key executives, we use the following two reverse-scaled measures (correlation = .22) from Govindarajan (1988): "Your annual incentive bonus is based on a formula tied to actual performance on quantifiable criteria rather than based on a subjective judgment," and "In your periodic evaluation, your superior places a lot of emphasis on short-term performance versus long-term performance." With respect to culture, we used the following three items (coefficient alpha = .82) of the adhocracy culture measure from Deshpandé, Farley, and Webster (1993): "This SBU is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks," "The head of this SBU is generally considered to be an entrepreneur, an innovator, or a risk taker," and "The glue that holds this SBU together is a commitment to innovation and development. There is an emphasis on being first." The measurement of the structure variable follows Tushman et al. (2002), i.e., "During the past five years, this SBU has created separate organizational units to develop innovations."

Results

The mean levels (of a possible 7.0) for long-term/subjective versus short-term/formula-based incentives (where we recoded the items accordingly), SBU culture, and creating separate organizational units for innovation were 2.81, 3.86, and 4.27 respectively; the

Table 3A
Random Effects Regression Results
Dependent Variable: Emerging-Customer-Segment Orientation
(*t*-values in parentheses, *n* = 136)

Independent Variable	Coefficient
Intercept	2.129***
	(3.39)
Subjective incentives	.171**
	(2.24)
Adhocracy culture	.445***
	(6.76)
Separate organizational unit	.141***
	(3.05)

Fit Statistics	
−2 log likelihood	400.2
AIC (Akaike information criterion)	404.2
BIC (Bayesian information criterion)	404.3
−2 log likelihood of the null model	470.3
chi-square statistic (*p*-value)	70.1 (< .001)

*$p < .1$,   **$p < .05$,   ***$p < .01$, two-tailed tests

respective standard deviations are 1.17, 1.45, and 2.0. We test H6-H8 by estimating Equation 3 via random effects regression analysis (see Table 3A). We do find that the hypothesized model fits significantly better than the null model that has the intercept and company-specific effects.

With respect to incentives for key executives, subjective incentives show a positive and significant ($p < .05$) effect on an SBU's orientation toward small, emerging segments, thus supporting H6. As hypothesized in H7, adhocracy culture shows a positive, significant ($p < .01$) effect on an SBU's orientation toward small, emerging customer segments. Creation of separate organizational units for innovation has the hypothesized significant ($p < .01$), positive impact on fostering an SBU's orientation toward small,

emerging customer segments. Thus, we find support for H8.

Additional Analyses
Mediation Tests. To address whether an SBU's emerging-customer-segment orientation really mediates the impact of each of the three organizational factors, i.e., the effect of incentives, culture, and structure on the disruptiveness of innovations is not direct but flows via the emerging-customer-segment orientation, we follow the procedure outlined by Baron and Kenny (1986). To establish perfect mediation, Baron and Kenny (1986) lay out three conditions. First, each organizational factor should have a significant impact on an SBU's emerging-customer-segment orientation. As seen in Table 3A, our results fulfill this condition. Second, each organizational factor must have a significant impact on the disruptiveness of innovations. Results from Models 1a, 2a, and 3a in Table 3B show that our results fulfill the second condition as well. Third, when considering the impact of both the organizational factor and the emerging-customer-segment orientation on the disruptiveness of innovations, perfect mediation is established when the emerging-customer-segment orientation exhibits a significant effect, while the organizational factor's impact is insignificant. As seen in Models 1b, 2b, 3b, and Model II (test of direct effects) in Table 3B, we find that our results fulfill the third condition too. Thus, based on the results reported in tables 3A and 3B, we conclude that an SBU's emerging-customer-segment orientation *perfectly* mediates the impact of the organizational factors on the disruptiveness of innovations.

Accounting for Endogeneity. Note that while in Table 2 we considered an SBU's emerging-customer-segment orientation as an exogenous variable, i.e., not impacted by other factors, in Table 3A we consider such an orientation at an SBU as a dependent, i.e., an endogenous, variable. Statistically speaking, this endogeneity needs to be taken into consideration in Table 2. Thus, following the hypothesized effects, we estimated equations 1, 2, and 3 as a single

Table 3B
Mediation Tests
Dependent Variable: Disruptiveness of Innovations

Independent Variable

Model Number	Emerging-Customer-Segment Orientation	Subjective Incentives	Adhocracy Culture	Separate Organizational Unit	−2 Log Likelihood	Chi-Square Statistic (*p*-value)
1a		.249**			494.8	34.8
1b	.588***	.051			460.0	(< .005)
2a			.415***		482.3	18.7
2b	.498***		.15		463.6	(< .005)
3a				.180***	498.6	31.9
3b	.573***			.040	466.7	(< .005)

Direct Effects

	Emerging-Customer-Segment Orientation	Subjective Incentives	Adhocracy Culture	Separate Organizational Unit	−2 Log Likelihood	Chi-Square Statistic (*p*-value)
I	---	.120	.350***	.085	480.2	15.6
II	.493***	.038	.129	.022	464.6	(< .005)

*$p < .1$,   **$p < .05$,   ***$p < .01$, two-tailed tests

system, using a three-stage least squares procedure that takes into consideration the endogenous nature of emerging-customer-segment orientation. We found that our hypothesized effects still hold under the three-stage least squares estimation procedure. (For clarity of presentation, we separated the paper into two parts, one for the innovation dimensions and another for an SBU's emerging-customer-segment orientation and report only the results of the simpler yet robust random effects regression results.)

Discussion and Future Research

In a fast-changing, complex environment, innovations that are both radical and disruptive are critical for organizational survival. We focused on the antecedents of two important and distinct innovation dimensions: technology based (radicalness) and market based (disrup-

tiveness). In this regard, we identified the key role of an SBU's emerging-customer-segment orientation in developing disruptive innovations. In addition, we identified the organization design variables that are associated with an SBU's emerging customer-segment-orientation.

Contribution

This paper makes four key contributions. First, we identify the differential impact of four SBU-level abilities (mainstream-customer orientation, emerging-customer-segment orientation, willingness to cannibalize, and technological opportunism) on the radicalness and disruptiveness of innovations, thus linking customer orientation and radical innovations areas to the disruptiveness literature in a single setting. In this regard, we developed a scale to measure the disruptiveness of innovations and establish the construct's reliability and discriminant and convergent validity. We find that, as expected, an SBU's technology sense-and-respond capa-

bility has a positive impact on the radicalness of innovations at that SBU. Interestingly, technological opportunism does not seem to play a role in determining disruptiveness of innovation.

This suggests that disruptive innovations do not necessarily require technological prowess and is consistent with some case-study examples (Abernathy and Clark 1985; Christensen 1997). Further, upon controlling for the impact of technological opportunism on the disruptiveness of innovations, an SBU's willingness to cannibalize continues to exhibit a positive, significant effect on the disruptiveness dimension but not on the radicalness dimension. Also, an SBU's mainstream-customer orientation has a significant, positive impact on the radicalness dimension but a significant, negative impact on the disruptiveness dimension. This result highlights the dilemma of maintaining a strong mainstream-customer orientation at an SBU. While such an orientation helps the SBU in developing radical innovations, it holds the SBU back in developing disruptive innovations, perhaps because the firm is listening "too closely to its customers" (Martin 1995). We also find that an SBU's capability in an orientation toward emerging customer segments has a strong, positive effect on the disruptiveness dimension but not on the radicalness dimension.

The second contribution of this paper lies in determining how incumbents can foster the development of radical and disruptive innovations, an aspect highlighted by the matrix below.

Christensen's (1997) examples suggest that incumbents excel at introducing innovations that fit quadrants 1 and 2 but not quadrants 3 and 4, and the recommendation is to spin off a new company to address innovations in quadrants 3 and 4. On the other hand, Tushman et al. (2002) discuss ambidextrous organizations, which introduce innovations that fit quadrants 2–4, but their recommendation does not distinguish among the three quadrants. While our results suggest that incumbents can indeed introduce innovations across all of the four quadrants, we show differential SBU abilities required for quadrants 2–4. Notice that innovations that involve high radicalness and high disruptiveness pose a particular challenge for firms. For such innovations, the SBU must develop willingness to cannibalize, technological opportunism, and an emerging-customer-segment orientation. What becomes tricky with such innovations is that while a mainstream-customer orientation is necessary to build radicalness, it hurts the disruptiveness dimension. Note, however, that our multivariate analysis uncovers the compensatory nature of such SBU abilities. In other words, an examination of Equation 1 suggests that a high level of technological opportunism would compensate for a low level of mainstream orientation, which would keep radicalness high.

How Incumbents Can Develop Radical and Disruptive Innovations: Required SBU Abilities

		Quadrant 2	Quadrant 4
	High	Mainstream-customer orientation Technological opportunism	Emerging-customer-segment orientation Willingness to cannibalize Technological opportunism
Radicalness	**Low**	Quadrant 1 Incremental innovations	Quadrant 3 Emerging-customer-segment orientation Willingness to cannibalize
		Low	**High**
		Disruptiveness	

The third contribution of this paper is in identifying the key role of an SBU's emerging-customer-segment orientation in introducing disruptive innovations. We show empirically that such an orientation is distinct from an SBU's mainstream-customer orientation, and examined the organizational factors such as incentives, culture, and structure that impact such an orientation. Further, we find a near-zero correlation between an SBU's mainstream-customer and emerging-customer-segment orientations; this suggests that these are two independent dimensions of customer orientation and not two ends of a continuum. In other words, it is not a zero-sum game for firms to have both mainstream-customer and emerging-customer-segment orientations; firms will be able to foster both types of customer orientations.

The final contribution of this study is in establishing the antecedents of an SBU's emerging-customer-segment orientation. Incentives based on subjective evaluation of long-term performance rather than formula-based evaluation of short-term performance, an adhocracy culture, and creating separate organizational units to develop innovations are organizational factors that we found have a positive effect on an SBU's ability to develop an orientation toward small, emerging customer segments. Most interestingly, we find the mediating role of an SBU's emerging-customer-segment orientation, i.e., the impact of incentives, culture, and structure on the disruptiveness of innovations mediates through an SBU's emerging-customer-segment orientation.

In summary, this paper identifies how firms can manage the duality of being able to create the future via developing an emerging-customer-segment orientation and disruptive innovations, while at the same time maintaining a mainstream-customer orientation and developing radical innovations.

Limitations and Avenues for Future Research
Future research could extend this study along several dimensions. First, while our research focuses on the radicalness and disruptiveness dimensions of innovations, future research could examine the antecedents of other dimensions of innovation, such as competency enhancing/destroying (Gatignon et al. 2002). Second, future research could consider other organizational factors, such as formalization, standardization, and frequency of communication, that could impact an SBU's emerging-customer-segment orientation. Third, it would be fruitful to study the impact of different innovation dimensions on performance. Fourth, future research could provide further refinement and/or establish validity for the scales for disruptiveness of innovations and an SBU orientation toward emerging customer segments. Fifth, akin to other studies in this area, we relied exclusively on self-report measures. While we believe the results of the reliability and validity tests carried out and reported in this study argue for sufficient confidence in those measures, future investigations using a multirater, multimethod approach (including use of objective data) undoubtedly would yield stronger results. Finally, because the data in this study are cross-sectional and snapshotlike, we cannot explicitly show causality. Nonetheless, on an a priori basis, the results of this study are promising for the fruitfulness of longitudinal studies undertaken specifically to examine such causal linkages. ■

Appendix: Measures

(All Likert-type items use 7-point scales. Unless otherwise specified, the scales were anchored strongly disagree/ strongly agree. Items with an asterisk are reverse scaled.)

Respondents, first read the following introduction:

Product, process, and service innovations can be distinguished along two main dimensions, i.e., (i) how radical the innovations are, and (ii) how disruptive the innovations are compared to the products, processes, and services that exist in the market. Below, we provide definitions for the two dimensions. In your responses, please consider only those innovations that have already been commercially introduced. In the remainder of this survey, for brevity, we refer to "product, process, and service" innovations as "product" innovations.

I. Radical Product Innovations (Coefficient alpha = .77)

Definition: A *radical* innovation is a *new product that is based on a substantially new technology relative to what already exists in the industry.* For example, cordless telephones would be a radical innovation since they were based on a substantially new technology relative to the wired phones. On the other hand, incorporating a speaker feature on the base of a cordless phone would be a less radical innovation.

1. In your opinion, how radical were your Strategic Business Unit's (SBU's) new product introductions during the past five years? (Not very radical/Very radical)
2. This SBU rarely introduces products that are radically different from existing products.*
3. This SBU lags behind in introducing radical product innovations.*

II. Disruptive Product Innovations (Coefficient alpha = .80)

Definition: A *disruptive* innovation *introduces a different set of features, performance, and price attributes relative to the existing products,* a combination that is *unattractive to mainstream customers* at the time of product introduction (due either to inferior performance on the attributes that mainstream customers value and/or a high price). *However, a different customer segment sees value in the innovation's new attributes. But, over time, subsequent developments raise the new product's attributes to a level that is sufficient to satisfy mainstream customers,* thus attracting more of the mainstream market.

Cellular phones provide an example of disruptive innovation. Cellular phones were rapidly accepted by corporate executives who appreciated their convenience and portability. At the time of their introduction, the mainstream market still preferred the land-line phone because of its reliability, cost, and coverage. However, over time, further developments in cellular technology have allowed reliable coverage at a price point that is sufficient to satisfy the needs of the mainstream market, thus attracting more of the mainstream market.

On the other hand, the earlier example of the cordless phone is an illustration of a radical but less disruptive innovation because the cordless phone began adding value to the mainstream market since the time of its introduction.

1. In your opinion, how disruptive were your SBU's new product introductions during the past five years? (Not very disruptive/Very disruptive)
2. This SBU rarely introduces products that are disruptive in nature.*
3. This SBU lags behind in introducing disruptive product innovations.*

III. Willingness to Cannibalize (Coefficient alpha = .67)

1. This SBU supports projects even if they could potentially take away from sales of existing products.
2. This SBU finds it difficult to change established procedures to cater to the needs of a new product.*
3. This SBU will not aggressively pursue a new technology that causes existing investments to lose value.*

IV. Technological Opportunism (Coefficient alpha = .96)

1. This SBU is often one of the first in our industry to detect technological developments that may potentially affect our business.
2. This SBU actively seeks intelligence on technological changes in the environment that are likely to affect our business.
3. This SBU is often slow to detect changes in technologies that might affect our business.*
4. This SBU generally responds very quickly to technological changes in the environment.
5. This SBU lags behind the industry in responding to new technologies.*
6. For one reason or another, this SBU is slow to respond to new technologies.

V. Mainstream-Customer Orientation (Coefficient alpha = .79)

1. This SBU pursues ideas that mainstream customers value.
2. This SBU invests adequate resources on innovations that mainstream customers value.
3. In deciding whether to pursue an innovation, this SBU places a great deal of emphasis on the quantification of market size, market share, and financial projections of revenue and cost.
4. Market research efforts in this SBU are aimed at obtaining information about the needs of mainstream customers.

VI. Small, Emerging-Customer-Segment Orientation (Coefficient alpha = .91)

1. This SBU pursues ideas that small, emerging customer

segments value.

2. This SBU sufficiently allocates the critical financial and human resources to carve out a strong position in small, emerging customer segments.

3. This SBU focuses adequate energy and talent in small, emerging customer segments.

4. This SBU places a lot of emphasis on customers of the future.

Notes

1. In the remainder of the paper, for brevity, we refer to "product, process, and service" innovations as "product" innovations.

2. Interestingly, we find that the empirical results with respect to the impact of mainstream-customer orientation on the radicalness of innovations have so far been mixed; Han, Kim, and Srivastava (1998) suggest a positive relationship, while Gatignon and Xuereb (1997) find a negative relationship.

3. Following Armstrong and Overton (1977), we assessed the nonresponse bias by conducting a t-test between responses from early and late respondents on key variables; we found no significant differences.

4. Note that Kopalle and Lehmann's (1997) results suggest that, ceteris paribus, coefficient alpha is lower with fewer items.

5. Six factors had eigenvalues greater than 1, and the percent variance explained by each are 22.0%, 21.3%, 15.9%, 13.5%, 10.7%, and 7.9% respectively. Only 1 of 23 factor loadings was less than .45, a conservative cutoff level.

6. Note the goodness of fit measures from a confirmatory factor analysis are not applicable for single-factor, 3-item scales, as the model is not identified.

References

Abernathy, William J., and Kim B. Clark (1985), "Mapping the Winds of Creative Destruction." *Research Policy* 14 (1), 3–22.

Adner, R. (2002), "When Are Technologies Disruptive? A Demand-Based View of the Emergence of Competition." *Strategic Management Journal* 23 (8), 667–88.

Ahuja, G., and C. M. Lampert (2001), "Entrepreneurship in the Large Corporation: A Longitudinal Study of How Established Firms Create Breakthrough Inventions." *Strategic Management Journal* 22 (6-7), 521–43.

Anderson, P., and Michael L. Tushman (1990), "Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change." *Administrative Science Quarterly* 35 (4), 604–33.

Armstrong, J. S., and T. S. Overton (1977), "Estimating Non-Response Bias in Mail Surveys." *Journal of Marketing Research* 14 (August), 396–402.

Baron, R. M., and D. A. Kenny (1986), "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations." *Journal of Personality and Social Psychology* 51 (6), 1173–82.

Benner, M. J., and Michael L. Tushman (2003), "Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited." *Academy of Management Review* 28 (2), 238–56.

Bentler, P. M. (1989), *EQS Structural Equations Program*. Los Angeles, Calif.: BMDP Statistical Software.

Bentler, P. M., and D. G. Bonett (1980), "Significance Tests and Goodness-of-Fit in the Analysis of Covariance Structures." *Psychological Bulletin* 88 (3), 588–606.

Bower, J. L., and C. M. Christensen (1995), "Disruptive Technologies: Catching the Wave." *Harvard Business Review* 73 (1), 43–53.

Capon, Noel, John U. Farley, Donald R. Lehmann, and James M. Hulbert (1992), "Profiles of Product Innovators among Large U.S. Manufacturers." *Management Science* 38 (2), 157–69.

Chandy, Rajesh, and Gerard J. Tellis (2000), "The Incumbent's Curse? Incumbency, Size, and Radical Product Innovation." *Journal of Marketing* 64 (3), 1–17.

_____, and Gerard J. Tellis (1998), "Organizing for Radical Innovation: The Overlooked Role of Willingness to Cannibalize." *Journal of Marketing Research* 35 (November), 474–87.

Christensen, Clayton M. (1997), *The Innovator's Dilemma*. Boston, Mass.: Harvard Business School Press.

_____, and J. L. Bower (1996), "Customer Power, Strategic Investment, and the Failure of Leading Firms." *Strategic Management Journal* 17 (3), 197–218.

_____, and M. Overdorf (2000), "Meeting the Challenge of Disruptive Change." *Harvard Business Review* 78 (March), 67–76.

Churchill, Gilbert A., Jr. (1979), "A Paradigm for

Developing Better Measures of Marketing Constructs." *Journal of Marketing Research* 16 (February), 64–73.

Damanpour, F. (1991), "Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators." *Academy of Management Journal* 34 (3), 555–90.

Danneels, E. (2002), "The Dynamics of Product Innovation and Firm Competencies." *Strategic Management Journal* 23 (12), 1095–121.

Danneels, E. (2003), "Tight-Loose Coupling with Customers: The Enactment of Customer Orientation." *Strategic Management Journal* 24 (6), 559–76.

Deshpandé, Rohit, John U. Farley, and Frederick E. Webster (1993), "Corporate Culture, Customer Orientation, and Innovativeness in Japanese Firms: A Quadrad Analysis." *Journal of Marketing* 57 (January), 23–37.

Dewar, R. D., and J. E. Dutton (1986), "The Adoption of Radical and Incremental Innovations: An Experimental Analysis." *Management Science* 32 (November), 1422–33.

Economist (1999), "A Survey of Telecommunications." (October 9), 1–36.

Eisenhardt, K. M., and J. A. Martin (2000), "Dynamic Capabilities: What Are They?" *Strategic Management Journal* 21 (10-11), 1105–21.

Ettlie, J. E., W. P. Bridges, and R. D. O'Keefe (1984), "Organizational Strategy and Structural Differences for Radical versus Incremental Innovation." *Management Science* 30 (6), 682–95.

Forbes (1999), "The Push for More User-Friendly Boxes." (January 11), 150.

Gatignon, Hubert, M. L. Tushman, W. Smith, and P. Anderson (2002), "A Structural Approach to Assessing Innovation: Construct Development of Innovation Locus, Type, and Characteristics." *Management Science* 48 (9), 1103–22.

_____, and J-M Xuereb (1997), "Strategic Orientation of the Firm and New Product Performance." *Journal of Marketing Research* 34 (February), 77–90.

Ghemawat, Pankaj (1991), "Market Incumbency and Technological Inertia." *Marketing Science* 10 (Spring), 161–71.

Govindarajan, Vijay (1988), "A Contingency Approach to Strategy Implementation at the Business-Unit Level: Integrating Administrative Mechanisms with Strategy." *Academy of Management Journal* 31 (4), 828–53.

_____, and C. Trimble (2002), "New York Times Digital." Hanover, N.H.: Amos Tuck School of Business Administration, Dartmouth College, Case Study.

Gupta, K. Anil, and V. Govindarajan (2000), "Knowledge Flows Within Multinational Corporations." *Strategic Management Journal* 21 (4), 473–96.

Häikiö, M. (2002), *Nokia: The Inside Story*. Helsinki, Finland: Nokia and Edita Publishing Ltd.

Han, Jin K., Namwoon Kim, and Rajendra K. Srivastava (1998), "Market Orientation and Organizational Performance: Is Innovation a Missing Link? *Journal of Marketing* 62 (October), 30–45.

Hannan, M. T., and J. Freeman (1984), "Structural Inertia and Organizational Change." *American Sociological Review* 49 (2), 149–64.

Hill, C. W. L., and F. T. Rothaermel (2003), "The Performance of Incumbent Firms in the Face of Radical Technological Innovation." *Academy of Management Review* 28 (2), 257–74.

Jaworski, Bernard J., and Ajay K. Kohli (1993), "Market Orientation: Antecedents and Consequences." *Journal of Marketing* 57 (July), 53–71.

King, A. A., and C. L. Tucci (2002), "Incumbent Entry into New Market Niches: The Role of Experience and Managerial Choice in the Creation of Dynamic Capabilities." *Management Science* 48 (2), 171–86.

Kopalle, Praveen K., and Donald R. Lehmann (1997), "Alpha Inflation? The Impact of Eliminating Scale Items on Cronbach Alpha." *Organizational Behavior and Human Decision Processes* 70 (June), 189–97.

Leonard-Barton, Dorothy (1992), "Core Capabilities and Core Rigidities: A Paradox in Managing New Product Development." *Strategic Management Journal* 13 (Special Issue Summer), 111–26.

Levinthal, D. A., and J. G. March (1993), "The Myopia of Learning." *Strategic Management Journal* 14 (Special Issue Winter), 95–112.

Mahajan, Vijay, and Yoram Wind (1992), "New Product Models: Practice, Shortcomings, and Desired Improvements." *Journal of Product Innovation Management* 9 (June), 128–39.

Martin, J. (1995), "Ignore Your Customers." *Fortune* 131 (May 1), 123–6.

Nunnally, J. C. (1978), *Psychometric Theory*, 2nd ed. New York, N.Y.: McGraw-Hill.

Raudenbush, S. W., and A. S. Bryk (2002), *Hierarchical Linear Models: Applications and Data Analysis Methods*. Thousand Oaks, Calif.: Sage Publications.

Rothaermel, F. T. (2001), "Incumbent's Advantage

Through Exploiting Complementary Assets via Interfirm Cooperation." *Strategic Management Journal* 22 (6-7), 687–99.

Slater, Stanley F., and John C. Narver (1998), "Customer-Led and Market-Oriented: Let's Not Confuse the Two." *Strategic Management Journal* 19 (10), 1001–6.

Srinivasan, Raji, Gary L. Lilien, and Arvind Rangaswamy (2002), "Technological Opportunism and Radical Technology Adoption: An Application to E-Business." *Journal of Marketing* 66 (3), 47–60.

Teece, David J., Gary Pisano, and A. Shuen (1997), "Dynamic Capabilities and Strategic Management." *Strategic Management Journal* 18 (7), 509–33.

Tripsas, M., and G. Gavetti (2000), "Capabilities, Cognition, and Inertia: Evidence from Digital Imaging." *Strategic Management Journal* 21 (10-11), 1147–61.

Tushman, Michael L., and P. Anderson (1986), "Technological Discontinuities and Organizational Environments." *Administrative Science Quarterly* 31 (3), 439–65.

_____, W. Smith, R. Wood, G. Westerman, and C. O'Reilly (2002), "Innovation Streams and Ambidextrous Organizational Designs: On Building Dynamic Capabilities." Cambridge, Mass.: Harvard Business School, Working Paper.

Urban, Glen L., and John R. Hauser (1993), *Design and Marketing of New Products.* Englewood Cliffs, N.J.: Prentice-Hall.

USA Today (2002), "Cellphone Ownership Soars." (August 2) 1A.

Von Hippel, Eric (1986), "Lead Users: A Source of Novel Product Concepts." *Management Science* 32 (7), 791–805.