

RAJESH K. CHANDY and GERARD J. TELLIS*

Why are some firms more successful at introducing radical product innovations than others? Following Schumpeter (1942), many researchers have suggested that firm size is the key organizational predictor of radical product innovation. The authors provide an alternate view and argue that one key variable that differentiates firms with strong radical product innovation records from others is the firms' willingness to cannibalize their own investments. The authors identify three organizational factors that drive a firm's willingness to cannibalize. Results from a survey of three high-tech industries tend to support the alternate view that willingness to cannibalize is a more powerful driver of radical product innovation than firm size is. These results suggest a need to reconsider conventional wisdom on firm size, cannibalization, and organizational synergy.

Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize

Typewriters. Telegraphs. Glass-plate cameras. Each of these once dominant products now is virtually extinct. They were swept away by radical innovations in the form of word processors, telephones, and celluloid-film cameras, respectively (Foster 1986; Utterback 1994). The firms that introduced the new products in each of these categories were small new entrants into the market (Utterback 1994). Yet they triggered the demise of the powerful firms that then held sway.

This David-versus-Goliath scenario is of great interest to managers for several reasons. First, radical innovations have the capacity to destroy the fortunes of firms (Foster 1986; Tushman and Anderson 1986). Hard-won customers quickly desert an incumbent firm when a radical innovation provides better performance per dollar than the incumbent's current products. Costly investments made over the years

suddenly may become useless because they cannot be applied to the new generation of products. Skills that once led to the firm's success later may cause it to become uncompetitive. Second, radical product innovation can be the source of competitive advantage to the innovator (e.g., Wind and Mahajan 1997). The effects of radical innovation on a firm's profits can be large, positive, and long-lasting (Geroski, Machin, and Van Reenen 1993). Both new and established firms can benefit from radical product innovation. Third, some authors argue that radical product innovations are increasing in frequency (e.g., Foster 1986). If so, the need to understand radical product innovation becomes particularly urgent.

With the availability of scanner data, marketing researchers increasingly have focused on tactical issues of product design, price points, or promotion levels. They have ceded the area of broad strategic issues such as radical product innovation to researchers in other fields (Day 1996). However, we believe this topic is important to marketing research. First, radical product innovation is linked intrinsically with a firm's product-market strategy and can set the tone for the rest of the marketing program (e.g., Gatignon and Xuereb 1997). Second, in many high-tech firms, marketing managers are confronted directly with these issues and take an active role in related decisions. As testimony of the importance of radical innovation, the Marketing Science Institute (MSI), the Institute for Study of Business Markets (ISBM), and the *Journal of Marketing Research* independently have ranked this as a priority research topic (e.g., Wind and Mahajan 1997).

*Rajesh K. Chandy is Assistant Professor of Marketing, Department of Marketing and Entrepreneurship, University of Houston (e-mail: rchandy@uh.edu). Gerard J. Tellis is the Neely Professor of Marketing, Marshall School of Business, University of Southern California (e-mail: tellis@usc.edu). This research was funded by grants from the Institute for Study of Business Markets at Pennsylvania State University, the Marketing Science Institute, the Center for International Business Education and Research at USC, and the USC Department of Marketing. The authors thank Ed Blair, Bernie Jaworski, Jon Miller, and Allen Weiss for their generous help and advice during the research. The authors also thank Kersi Antia, Raj Echambadi, Roy Howell, Shelby Hunt, Philip Birnbaum-More, Julia Leibeskind, Ofer Meilich, Om Narasimhan, Lars Perner, Anil Peter, Jaideep Prabhu, Pattana Thaivanich, Russ Winer, and four anonymous *JMR* reviewers for their comments on previous drafts of this article.

Much of the research on the causes of organizational innovation is rooted in Schumpeter's (1942) seminal work. His notion of "creative destruction," in which innovations destroy the market positions of firms committed to old technology, first drew attention to the powerful effects of radical innovation on the economy and the fortunes of individual firms. A key Schumpeterian hypothesis is that large firms innovate more "intensively" than small firms do (Scherer 1992, p. 1422). This hypothesis has been the subject of extensive and continuing research (Cohen 1995). More than 100 research articles have studied the effects of size on innovation (Acs and Audretsch 1991). However, results of the research have been decidedly mixed (Scherer 1991).

Authors such as Galbraith (1952) and Ali (1994) build on Schumpeter's basic arguments and suggest that large firms have many advantages over small ones in their ability to produce radical innovations. They note that large firms enjoy economies of scale in research and development, can spread risks widely, and have greater access to financial resources. Other researchers argue that, as firms become large, they become more bureaucratic, slower to react, and less willing to take risks (e.g., Mitchell and Singh 1993). As a result, they are less likely to produce radical innovations than smaller firms that do not possess these handicaps. These two views are contradictory. In addition, some authors suggest that the relationship between innovative productivity and size is bell-shaped (e.g., Ettl and Rubenstein 1987). Medium-sized firms are positioned best for radical product innovation, because unlike small firms they possess the critical mass for research but do not suffer from the bureaucratic inertia of large firms. Conversely, Pavitt (1990) argues for a U-shaped curve. He suggests that the "proportions of significant innovations made by both large and small firms have been increasing at the expense of the medium-sized firms in between" (p. 23). Perhaps medium-sized firms have the liabilities of large and small firms and few of their strengths.

Our review of the decades of research on the effect of size on radical innovation indicates that it has led to little progress in understanding the true drivers of radical product innovation. Researchers have not reached a consensus about the role of size. Contradictions abound. Managerially useful generalizations are rare.

In its focus on size, the literature neglects attitudinal and organizational factors that may influence radical innovation in firms more strongly (e.g., Acs and Audretsch 1991; Scherer 1992). Ironically, Schumpeter (1942, p. 101) himself notes that "mere size is neither necessary nor sufficient" for the superior innovative performance of a large firm. Anecdotal evidence suggests that small, medium, and large firms all can be radical innovators. For example, the Bell Telephone Company introduced the first telephone when it was small. The Buffalo Forge Company, a medium-sized firm, introduced the first air conditioner. Raytheon, a large firm, introduced the first microwave oven.

This article proposes an alternative explanation for radical innovation. Our explanation is based on organizational and attitudinal factors that drive radical product innovation. It suggests that the effects of size are weak when these factors are taken into account. We define *radical product innovation* as the propensity of a firm to introduce new products that (1) incorporate substantially different technology from existing products and (2) can fulfill key customer needs better than

existing products. The next section explains our theory and hypotheses, which are based on in-depth field interviews and the literature of radical product innovations. The subsequent sections describe the method and results. In particular, we test the role of size versus that of organizational and attitudinal factors in explaining radical product innovation. The final section discusses the implications of the results.

BEYOND SIZE: WHAT REALLY DRIVES RADICAL PRODUCT INNOVATION?

The bulk of the literature has focused on firm size as the key organizational variable affecting radical product innovation (Cohen 1995). Yet, a small, recent stream of research in management and marketing suggests other factors that drive radical product innovation (e.g., Gatignon and Xuereb 1997; Kleinschmidt and Cooper 1991; Moorman and Miner 1997). In particular, authors note that the manner in which a firm is organized might have an important effect on its radical innovation performance (Damanpour 1991). For example, Olson, Walker, and Ruekert (1995) note that a high level of autonomy within the firm is conducive to radical product innovation. Ettl, Bridges, and O'Keefe (1984) highlight the role of product champions in promoting such innovations. Gatignon and Xuereb (1997) stress the influence of the firm's strategic orientation on its innovation performance. Moorman (1995) and Moorman and Miner (1997) identify the effects of organizational information flows and organizational memory on the level of new product creativity. Unfortunately, despite these recent advances, research in this area continues to be limited, disparate, and somewhat equivocal (Kleinschmidt and Cooper 1991; Wind and Mahajan 1997). We do not have a unifying framework yet that parsimoniously explains how organizational factors affect radical product innovation.

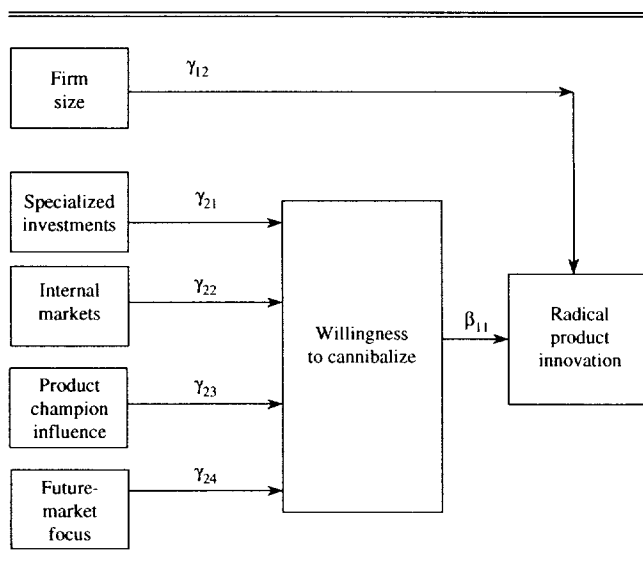
In this article, we introduce a concept that might help provide such a unifying framework. We argue that an important factor separating many radical product innovators from other firms is the willingness of the former to cannibalize their own investments. *Willingness to cannibalize* refers to the extent to which a firm is prepared to reduce the actual or potential value of its investments. It is an attitudinal trait of the key decision makers of the firm and resides in the culture, or shared values and beliefs, of the firm (Deshpandé and Webster 1989).

Willingness to cannibalize is critical because firms that dominate markets often are reluctant to embrace or foster radical innovations in their markets. Their reluctance derives from the established base of specialized investments with which they serve such markets. Nevertheless, organizational forces can compensate for the negative effects of specialized investments on willingness to cannibalize. In particular, the presence of internal markets, influential product champions, and future market focus can overcome the reluctance to cannibalize and motivate radical product innovations. Thus, willingness to cannibalize mediates the relationship between these organizational factors and radical product innovation. Although marketing managers have little control over their firm's size, they have considerable influence over these organizational factors (e.g., Kohli and Jaworski 1990; Menon, Bharadwaj, and Howell 1996). In Figure 1, we summarize these effects. The subsequent sections explain each of the concepts.

Table 1
TYPES OF PRODUCT INNOVATIONS

		Customer Need Fulfillment Per Dollar	
		Low	High
Newness of Technology	Low	Incremental innovation	Market breakthrough
	High	Technological breakthrough	Radical innovation

Figure 1
HYPOTHESIZED MODEL OF RADICAL PRODUCT INNOVATION



Radical Product Innovations

What, exactly, is a radical product innovation? Researchers have defined such innovations in a variety of ways (e.g., Damanpour 1991; Gatignon and Xuereb 1997; Henderson and Clark 1990). Our review of the literature suggests that two common dimensions underlie most definitions: (1) technology and (2) markets. The first factor determines the extent to which the technology involved in a new product is different from prior technologies. The second factor determines the extent to which the new product fulfills key customer needs better than existing products (on a per-dollar basis). Considering two levels (low and high) for each factor leads to four types of product innovations (see Table 1): incremental innovations, market breakthroughs, technological breakthroughs, and radical innovations.

Incremental innovations involve relatively minor changes in technology and provide relatively low incremental customer benefits per dollar. An example is Fuji's "environmentally friendly" photographic film, which is enclosed in paper canisters instead of the plastic canisters that traditionally hold film. *Market breakthroughs* are based on core technology that is similar to existing products but provide substantially higher customer benefits per dollar. An example is cable television with signal compression systems that allow a substantially higher number of channels to be transmitted to customers using existing cable technology. *Technological breakthroughs* adopt a substantially different technology than existing products but do not provide supe-

rior customer benefits per dollar. For example, electronic imaging uses a substantially different technology than celluloid film but does not yet provide comparably good resolution. In contrast to the previous three, *radical innovations* involve substantially new technology and provide substantially greater customer benefits per dollar, relative to existing products. An example is today's celluloid roll film, which displaced the glass plates used previously.

These different types of innovations are also related by an important dynamic, a series of S-curves of technological innovation (see Figure 2; Foster 1986; Utterback 1994). The S-shape emerges because an existing technology (T_1) initially improves benefits to consumers rapidly when the technology is new and then more slowly as the technology matures. At some point in the history of that technology, a new technology, T_2 , emerges. Initially, T_2 's benefits are inferior to those of T_1 , and the new product based on T_2 might be considered a technological breakthrough (a). However, with research, T_2 begins to improve rapidly in consumer benefits, and it ascends on its own S-curve. A point comes at which T_2 passes T_1 in benefits. At this point (b), the product based on T_2 becomes a radical product innovation. Recent empirical evidence strongly supports this sharp turning point in the sales history of a radical innovation (Golder and Tellis 1997).

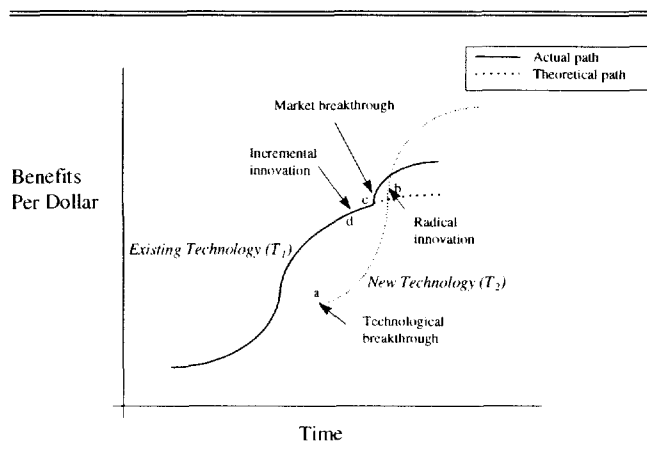
Faced with the threat of T_2 , supporters of T_1 make fresh efforts to improve the benefits of T_1 . These efforts might yield some product improvements, which might represent a market breakthrough (c) or just incremental innovations (d). However, the improvements cannot keep pace with the much faster rise of T_2 , which ultimately replaces T_1 as the dominant technology. In time, T_2 itself is threatened by a new technological breakthrough, and the cycle is repeated. The history of technologies shows that innovation generally proceeds nonmonotonously as a series of S-curves (Foster 1986; Utterback 1994).

Although not every technological breakthrough becomes a radical product innovation, radical product innovations do have the potential to render existing products obsolete. Thus, a firm's willingness to cannibalize is a vital factor that drives managerial support for radical innovation (e.g., Nault and Vandenbosch 1996).

A Broader View of Cannibalization

Marketers traditionally use the term "cannibalization" to refer to *sales cannibalization*, which is a loss in sales of a firm's current product due to sales of its new product (e.g., Mason and Milne 1994). Often, marketers also consider cannibalization a problem against which to guard. For example, Copulsky (1976, p. 103) discusses how companies can avoid the "error of cannibalism" in product development. Kerin, Harvey, and Rothe (1978, p. 25) note that "can-

Figure 2
A DYNAMIC VIEW OF PRODUCT INNOVATION



nibalism ... may be the unwelcome consequence of new product development.” In contrast, we view cannibalization as a desirable trait that can promote radical product innovation and the long-term success of the firm. It is a multidimensional construct; firms can cannibalize investments in the form of assets or organizational routines.

Assets might be tangibles, such as manufacturing or processing equipment, or intangibles, such as knowledge and expertise in the firm (e.g., Henderson and Clark 1990) or access to distribution channels. The success of a new technology can cannibalize a firm’s assets in a prior technology. For example, if Kodak’s current efforts in the area of electronic imaging succeed, they will substantially reduce the value of the firm’s prior assets in the research, production, processing, and marketing of celluloid film.

Organizational routines are the established procedures used by a firm to carry out its day-to-day activities (Nelson and Winter 1982). Such routines develop to ensure efficiency in the operations related to existing technology but might be irrelevant for a new technology. This broadened view of investments as comprising assets and routines is essential to explain willingness to cannibalize.

Willingness to Cannibalize and Radical Product Innovation

Why is willingness to cannibalize an important driver of radical product innovation? To answer this question, we consider managerial behavior with respect to the S-curves. When the new technology T_2 is in its embryonic stage, an incumbent faces two options: it can either choose to advance the current technology, T_1 , or switch to the new technology, T_2 . A firm using current technology possesses many specialized investments, whose value is tied strongly to that technology (Ghemawat 1991; Leonard 1992). Continuing with the current technology enables the firm to capitalize on its specialized investments. Switching to the new technology requires the firm to make fresh investments in the new technology, potentially rendering the current investments obsolete. A firm that is reluctant to cannibalize will continue with the current technology, T_1 . Its efforts initially might yield some market breakthroughs, as explained previously. These achievements give the impression of success, but they

are the last gasp of a declining technology. While investing in this technology, the firm ignores T_2 and fails to create the environment for radical product innovations. Indeed, its adherence to the old technology might lead to its ultimate demise (Foster 1986; Utterback 1994).

In contrast, a firm willing to cannibalize encourages employees to work on new technologies. It allocates adequate resources to radical product innovation. Such a nurturing atmosphere is more likely to lead to a breakthrough technology. The firm also is willing to introduce the technology to the marketplace before others. Therefore, we expect the following:

H₁: Firms that exhibit high willingness to cannibalize are more likely to be radical product innovators than other firms.

The relationship between willingness to cannibalize and radical product innovation might seem intuitive, or the two concepts might seem indistinguishable. However, we note that

1. Radical innovation is a behavioral variable, whereas willingness to cannibalize is an attitudinal one.
2. Other environmental or structural factors also could drive radical innovation. For example, prior literature focuses on size, a structural variable.
3. Radical innovations do not always result in cannibalization or obsolescence of related products. For example, microwave ovens did not render conventional ovens useless.

Often, dominant firms are unwilling to cannibalize their specialized investments until it is too late. The history of innovation indicates that a new innovation (e.g., T_2) often is introduced not by the managers of T_1 but by some other party, sometimes even an outsider (e.g., Christensen 1997; Foster 1986). The managers of T_1 tend to fight T_2 by making further investments in T_1 . Why are managers reluctant to cannibalize their specialized investments? We believe the answer lies in the level of specialized investments owned by the firm.

Specialized Investments and Willingness to Cannibalize

Specialized investments are investments that lose value if they are not applied to a specific technology. Firms that are successful with their current products possess many specialized investments, frequently the fruit of years of labor by the firm’s senior managers. As such, managers develop a strong professional and personal commitment to the investments, which can lead to suboptimal or even irrational decisions. Literature in at least three disciplines address this issue. Psychologists study why decision makers continue with prior courses of action, even when such actions might be irrational (Brockner and Rubin 1985). Boulding, Morgan, and Staelin (1997) note that such behavior is a major problem in managing new products. Economists and sociologists study why firms are unable to change their previous modes of action to respond to changed environments (e.g., Hannan and Freeman 1977; Leonard 1992; also see Moorman and Miner 1997). We summarize this literature in terms of four biases that afflict firms with large investments in current technology: cognitive dissonance, self-justification, external justification, and sunk cost fallacy (for reviews, see Brockner and Rubin 1985; Staw 1981).

Cognitive dissonance and self-justification theories imply that people need to justify prior actions to themselves, which leads them to increase commitment to the actions further.

External justification suggests that people persist in actions to "save face" in front of others. The *sunk cost fallacy* suggests that people's future actions are influenced by expenditures that already have been made, even though they rationally should not be taken into account.

A firm might be affected by these biases, even if the top managers do not necessarily suffer from them. Operating managers could suffer from these biases and manipulate the information provided to top management to justify commitment to the current investments. Moreover, as the cumulative investment in a particular course of action increases, these biases become more pronounced (Brockner and Rubín 1985).

The S-curve of technological innovation can accentuate these biases. A manager's commitment to a current technology can be high if he or she was involved with the current technology and previously rode its S-curve to success when it replaced an older technology (see Figure 2). In that case, the manager will be less open to a new or future innovation. Overall, these arguments suggest the following:

H₂: The more specialized investments a firm has in a current technology, the lower its willingness to cannibalize those investments will be.

Are established firms with many specialized investments doomed to die with out-dated technologies? Although the literature generally suggests this conclusion, history suggests that this need not be the case. For example, Hewlett-Packard, a dominant firm in the laser printer market, is also on the forefront of the next generation of printers, the ink-jets. The key question then becomes, What factors enable a firm to overcome commitment to current investments? We believe that three such factors are internal markets, strong product champions, and a focus on future markets.

Internal Markets

The idea of internal markets has a long history in the organizational literature (see Halal, Geranmayeh, and Pourdehnad 1993). We consider a firm to have an active internal market if it possesses high levels of (1) internal autonomy and (2) internal competition. *Internal autonomy* refers to the extent of authority the business unit manager enjoys, relative to the corporate office, in making decisions relating to his or her business unit (e.g., Aiken and Hage 1968; Gupta 1987; Olson, Walker, and Ruckert 1995). *Internal competition* refers to the extent of rivalry among business units in a corporation. In this article, we refer to an organizational structure with high internal autonomy and internal competition as an *internal market*.

High levels of internal autonomy and competition have the potential for dysfunctional conflict in the firm. Moreover, strong internal markets can lead to duplication of scarce resources. This is especially true in the area of research and development, in which rival business units might have to duplicate research facilities to develop alternate technologies in secret competition with one another. For these reasons, authors recently have urged firms to extract synergies across business units and promote cooperation rather than competition among business units (e.g., Vizjak 1994).

However, we argue that active internal markets provide a critical benefit to firms (Menon, Bharadwaj, and Howell

1996). They increase willingness to cannibalize and thereby cause a firm to be more radically innovative for two reasons. First, in firms with active internal markets, the key decision maker for product-related decisions is the manager of each business unit. In considering the decision to switch to the new product technology, the business unit manager takes into account the specialized assets owned by the business unit. Therefore, the decision to cannibalize is easier for the business unit manager than it is for top management.

Second, in the perceived absence of external competition, a manager in a large, successful, dominant firm might not be eager to cannibalize his or her assets to be innovative. However, in the presence of internal markets, the business unit manager has to compete not only with external competitors (i.e., other firms) but also with other managers within the firm. If a particular business unit manager does not support a radical new product that originates within the firm, a competing manager might. Therefore, the business unit manager has a strong incentive to preempt competing managers by cannibalizing his or her own investments in the existing technology. On the basis of the previous two reasons, we hypothesize the following:

H₃: Firms with active internal markets exhibit greater willingness to cannibalize than do other firms.

Product Champion Influence

The product champion long has been cited as a preeminent factor in producing radical product innovations (e.g., Ettlíe, Bridges, and O'Keefe 1984). But prior research has focused on the traits of individual product champions (e.g., Howell and Higgins 1990) and their role in the innovation process (e.g., Ettlíe, Bridges, and O'Keefe 1984). The product champion is generally a person with drive, aggressiveness, political astuteness, technical competence, and knowledge of the market. Most accounts imply that the match of the product champion with the innovative project is due to happenstance; the product champion often is portrayed as being at the right place at the right time.

We take a different approach. We focus on the influence of product champions in a firm rather than on their individual traits. Indeed, persons who fit the personality traits of a product champion might be equally likely to work in radically innovating and noninnovating firms. However, the product champions in innovating firms wield substantially more influence. *Product champion influence* refers to the extent to which employees who advocate new product ideas affect the activities of the organization. The reward systems, organizational legends, and training programs at these firms promote the influence of product champions (e.g., Deshpandé and Webster 1989). Top management actively supports the activities of product champions. Nontraditional ideas, which typically meet intense resistance in firms, stand a better chance in firms with influential product champions, who aggressively push such ideas (Moorman 1995). In such firms, key decision makers are aware of the advantages of radical products and the need to cannibalize past investments to function effectively in the new product technology. Overall, these arguments suggest that firms with influential product champions would be willing to cannibalize, even if their specialized investments are high, because the opportunities and threats of potential new products are salient to them. Thus, we hypothesize the following:

H₄: The greater the influence of product champions in a firm, the greater its willingness to cannibalize is.

Focus on Future Markets

Marketing traditionally emphasizes that firms should be market oriented. Indeed, market orientation has become the foundation of marketing strategy. However, some authors posit that a strong market orientation "inhibits organizations from developing truly breakthrough innovations" (see Kohli and Jaworski 1990, p. 13; Tauber 1974). Recent empirical research appears to validate this assertion. Gatignon and Xuereb (1997) find that a strong customer orientation led to less radical innovation among firms in their survey sample. Christensen (1997) notes that dominant firms in the rigid disk-drive, copier, tire, minicomputer, and mainframe computer markets stayed too close to their customers and consequently lost their market position to the new generation of products. Thus, the literature seems to suggest that radically innovative firms must "ignore their customers" (Martin 1995, p. 121). Which of these two positions is right?

Our analysis of field interviews and case studies indicates that radically innovative firms pay close attention to their markets. However, the difference lies in distinguishing between current and future markets. The negative findings about market orientation, discussed previously, refer to firms that stayed close to their current markets. Our field interviews with radically innovative firms suggest that such firms focus on future customers and competitors. We term this emphasis a *future-market focus* and define it as the extent to which a firm emphasizes future customers and competitors relative to current customers and competitors. Such a focus can involve considering those customers and competitors that will constitute the future market of the firm. It also can involve considering future needs of existing customers or future actions of existing competitors.

The availability heuristic explains the important influence of future-market focus on willingness to cannibalize (Tversky and Kahneman 1973). People judge the likelihood of events on the basis of the ease with which they imagine or recall them (Folkes 1988). A future-market focus causes decision makers in a firm to become keenly aware of market-related developments and their potential effects on the firm. Therefore, a future-market focus broadens the horizons of managers and alerts them to new technologies, competitors, and customers (see Moorman 1995). It also alerts them to the potentially destructive results of radical innovations introduced by competitors. Thus, managers are not overly committed to the past investments of the firm and are more willing to cannibalize them. Therefore, we hypothesize the following:

H₅: The greater the future-market focus of a firm, the higher its willingness to cannibalize is.

H₂, H₃, H₄, and H₅ suggest that specialized investments, internal markets, and product champions affect a firm's willingness to cannibalize. H₁ argues that willingness to cannibalize affects radical product innovation. Taken together, these hypotheses suggest that willingness to cannibalize mediates the effect of the other organizational factors on radical product innovation.

Summary

Radical product innovation can catapult firms to positions of great success or drive once mighty firms to oblivion. A large body of literature has focused on firm size as a key organizational variable that drives radical product innovation. It ignores the rich variety of organizational forms that exist among firms, both large and small. This article suggests an alternate model of radical product innovation that is based on organizational and strategic factors. We propose that a key psychological factor that explains radical product innovation is a firm's willingness to cannibalize. Firms vary substantially in their willingness to cannibalize. Specialized investments decrease willingness to cannibalize. However, internal markets, product champions, and future-market focus are organizational factors that increase willingness to cannibalize. Thus, the latter three factors can be considered counterforces to the effect of specialized investments. Figure 1 illustrates these relationships. The line linking size and radical product innovation depicts the Schumpeterian hypothesis that size has a significant, direct effect on radical product innovation (e.g., Scherer 1992). We next describe a test of these hypotheses.

METHOD

We formally test our hypotheses with a path model, using data we collected through a survey of key managers at a large number of firms. This section describes the sample, measures, and model used.

Sample

Our model of radical product innovation focuses on intraorganizational factors. However, the industry environment in the form of competitive intensity (Schumpeter 1942) or environmental turbulence (Anderson and Tushman 1990) also can affect innovation (and willingness to cannibalize). Because our focus is on organizational factors, we controlled for the effects of the environment by restricting our sample to three highly competitive and turbulent high-tech industries: (1) computer hardware, (2) photonics, and (3) telecommunication. We used stratified random sampling to select firms in our survey sample. We divided corporations into four size categories: fewer than 100 employees, 100 to 499 employees, 500 to 4999 employees, and more than 5000 employees. Roughly a fourth of the sampling frame consisted of corporations in each of these four categories.

We tried to ensure that informants were knowledgeable about the issues by targeting senior managers in these firms who are responsible for innovation. A majority of the managers in the sample were at the director or vice president level. We used multiple approaches to increase the managers' response rate, including (1) presurvey phone calls; (2) a small (\$1) financial incentive; (3) a highly personalized cover letter with a hand-written note; (4) a professional-looking survey packet that highlighted the academic and nonprofit sponsors of the study; and (5) two reminder letters, the second of which was sent by priority mail (together with a fresh copy of the questionnaire and a stamped return envelope).

MEASURES

We measured all variables at the strategic business unit (SBU) level (we also measured size at the corporate level).¹ We define an *SBU* as a profit center with distinct products and markets. We developed the measures using a combination of literature searches and in-depth interviews with knowledgeable managers. The face-to-face interviews encompassed 24 managers involved in new product development or product strategy from 14 high-tech firms nationwide. The Appendix provides the measures used in the study.

We used a multistage process to purify the measures. The first stage involved successive reviews of the item pool by academic experts and two rounds of pretests using managerial samples. The next stage was an iterative process, carried out after the data had been collected. This stage involved calculation of coefficient α and exploratory factor analysis. We first examined the internal consistency of the sets of items by computing coefficient α values for each scale. We dropped items with low item-to-total correlations. We also deleted items that produced a substantial or sudden drop in the item-to-total correlations. We then performed an exploratory factor analysis using the remaining items and deleted all items that did not load heavily on the primary factor. Next, we conducted a confirmatory factor analysis to test for convergent and discriminant validity (Anderson and Gerbing 1988). Results of the tests indicated satisfactory levels of validity for all the constructs. We next recalculated coefficient α scores. The α values range from .63 to .93 (see the Appendix), and all scales except one have reliabilities greater than .7. We finally constructed additive, equally weighted indices for each of the constructs. Table 2 provides the pairwise correlations for all the variables in the study.

To measure radical product innovation, we first standardized the scores from each of the three types of scales (Likert, Numeric, and Ordinal). Next, we constructed our index of radical product innovation by summing the standardized scores. Before responding to these items, respondents first completed a two-page exercise with specific examples to define each term clearly and clarify its meaning. To measure specialized investments, we first asked respondents to name and describe the most radical product innovation introduced

¹For ease of exposition, we use the terms "firm" and "SBU" interchangeably in the remainder of this article. We use the term "company" to refer to the corporation as a whole.

in their industry during the last three years.² We then asked them to indicate the established technology that preceded this radical product innovation. Later, we presented them with the specific questions that measured specialized investments. Therefore, our scale of specialized investments measures the level of specialized investments owned by the SBU in the established technology that preceded the most radical innovation introduced in the respondents' industry. Internal markets is a second-order factor consisting of internal autonomy and internal competition.

Model Specification

Our theory and hypotheses suggest the following model of radical product innovation (see Figure 1):

$$(1) \text{ Radical product innovation} = \beta_{11} \text{ Willingness to cannibalize} \\ + \gamma_{12} \text{ Size} + \epsilon_1.$$

$$(2) \text{ Willingness to cannibalize} = \gamma_{21} \text{ Specialized investments} \\ + \gamma_{22} \text{ Internal markets} + \gamma_{23} \text{ Influence of product champion} \\ + \gamma_{24} \text{ Future-market focus} + \epsilon_2.$$

We tested this model using path analysis. The path diagram in Figure 1 forms a recursive system; that is, there are only one-way causal flows in the system. Recursive models, with the assumption of independent errors, fulfill the rank-and-order conditions for identification with no additional exclusion restrictions³ (for a formal proof, see Land 1973, p. 31). We thus can obtain consistent estimates of the parameters in each equation.

To test alternate models, we compare the goodness of fit of the models after accounting for the sample size and the number of restrictions imposed on the model (see Specht 1975). The goodness-of-fit statistic for recursive models

²If the respondents believed that no radical product innovations had been introduced in their industry during the last three years, they were asked to note this by checking a box and then to describe the product that came closest to being a radical product innovation. Given the nature of the industries we studied, relatively few persons suggested that no radically new products had been introduced in their industry.

³An analysis of the residuals from each of the equations estimated using the data in this study reveals that the residuals are independent of one another. Therefore, the independent errors assumption is appropriate in this context.

Table 2
CORRELATION MATRIX

Variable	Radical Product Innovation	Willingness to Cannibalize	Specialized Investments	Internal Markets	Influence of Product Champions	Future-Market Focus	Firm Size
Radical Product Innovation	1.00						
Willingness to Cannibalize	.54***	1.00					
Specialized Investments	-.12*	-.17**	1.00				
Internal Markets	.13*	.31***	-.08	1.00			
Influence of Product Champion	.46***	.46***	-.02	.21***	1.00		
Future-Market Focus	.49***	.51**	-.16*	.16**	.43***	1.00	
Firm Size	-.04	-.04	.20***	.04	-.06	-.03	1.00

* $p < .1$.

** $p < .05$.

*** $p < .01$.

with uncorrelated residuals is given by $Q = (1 - M_1)/(1 - M_2)$, where M_1 and M_2 are the squared multiple correlations for each of the alternate models. The values of M_1 and M_2 are obtained from the general formula:

$$(3) \quad M = 1 - (1 - R_1^2)(1 - R_2^2), \dots, (1 - R_p^2),$$

where R_i^2 is the ordinary squared multiple correlation coefficient of the i th equation in the system of equations that forms the recursive model, and p is the number of equations in the model. We can test the significance of the fit of the model by forming the test statistic W (Specht 1975). For large samples, W is χ^2 distributed with d degrees of freedom.

$$(4) \quad W = -(N - d)\ln Q,$$

where N is the sample size and d is the number of overidentifying restrictions.

H_1 suggests that β_{11} , the path coefficient that links willingness to cannibalize to radical product innovation in Figure 1, will be positive and significant. H_2 suggests that γ_{21} , the coefficient between specialized investments and willingness to cannibalize, will be negative and significant. H_3 – H_5 lead us to expect that the coefficients γ_{22} , γ_{23} , and γ_{24} will be positive and significant. The Schumpeterian hypothesis suggests that γ_{12} , the coefficient between size and radical product innovation, will be positive and significant.

RESULTS

This section covers the response rate from the survey and the results pertaining to each hypothesis outlined previously. It then examines whether internal markets, strong product champion roles, and future-market focus overcome the effects of specialized investments on willingness to cannibalize.

Response Rate

We mailed surveys to 504 SBUs. Twenty-one surveys were returned because the address was wrong, the addressee had left the company, or the company had gone out of business. Thus, we had a potential sample of 483 SBUs. Four weeks after the first mailing, we had received 194 completed surveys.⁴ This figure provides us with an effective response rate of 40.3%, which is relatively high compared with other surveys using similar samples of senior managers

⁴Two outliers were deleted from the sample, providing us with a final sample size of 192 firms.

at high-tech firms. The high response rate probably is due to the many efforts we took to increase cooperation from the respondents.

Estimation Results

In Table 3, we present the estimation results for Equations 1 and 2. A formal test of industry-specific effects indicates that the key variables did not vary by industries (ANOVA of industry effects provide $p > .10$ in all cases). Thus, we exclude industry-specific variables in the model.

How does firm size affect radical product innovation? Is the shape of the relationship positive, negative, U-shaped, or bell-shaped, as various segments of the literature suggest? As Table 3 indicates, the coefficient of firm size on radical product innovation is small and nonsignificant ($\gamma = -.02$, $p > .76$).⁵ The coefficient of the square of firm size, if included in the model, is also small and nonsignificant (standardized coefficient = .1, $p > .5$). An analysis of alternative model specifications reveals that an unrestricted model that includes firm size does not provide a better fit with the data than a restricted model without firm size ($W < \chi^2_{2df} = 5.99$). Overall, these results suggest that firm size has no significant effect on radical product innovation. The results contradict most of the Schumpeterian literature, in which, ironically, the controversy is about the sign of the relationship, not whether the relationship exists at all.

If not size, then what? The results lend support to H_1 , which suggests that a key predictor of an organization's propensity for radical product innovation is its willingness to cannibalize. As Table 3 indicates, the coefficient of willingness to cannibalize is positive and statistically significant at the $p < .001$ level. The standardized coefficient for willingness to cannibalize is substantially larger than the effect of firm size on radical product innovation. A formal test comparing the β values of willingness to cannibalize and firm size indicates that the difference between the coeffi-

⁵We also regressed firm size alone on radical product innovation. Its coefficient is also small ($\beta = -.04$) and not significantly different than zero ($p > .5$). Analyses using alternate operationalizations of the size variable—corporate size (number of employees in the firm as a whole), SBU sales (dollar sales of the SBU in the last year), and natural logarithms of corporate size and SBU sales—yielded similar results. We did not have data on corporate revenue for the set of firms we studied; we therefore were unable to study the effects of this variable on radical product innovation. Corporate size was measured as a categorical variable corresponding to the four size levels used in our sampling procedure. Therefore, this measure might not capture all the variance in the size variable. However, all the other size measures involve continuous variables.

Table 3
PATH COEFFICIENTS OF THE HYPOTHESIZED MODEL (STANDARDIZED)
(Including all SBUs in the data set, $n = 192$)

Model Number	Dependent Variable	Independent Variable						R ²
		Willingness to Cannibalize	Specialized Investments	Internal Markets	Influence of Product Champion	Future-Market Focus	Firm Size	
1	Radical product innovation	.54***	—	—	—	—	-.02	.29
2	Willingness to cannibalize	—	-.10*	.20***	.27***	.34***	—	.38

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Note: All coefficients are standardized values.

icients is significantly different from zero ($p < .001$). These results support our thesis that willingness to cannibalize provides a better indicator of radical product innovation than firm size does.

Do specialized investments cause firms to be less willing to cannibalize? The coefficient of specialized investments is negative, as was hypothesized, but significant only at $p < .10$. Thus, H_2 is supported weakly. This result suggests that, as specialized investments in a particular technology increase, firms do become less willing to engage in actions that could reduce the value of these investments.

What are the key drivers of willingness to cannibalize? H_3 – H_5 focus on variables that help firms overcome the negative effects of specialized investments. H_3 proposes that the presence of active internal markets increases an organization's willingness to cannibalize. As Table 3 indicates, the coefficient of internal markets is positive and statistically significant ($p < .01$). H_4 suggests that firms with strong product champion roles are more willing to cannibalize than other firms. The results support this hypothesis ($p < .01$). H_5 suggests that firms that focus on future markets more than on current markets are more willing to cannibalize than others. The results confirm this hypothesis ($p < .01$). Overall, the results indicate that these organizational factors cause firms to be more radically innovative by increasing their willingness to cannibalize.

Willingness to cannibalize has a strong positive effect on radical product innovation. Contrary to the Schumpeterian hypothesis, firm size has no effect on radical product innovation. All the hypotheses relating these three variables to willingness to cannibalize are supported by the results.

Additional Analysis

Although the hypotheses suggested here generally are supported by the results of the survey, we found an unexpectedly weak empirical relationship between specialized investments and willingness to cannibalize. One reason for these surprising results may be that specialized investments have the strongest effects on incumbent firms (i.e., firms that actually participate in the technology preceding the radical product innovation), but they are not important issues for nonincumbents. To explore this issue, we conducted some additional analyses. We isolated all SBUs that participated in the previous technology generation ($n = 130$) and reestimated the path analysis. In Table 4, we provide the results using the select sample. The results remain generally the same as in the previous sample, except for one key dif-

ference. The effect of specialized investments on willingness to cannibalize becomes large ($\gamma_{21} = -.28$) and significant at $p = .01$. This result suggests that specialized investments strongly decrease the willingness to cannibalize of incumbent firms.

The finding that specialized investments reduce willingness to cannibalize, whereas internal markets, product champion roles, and future-market focus increase it, prompts the following question: Can organizational factors help firms compensate for the negative effects of specialized investments? If so, these organizational factors would be a means for managers to break the trap of specialized investments. If not, firms with many specialized investments may be bound to become victims of their prior investments. To answer this question, we compared the standardized coefficient of specialized investments with that of the three other organizational variables in Figure 1 (see Table 4). Standardization enables us to compare the coefficients of different independent variables. The arithmetic sum of the three organizational variable coefficients is substantially higher than that of specialized investments (i.e., $\gamma_{21} < \gamma_{22} + \gamma_{23} + \gamma_{24}$, $p < .05$) in both the full sample of firms and the sample of incumbent firms. This result suggests that active internal markets, strong product champion roles, and a focus on future markets can more than compensate for the negative effect of specialized investments on willingness to cannibalize.

Test of Mediating Effects

Does willingness to cannibalize mediate the effect of specialized investments, internal markets, product champion influence, and future-market focus on radical product innovation? To test the mediating effects of willingness to cannibalize formally, we used the procedure suggested by Baron and Kenny (1986). As Tables 2, 5, and 6 indicate, the results fulfill the three conditions for mediation that Baron and Kenny (1986) specify.⁶ We conclude that the effects of specialized investments and internal markets on radical product innovation are mediated fully by willingness to cannibalize because the direct effects disappear when we control for the mediator. The effects of product champion influence and future-market focus on radical product innovation are mediated partially by willingness to cannibalize because the direct effects are reduced when we control for the mediator.

⁶For further details on the test of mediating effects, see Chandy and Telis (1998).

Table 4
RESULTS OF EXTENDED ANALYSIS
(Using data from incumbent SBUs only, $n = 130$)

Model Number	Dependent Variable	Independent Variable						R ²
		Willingness to Cannibalize	Specialized Investments	Internal Markets	Influence of Product Champion	Future-Market Focus	Firm Size	
1	Radical product innovation	.37***	.00	-.09	.11	.30***	-.01	.39
2	Willingness to cannibalize	—	-.28***	.23***	.27***	.31***	—	.50

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Note: All coefficients are standardized values.

Table 5
TEST OF MEDIATING EFFECTS
(Including all SBUs in the data set, n = 192)

Model Number	Dependent Variable: Radical Product Innovation					R ²
	Independent Variable					
	Willingness to Cannibalize	Specialized Investments	Internal Markets	Influence of Product Champion	Future-Market Focus	
1a		-.12*				.02
1b	.53***	-.02				.29
2a			.13*			.02
2b	.55***		-.04			.29
3a				.46***		.22
3b	.41***			.27***		.35
4a					.49***	.24
4b	.39***				.29***	.35

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Note: All coefficients are standardized values.

Tests of Alternate Models

The previous results suggest that the effects of product champion influence and future-market focus do not disappear completely when willingness to cannibalize is taken into account. Thus, our exogenous variables also might have statistically significant direct effects on radical product innovation. A comparison of alternate model specifications reveals that a model that includes the direct effects of all the organizational variables in Figure 1 provides a better fit with the data than a model that includes only the indirect effects ($W = 28.97 > \chi^2_{4df} = 9.49$). Results from the corresponding equation appear in Table 6. This full model does not provide a better fit than a reduced model that excludes the direct effects of specialized investments and internal markets ($W = 1.03 < \chi^2_{2df} = 5.99$). In Table 6, we also provide results from a model with radical product innovation as the dependent variable and our organizational variables as independent variables (without including the effects of willingness to cannibalize). A comparison of the R² values from Equation 1 (organizational variables with willingness to cannibalize) and Equation 2 (organizational variables without willingness to cannibalize) indicates that the R² increases by 22%—from .32 to .39 when willingness to cannibalize is included in the model.

These results indicate that most of the variables play the role we expected of them, except for one. Willingness to cannibalize is not a complete mediator of the effects of two of the four exogenous variables on radical product innovation: product champion and future-market orientation. We speculate that perhaps, in addition to affecting willingness to cannibalize, influence of product champion and future-market focus might increase firms' propensity for risk and their technological capability and, thus, increase radical product innovation. Additional research could examine the role of these variables.

DISCUSSION

In this section, we first discuss some implications of the findings, point to some limitations of the research, and then highlight areas for further research.

Implications

Many authors suggest that radical product innovations can have powerful effects on a firm's performance and perhaps on its very survival. Much current research has been focused around the Schumpeterian theory that size is an important determinant of radical product innovation. We identify an alternate driver of radical product innovation: the

Table 6
TEST OF DIRECT EFFECTS
(Including all SBUs in the data set, n = 192)

Model Number	Dependent Variable: Radical Product Innovation						R ²
	Independent Variable						
	Willingness to Cannibalize	Specialized Investments	Internal Markets	Influence of Product Champion	Future-Market Focus	Firm Size	
1	.33***	-.02	-.06	.22***	.23***	.00	.39
2	—	-.06	.01	.31***	.34***	—	.32

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Note: All coefficients are standardized values.

firm's willingness to cannibalize. The presence of investments specialized to an existing technology reduces a firm's willingness to cannibalize. However, internal markets, product champions, and a future-market focus overcome the negative effects of specialized investments. These results raise questions about some commonly held beliefs about technology and product market strategy.

Is size an important driver of radical product innovation?

The results on size raise doubts about the generalizability of a key hypothesis from Schumpeter's (1942) classic and heavily cited work. In contrast to the Schumpeterian view, our results suggest that firms of all sizes can be radical innovators (at least in high-tech industries such as those studied here) if they are organized appropriately. Therefore, the key issue to consider in high-tech markets is not which is the larger firm, but how is the firm organized? Ignoring this key issue is likely to lead to contradictory and perhaps dubious findings. More broadly, public policymakers always have been wary of large firms (note the antitrust actions against Microsoft and IBM in recent years). In the area of innovation, this fear is unfounded. Large firms, such as Hewlett-Packard, that are organized in a manner that promotes willingness to cannibalize will be innovative. Those that are not (e.g., telegraph firms such as Western Union) will be threatened or overrun by small firms that are more innovative. In either case, customers benefit with a stream of radically innovative products.

Is cannibalization an "error"? Marketers generally view cannibalization as an outcome of improper product positioning and management. A casual review of widely used marketing principles textbooks suggests that this view is commonly shared. For example, these texts refer to cannibalization as "a form of negative synergy," an "unfavorable consequence of ... new product introduction," a "risk," and a problem to "avoid." Another text categorically states that "if there is a great deal of cannibalization, sales shift from one product to the new product, with little overall gain for the firm" (Bearden, Ingram, and LaForge 1995, p. 267, emphasis added). Among eleven marketing textbooks that discuss the phenomenon of cannibalization, all except two frame it in a negative context. Only Kerin and Peterson (1997) and Dickson (1997) provide relatively balanced depictions of the topic.

One reason cannibalization is viewed as a problem is that it often occurs in the context of incremental new products or line extensions. Our results indicate that, in the context of radical product innovation, such views can be misleading or harmful. Assuming cannibalization is something to be avoided might cause managers to persist in courses of action, even when it is no longer appropriate to do so. To our knowledge, this study is the first to validate empirically the positive effects of willingness to cannibalize.

Should firms always stay close to their customers? Customers of the future frequently have different needs and wants than current customers. Similarly, competitors of the future might be different than current competitors. For example, Sony typically is not considered a photography company. However, it was the first to commercialize electronic imaging technology in the consumer market. If electronic imaging takes off, traditional photography firms might find Sony to be one of their biggest competitors.

The strong direct and indirect effects of future-market orientation suggest that radically innovative firms tend to focus on the future customers and competitors that could enter their markets, more than on those with whom they currently deal. This finding fits well with emerging thinking in the technology management area that suggests that listening closely to current customers actually might mislead and hurt firms (Christensen 1997). Given their information processing limitations, a strong focus on current customers might cause managers to focus less on future customers. Most current research in the area of market orientation does not differentiate between current and future markets. Our results clearly point to the need to differentiate between them. Further research on methods to identify likely future customers and competitors would provide valuable insights.

Should firms emphasize synergies among business units?

Lately, many authors have advocated a push for "synergies" among business units in firms (e.g., Vizjak 1994). Such a push, they argue, would enable firms to exploit interrelationships among business units. In contrast, internal markets involve high degrees of autonomy for business units, relative to the corporate office. Active internal markets promote willingness to cannibalize because individual business units only consider the specialized investments that they possess, which might be fewer than the specialized investments owned by the firm as a whole. Furthermore, the threat of internal competition causes managers to become more willing to cannibalize than otherwise.

An emphasis on synergy results in a decrease in both internal autonomy and competition among business units. In the product development context, the corporate office takes the lead in product strategy formulation and implementation. If the firm has many specialized investments, the corporate office is likely to emphasize incremental products, which build on these investments, rather than radical product innovations, which potentially could destroy them. Although good arguments exist for exploiting economies of scale and scope among business units, our study suggests that such efforts should not be made at the expense of reducing the autonomy of business units. Business units themselves should judge when and with whom to cooperate or compete.

Limitations and Further Research

This research represents an early inquiry into a complex phenomenon. It is easy to list the many limitations of the study, which greatly qualify the applicability of the findings. First and foremost, resource constraints required us to focus on a few potential drivers of radical product innovation. These few drivers cannot describe radical product innovation exhaustively. Additional research should identify other factors involved in innovation. In particular, researchers should study how a firm's propensity for risk, technological capability, formalization, and complexity affect willingness to cannibalize and radical product innovation (e.g., Chandy and Prabhu 1998).

Second, our model is better suited to explain radical product innovation among existing firms rather than start-ups. If a firm has absolutely no assets or organizational routines that relate to the previous technology, willingness to cannibalize would not play a role in explaining its level of

innovation.⁷ To the extent that innovation is driven by start-ups, willingness to cannibalize does not explain the entire phenomenon. The organizational variables we identify (product champion influence and future-market focus in particular) might affect radical product innovation directly in such situations.

Third, the current study is based on only three high-tech industries. Research should determine whether the findings hold equally well for low-tech markets. Such a quest might not be futile. For example, the demise of the typewriter, slide rule, and glass-plate camera suggests that today's stable, low-tech industries can be transformed quickly into tomorrow's fast-moving, high-tech industries. However, firms in relatively stable industries might have the luxury of longer response times to a technological breakthrough.

Fourth, we did not analyze firm performance in terms of profits and market share. This issue certainly warrants further study. The relation between radical product innovation and firm performance might not be straightforward (Golder and Tellis 1993). In the short run, such innovations appear to lead to higher profits and market share for the firms that pioneer them (Geroski, Machin, and Van Reenen 1993; Kleinschmidt and Cooper 1991). In the long run, failure to embrace a radical product innovation has caused the downfall of many an established firm (e.g., Tellis and Golder 1996).

Fifth, the scales for some of the variables must be improved. In particular, our scale for internal competition is not broad enough and might contain some ambiguity. Our scale for internal autonomy relates to general strategy rather than to specific decisions. This limitation might account for the generally weaker results of internal markets. Further research should involve examining specific decisions in which the SBU enjoys autonomy.

Sixth, some findings of this study suggest that many large, incumbent organizations now are able to overcome the inertia and commitment to prior technology that beset large firms previously. In many older industries, however, dominant incumbents appear to have succumbed to such inertial pressures (e.g., Foster 1986; Utterback 1994). These differences raise the question: Are the radical innovators of today different than those of the past? Only an historical analysis of radical innovations over time could answer that question.

CONCLUSION

What really causes some firms to be radically innovative over long periods of time, whereas many others ossify and perish? We suggest that the answer lies in the extent to which the firms are prepared to give up the old and embrace the new. Firms must break out of the natural human trait that propels them to use yesterday's bag of tools to solve tomorrow's problems. They must do so today, while they still have options, not tomorrow, when they will have nothing

left but a useless bag of tools. They must be willing to cannibalize before there is nothing of value left to cannibalize.

Cannibalization clearly is a difficult and painful thing to do. It requires the firm to swim against the tide of organizational inertia. Our results suggest that firms that are able to do so are designed specially for the purpose. They possess unique organizational features that help them overcome the natural instinct to preserve rather than destroy past investments. Thus, radical innovation might not be just the province of the small (or the large or the medium-sized). Firms of any size could play this game, if they have the right organizational setup.

APPENDIX: SCALE ITEMS

All Likert-type items use seven-point scales: "Strongly Agree"—"Strongly Disagree"). Items with an asterisk are reverse coded.

RADICAL PRODUCT INNOVATION (Adapted from Mahajan and Wind 1992; Price and Mueller 1986)
(Overall scale $\alpha = .72$)

1. This SBU rarely introduces products that are radically different from existing products.*
2. This SBU lags behind in introducing radical product innovations.* Likert-type scale (mean = 8.68; S.D. = 3.09)
3. Please indicate the number of radical product innovations introduced by your SBU in the last three years. Numeric scale (mean = 1.83; S.D. = 1.68)
4. % of total sales from radical product innovations introduced in the last three years. (Less than 1%; 1–5%; 5–10%; 10–20%; 20–30%; More than 30%) Ordinal scale (mean = 3.48; S.D. = 1.81)

WILLINGNESS TO CANNIBALIZE

(Mean = 34.99; S.D. = 8.15; $\alpha = .85$)

1. This SBU can easily change its organizational scheme to fit the needs of a new product.
2. This SBU supports projects even if they could potentially take away from sales of existing products.
3. We find it difficult to change established procedures to cater to the needs of a new product.
4. This SBU easily replaces one set of abilities with a different set of abilities to adopt a new technology.
5. We tend to oppose new technologies that cause our manufacturing facilities to become obsolete.
6. We are very willing to sacrifice sales of existing products in order to improve sales of our new products.
7. We can easily change the manner in which we carry out tasks to fit the needs of a new product.
8. This SBU will not aggressively pursue a new technology that causes existing investments to lose value.*

SPECIALIZED INVESTMENTS (Adapted from Anderson and Weitz 1992)

(Mean = 26.77; S.D. = 15.21; $\alpha = .93$)

1. Switching to the new technology involves losing a lot of the investment in the established technology.
2. It is difficult for us to apply investments made in the established technology to the new technology.
3. Many of our manufacturing skills cannot be applied to the new technology.

⁷We could argue that, typically, even so-called start-ups do not have zero investments in the current technology. The owners of these start-ups are often employees of existing firms who had some interest in the success of the firm with the current technology. However, they were more willing to leave their employer and invest in a new technology because their investments in the current technology were small compared with those of the employer. Alternatively, we might view start-ups as the limiting case of willingness to cannibalize increasing as investments decrease to zero.

4. Our current marketing abilities are not very useful in marketing products based on the new technology.
5. We have a substantial investment in facilities dedicated to the established technology.
6. We possess a large amount of assets that will have little value outside the established technology.
7. Much of our technical expertise cannot be applied to the new technology.
8. Many of our current operating procedures cannot be applied in the new technology.
9. To be successful in the new technology, we need to substantially change the manner in which we carry out many of our tasks.
10. We have to significantly reinvent this SBU to operate successfully in the new technology.
11. We have to retrain or lay off employees to operate successfully in the new technology.

INTERNAL AUTONOMY (Adapted from Aiken and Hage 1968; Gupta 1987)

(Mean = 17.66; S.D. = 6.37; $\alpha = .88$)

1. The corporate office has much more influence than the SBU managers in formulating the SBU's product strategy.*
2. Few strategic actions can be taken in the SBU until the corporate office approves the decisions.*
3. Even small product strategy issues have to be referred to someone in the corporate office for a final answer.*
4. All new product decisions need the corporate office's approval.*

INTERNAL COMPETITION

(Mean = 8.44; S.D. = 2.39; $\alpha = .63$)

1. The SBU is free to enter markets served by other SBUs in the firm.
2. When making strategic decisions, the SBU has to make sure it does not take away customers from other SBUs.*

PRODUCT CHAMPION INFLUENCE

(Mean = 25.14; S.D. = 5.79; $\alpha = .83$)

1. Product champions play an important role in this SBU.
2. Senior managers in this SBU strongly support champions of radical product ideas.
3. Activities of product champions have a clear impact on product development in this SBU.
4. Top managers in this SBU are frequently the most ardent champions of radical product ideas.
5. Product champions wield considerable clout in this SBU.

FUTURE-MARKET FOCUS (Adapted from Kohli, Jaworski, and Kumar 1993)

(Mean = 16.91; S.D. = 4.35; $\alpha = .72$)

1. The SBU gives more emphasis to customers of the future, relative to current customers.
2. Market research efforts in the SBU are aimed at obtaining information about customers' needs in the future, relative to their current needs.
3. We are slow to detect fundamental shifts in our industry (e.g., competition, technology, regulation).*

4. The SBU is oriented more toward the future than the present.

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