The theory of rejecting superior, new technologies

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We have so little information on the outside, on markets, on customers. Nothing—as many people have learned the hard way—is changing faster than distribution channels (Drucker, 1994).

Baker and Hart (1989) have emphasized that single-factor explanations have been singularly unsuccessful in explaining competitive performance, as well as management decision-making and behavior. However, research on the patterns, or scenarios, of decision-event streams may be useful for both understanding and predicting outcomes, including the success and failure to adopt proven superior technologies. Such research should include mapping of the multiple-factor scenarios of both success and failure when implementing combined marketing-buying strategies. Such mapping research of failure in marketing-purchasing superior new technologies is the focus of this contribution.

Bringing a superior technical innovation to market is no guarantee of industrial customer acceptance of the innovation and replacement of a currently used (inferior) product service technology (Gatignon and Robertson, 1989; Ram, 1987; Sheth, 1981). Based on a survey of the research literature described in this report, this proposition holds even when the evidence is overwhelming that the adoption of the innovation will enable the customer to both dramatically decrease the customer’s product-service manufacturing costs and improve both performance and conformance quality of the customer’s delivered product-service to downstream customers.

Adoptions of new, electronic-based, manufacturing technologies, occurred in some US firms in many industries in the 1980s and early 1990s resulting in the counter-intuitive combination of dramatic increases in product quality with dramatic decreases in manufactured costs (see Gross et al., 1995; Narasimhan et al., 1993; Woodside, 1994). This new reality has been named, “The Technology Paradox: as high technology becomes dirt cheap, producers must find new ways to prosper. They have” (Gross et al., 1995).

However, successfully introducing superior technologies (compared to inferior performing, currently installed technologies) in the marketplace often does not translate into commercial success for the superior new technologies. For industrial products-services, “typically a long time is required from the introduction of a superior industrial product (and/or technology) until it has replaced half of the uses of the inferior product (or installed base technology). In one extensive study, the modal time was 12-15 years, with 23 percent of the superior products requiring 24 to 47 years. See Martino et al. (1978) and Linestone and Sahal (1978) (quoted in Moore and Pessemier, 1993, p. 76). The causes of delaying and rejecting technological innovations (that are proven to combine superior performance and lower
total costs compared to currently operating technological processes-equipment) have received little attention by product innovation researchers.

Ram (1987, p. 36) introduced the concept of “innovation resistance” as a summary construct for customers not adopting a superior new technology. While Gatignon and Robertson (1989) explicitly examine both adoption and rejection outcomes of laptop computers for use by organizational salesforces, their “hypotheses account only for adoption because the lack of previous findings precludes concrete hypotheses about rejection”.

Senge (1990, p. 348) quotes Ed Simon’s (President and COO, Herman Miller Company) general observations on this widespread enterprise malaise that affects many firms in many industries:

I believe that human beings truly seek to live in a more creative orientation. But people don’t realize the incredible extent to which traditional organizations are designed to keep people comfortable and to inhibit taking risks. The learning cycle is a continuous process of experimentation. You cannot experiment without taking risks. Despite rhetoric to the contrary, I believe most American businesses are engaged in building “no-risk” environments.

The purpose of this article is to describe several propositions on the causes and realized strategies (Mintzberg and Waters, 1985) that are likely to be found in different industrial marketing-purchasing situations involving rejecting versus accepting superior technological innovations – innovations independently verified to provide superior operating characteristics and lower total costs compared to currently used products and manufacturing processes. An initial theory of customer rejection of superior manufacturing technologies and product-service innovations is developed as a vehicle for summarizing a set of related propositions explaining such behavior.

The following issues are raised with tentative answers offered based on a literature review. In what ways are both marketers and customers responsible for rejecting superior technological innovations? In natural field settings, how do a few marketers and customers overcome such rejection and end-up successfully adopting superior technological innovations and replacing the in-place, and now out-of-date technologies? What general observations, conclusions, appear to follow from case-study field research on rejecting and accepting technological innovations?

First, a brief review is presented of relevant literature on successful and unsuccessful marketing-purchasing of industrial innovations. In this review several core and micropropositions are developed; these propositions are relevant for improving environmental scanning and learning in organizations involved in both marketing and adopting superior innovations. Second, the theory of customer rejection of superior industrial technologies is described. Third, suggestions for empirical research on testing theory on rejection of superior, new technologies are offered.

Propositions and findings from the literature
Many important, core, propositions related to both marketing and adopting superior technological innovations can be found in the relevant academic and business literatures. First, Drucker (1994, p. 108) proposes that technology is no longer a series of parallel streams coming out of major research labs and universities: “It is chaotic and therefore has to come from outside (e.g. from customers, customers’ customers, and others in seemingly unrelated industries). And about this outside we know nothing.” Drucker
(1994, p. 109) goes on to observe: “We must begin to organize information from the outside, where the true profit centers exist. We will have to build a system that gives this information to those who make decisions.”

Biemans (1989, 1990) provides details on the innovation chaos from in-depth analyses of 17 cases on both marketing and adopting superior technological innovations in the Dutch medical equipment industry. Biemans (1990) relates the central conclusion of his research to earlier observations by Quinn (1985): “Innovation tends to be individually motivated, opportunistic, customer responsive, tumultuous, nonlinear, and interactive in its development. Managers can plan overall directions and goals, but surprises are likely to abound.”

Biemans (1990, p. 539) emphasizes that the revealing title of Quinn’s article, “Managing innovation: controlled chaos,” “captures the essence of our argument: even though innovation (including marketing and adopting innovation) processes are very much characterized by chaos, in the sense of surprises and unexpected changes, they can still be controlled (by both marketers and adopters) to a certain extent. The three Cs of cooperation, coordination, and communication are key elements in successfully developing (commercially viable) innovations through reduction of the level of chaos.”

Proposition 1

$P_1$: Managing technological innovation marketing/adoptions is controlled chaos

Drucker’s and Quinn’s central point can be stated as a general, and very insightful, proposition: ($P_1$) managing technological innovation marketing/adoptions effectively is having some success at controlling chaos. Related to $P_1$ is Senge’s (1990) detailed observations that most managers develop/use oversimplified and inaccurate mental models of how the world works, including how marketing and adopting technological innovations will occur.

More specifically, new insights fail to get put into practice because they conflict with deeply held internal images of how the world works, images that limit us to familiar ways of thinking and acting. That is why the discipline of managing mental models – surfacing, testing, and improving our internal pictures of how the world works – promises to be a major breakthrough for building learning organizations (Senge, 1990).

Quinn’s global conclusion (stated formally as $P_1$) can be broken down into a series of micro-propositions (MPs). The following micro-propositions are based on Quinn’s conclusions and the literature cited.

$MP_1$: Innovations tend to be individually motivated

Learning about superior technological innovations and attempting to transform an organization from an established older technology to the superior technology is hard work financially and socially. Most persons become comfortable with the status quo – working with the established technology – and do not want to make the commitments in time and effort, and do not want to assume the risks involved, in either marketing and adopting the superior new technology. Socially, comfortable co-workers may be expected to object to the efforts of champions attempting to promote the adoption of new technologies. Nevertheless, a few individuals surface who...
embrace marketing and/or adopting the new technology as a calling rather than simply a good idea. From the manufacturing-marketing side, Schön (1967) refers to such unique people as product champions; from the adoption side, von Hippel (1988) identifies such individually motivated persons as lead users; also see Burgelman (1983) and Hutt et al. (1988).

A general human tendency toward favoring “defensive routines” (mental maps of how things are done now and should continue to be done) prevent most persons from learning new routines/technologies. Defensive routines are “habitual ways of interacting that protect us and others from threat or embarrassment, but which also prevent us from learning” (Argyris, 1985).

Some marketing and adopting implications of MP1 include the following observations. Product champions and lead users must be found or grown for superior technological innovations to flourish. Finding organizations having such persons may not be good enough because too few of them (both organizations and persons) may exist; the power of the installed-base of the inferior technology may preclude such persons from raising their heads (see Herbig and Kramer 1993; Herbig et al., 1995). Thus, Herbig and his colleagues define the installed base effect as the massive inertia produced by an existing technology’s installed based that impedes the adoption of a new technology or new product.

**MP2: Marketing/adopting a technological innovation is opportunistic and requires interactive learning**

Adoptions of new industrial products and technologies is concentrated in a few firms in a customer industry; this concentration may continue over several years. For example, Cardozo et al. (1988, p. 106) found a 20/70 concentration. “For all [new] products combined, the top 21 percent of customers (28 customers in total) accounted for 70 percent of total sales during the five-year period. The top five customers for each (new) product (25 customers in all, 19 percent of total customers) together accounted for 68 per cent of sales. Concentration of sales among the top five customers for each (new) product ranged from 55 to 80 percent of the total purchases of that product.” In their study, repeat purchasers of the new industrial products constituted 61 percent of all customers and accounted for 93 percent of all units purchased during a five-year period after product introduction.

The strategy implications following the Cardozo et al. (1988) findings: adoption of technological innovations should be expected to be concentrated among a few customer firms within any one industry of customers, adoption will not to be widespread across many customers for a long time; for many products, repeat purchases among these few adopters is critical for success of the new technology. Thus, in any one customer industry, marketers of technological innovations need to recognize and respond to unique customer opportunities by concentrating marketing resources to nurture adoptions and repeat purchases among these few adopters.

Consequently, successful marketing of technical innovations requires interactive learning among:

- the manufacturer of the new technology;
- lead-user customers;
channel members, for example, the manufacturing agent representing the manufacturer; and

- third-party specialists who help overcome roadblocks (e.g. technical and financial) in getting the innovation up-and-running at specific customer sites.

Related to third-party participation in the innovation adoption process, in his study of 17 industrial case studies, Biemans (1989) concludes that one of the major causes of rejection of superior new technologies is that manufacturers of the new technologies often interact insufficiently with various third parties during the critical development and testing stages of the innovation. Wilson and Woodside (1992) and Woodside (1994) concluded that additional third-parties may be necessary to create and strengthen the necessary weak ties among the multiple participants in the marketing-buying of new technologies.

**MP3: Successful marketing/adopting technological innovations is customer responsive**

This micro-proposition leads to the often overlooked insight that a request from a customer’s customer (the CC) to evaluate (and test on-site) the operating and downstream benefits provided by a technology innovation is likely to receive more attention that a request made only by the marketer of the new technology. Given that superior technological innovations usually result in superior performance quality, higher conformance product quality, and lower unit cost in the workpiece being delivered to the customer’s customer, the CC has a strong vested interest in motivating the supplier firm to adopt such technological innovations. A related marketing problem-opportunity is that the CC may be unaware of the available technological innovation because of the high comfort level his/her supplier has operating with the out-of-date installed technology and the lack of awareness/benefit-building contact by marketers of the new technology with these CCs.

Given the substantial powers of inertia and the installed base of the out-of-date technology, recognizing and activating longer routes (designing a “pull” versus a “push” strategy) may be more than beneficial for the technological innovation, it may be a necessity: the marketer of the technological innovation may need to recruit the CC to champion the new product or manufacturing process with the CC’s suppliers of component parts and finished workpieces.

**Network relationships**

These observations lead to the strategic and theoretical importance of examining network relationships among firms in the marketing/adopting of technological innovations (see Arabie and Wind, 1994; Nicosia and Wind, 1977; Taylor and Kaufmann, 1990; Wisnieski, 1991; Woodside, 1994). Research on the development of weak ties (Granovetter, 1973) between manufacturers of technological innovations and CCs, as well as creating and maintaining weak ties among each of the three parties with other, “third-party”, participants in successful adoption processes of new technologies provide empirical support for these observations (see Biemans, 1989, 1990; Woodside, 1994).

Imparato and Harari (1994) describe the critical impact of customers’ customers on causing new technology adoption by both manufacturers and their channel intermediaries; they label “looking a customer ahead” their...
first organizing principle for “jumping the [technological ‘S’] curve” by embracing new superior technologies and discarding obsolete installed technologies.

Willingness to look a customer ahead is the exception rather than the role among managers in established organizations. Cooper and Smith (1992) note that “where established firms enter young industries, they do not pursue the new product aggressively, and they continue to make substantial commitments to their old product even after its sales begin to decline (Imparato and Harari, 1994, p. 104).

MP4: Marketing/adopting a technological innovation tends to be tumultuous
Among industrial participants in the marketing and adopting/rejecting of new industrial technologies, tumult is likely to occur in two ways:

(1) inside the customer firm in discussions among advocates of the new versus the old technologies;

(2) between multiple marketing, customer and third-party firms presenting conflicting “facts” and a continual series of revised proposals to switch, or keep, the customer-firm to the new, or current, form of technology.

In the scholarly and popular business literature, very little has been written to describe these tumults, or to build theories useful for predicting/explaining outcomes such unsettling processes (for a theory-in-use exception, see Yoder, 1994).

We do know that champions of the older technology product-forms do not go quietly into the good night; they fight. And we know that customer-firms successfully making “the chasm leap” from old to the new technologies (see Starr, 1991) often involve third-party firms to verify, help test the new technology on-site, and recommend such transformations (see Biemans, 1990; Herbig and Kramer, 1993).

MP5: Innovation marketing/adopting processes tend to be nonlinear
This micro-proposition implies that push-only marketing strategies for innovations are doomed; marketers of innovations need to work patiently with customers who are “lead users” (von Hippel, 1988) to help pull innovations through distribution channels. Often, such pulling-strategies involve using new distribution linkages that were not planned-for-use originally by the marketer. Consequently, marketers of innovations need to plan two actions often overlooked:

(1) initiating direct contacts and working closely with potential lead users of customers’ customers located in multiple industries;

(2) opening-up new distribution linkages that are preferred by lead users in customer categories previously unrecognized by the marketers (see Lynch, 1994).

For example, such strategies were used by Hewlett-Packard in the firm’s successful relaunch strategy of inkjet printers: toward the end of a two-day strategy retreat in 1988, the H-P inkjet product development team identified a new target market, a new distribution channel, and a different competitor to gain market acceptance for the failing innovation. In late 1994, six years later, the new strategy appears to be a major cause for both the dramatic increase in sales of inkjet printers and the substantial decline in sales of dot matrix printers.
The new H-P strategy included targeting small-firm customers currently buying dot matrix printers who were most sensitive to a combination of better performance-quality and low purchase-price (instead of the previous strategy of targeting large-firm customers currently buying laser printers and demanding the best performance-quality and who were less purchase-price sensitive). The new marketing strategy included high involvement by H-P in gaining store channel distributions of its inkjet printers and demanding that these stores place these printers alongside Epson’s dot matrix printers (for additional details see Yoder, 1994).

The details of this example are described to imply that a “shift of mind, seeing the world anew” (Senge, 1990), is often a necessity for overcoming the environmental blocks that greet innovations that are technically superior in performance and priced competitively.

The H-P case is presented to suggest that while the nitty-gritty details may vary, the problems and solutions described can be found in the realized strategies for most successful innovations. Senge (1990, p. 71) develops a compelling case that systems thinking is part of the antidote “when doing the obvious thing does not produce the obvious, desired outcome.” Systems thinking is the discipline for seeing the “structures” that underlie complex situations, and for discerning effective versus ineffective (high versus low) leverage points for improving system performance.

“Reality is made up of circles but we see in straight lines” (Senge, 1990, p. 73). In thinking about marketing-distributing the initial focus of the marketing strategists of the firm manufacturing the innovation is on these existing distribution structure that is most attractive and/or visible to the strategists, and most likely to be dominated by distribution and “end” customers who will reject the innovation. The strategists in the manufacturing firm most often will focus initially on the biggest-sized customers currently buying the older, proven technology that the innovation is designed to replace. Given the powers of customer-inertia and the relationship marketing programs of manufacturers of the older technology, such a focused marketing effort for the innovation will almost always fail initially (or result in very slow/delayed customer adoptions, see Herbig and Kramer, 1993; Herbig et al., 1995).

Often, other (i.e. small-sized) customers in different industries than intended initially need to be identified for successful market entry somewhere for the technological innovation. This script of focus->failure->refocus->success in marketing/adopting might be shortened if dynamic complexity of such systems is recognized by all the parties in the distribution channels-including manufacturers, within-channel-members, third-parties, and large- and small-size customers.

Elg and Johansson (1994) report a detailed case study of a network of manufacturers, wholesalers, and retailers in the Swedish food industry on how large wholesalers were successful in blocking a new, superior technology (i.e. a computer/based data-information system). These researchers concluded, “The success of the more powerful organizations (of wholesalers) suggests interorganizational inertia as a major a factor in cooperation and strategic change (prevention) in industrial networks” (Elg and Johansson, 1994, p. 2).
Proposition 2

$P_2$: With few exceptions, new channel connections with new customers are required to achieve marketing success for new superior product technologies.

This proposition follows directly from the work of Herbig and his colleagues, as well as field studies by Biemans (1989) in the medical equipment industry, Elg and Johansson (1994) in the Swedish food industry, and Woodside (1994) in industrial manufacturing.

While new users are not shackled by a commitment to an old standard, current users frequently are (Farrell and Saloner, 1985). This inertia leads directly to the Installed Base Effect. Consequently, since old users are usually hesitant to switch immediately to the new technology, most of the growth of a new product must come from new, previously uncommitted users (Herbig et al., 1995, p. 393).

Proposition 3

$P_3$: Rejection of a new superior technology by heavy users of the installed base technology is associated with lack of familiarity-experience in buying from the manufacturer of the new technology compared with high familiarity-experience-trust-comfort-efficiency in buying from known suppliers providing the installed base technology.

Given that new superior technologies are often not developed by manufacturers of the dominant installed base technologies, customer adoption of the new technologies requires the customer to move outside his/her comfort zone. Thus, the new superior technology suffers from a triple-whammy effect: the customer is unfamiliar with the technology applied to his/her manufacturing process; the customer is unfamiliar with the manufacturer of the technology; the installed base technology is up-and-running.

Consequently, high relative advantage of a new manufacturing technology over the installed base technology is not enough to insure changeover. A combination of additional forces likely need to be present to force customer installation of the new superior technology. Such additional forces are likely to include requests (i.e. pressure) by important customers of the prospective buyer of the new technology to provide the performance benefits and lower prices associated with the new technology. Also, third-party technical expertise-endorsement, and on-site installation, of the new superior technology may be required. Third, additional third-party participation in financing the purchase-installation of the new technology may be required (e.g. see Woodside, 1994).

A corollary to $P_4$ is the lack of standards in engineering/purchasing specifications for the new technology coupled with the in-place and operating standards for the installed base technology. “Failure to meet standards” is used often as a primary reason to reject proven, superior performing new technologies by users of the installed base technology. This corollary holds especially when:

- the current standards include materials and design features held exclusively by the installed base technology versus when the standards focus exclusively on performance requirements of the product-service being purchased;
important network externalities relate to purchases of the installed base technology that need to be changed or eliminated if the new technology is adopted;

much effort, time, and risk is associated with testing-approving-writing new standards associated with buying the new technology.

A new manufacturing firm (e.g. firm X) considering the purchase of alternative technologies (i.e. the older technology installed at many firms competing with X versus a new, superior technology) is more likely to consider the purchase of the new technology versus an on-line manufacturing firm operating with standards related to the installed base technology. Herbig et al. (1995, p. 393) conclude, “since old users are usually hesitant to switch immediately to the new technology, most of the growth of a new product [e.g., an industrial electric oven versus a gas oven, a variable-speed electric motor drive versus a single-speed drive] must come from new, previously uncommitted users.” This proposition holds true for purchases of MRO (maintenance, repair, and operating items) and component parts.

Proposition 4  
$P_4$: Defensive marketing tactics by marketers of the installed base technology occur to block the adoption of a new, superior technology.

Though often overlooked in planning the launch of new, superior technologies, the marketers of installed base technologies do not often fade away without fighting. Substantial evidence supports the proposition that supplier firms that sustain long-term relationships with customers are more able to retain and improve their own profitability than firms with high customer turnover (see Kalwani and Narayandas, 1995).

Marketers of new, superior technologies should expect counter-attacks from marketers of the installed base technologies (see Kotler, 1994, pp. 384-90). Given the ongoing working-relationships with suppliers of the current technologies, the odds are strongly in favor of the installed base technologies winning such battles. In fact, some industrial customers have been found to review specifications and proposals of marketers of new technologies with their current suppliers of the installed base technology. This process results in the conclusion, “the new, superior technology might work elsewhere but it can’t work here” (see Woodside, 1992).

Systems-thinking that includes such feedback status-quo forces and planning to such counter-attacks is rarely described, and rarely done, by marketers of new, superior technologies. In fact, the most notable finding on the marketing strategies of small high technology firms is the lack of:

- formal marketing planning of any sorts;
- lack of knowledge about customer applications of the new, superior technology;
- the general lack of expertise in implementing marketing strategies (see Oakey, 1991; Oakey et al., 1990).

Proposition 5  
$P_5$: Third party involvement in the marketing-purchasing process is necessary to achieve adoption of the new, superior technology.
Substantial empirical evidence from case research studies supports this fifth proposition especially from European scholars (see Biemans, 1989; Gemunden, 1985; Gemunden and Walter, 1994; Gemunden et al., 1992). In Europe, Biemans’ (1989, 1990) in-depth case research reports of third-party involvement on the adoption of proven, superior new technologies provides strong support of P5. Biemans concludes from his research in The Netherlands that third-parties contribute substantially both in developing working prototypes of new technologies and in commercially launching superior new technologies, and most manufacturers of the new, superior technology are focused “insufficiently” on customers compared with their first, true-love, the new technology. This second conclusion fits perfectly with a central conclusion on innovation and marketing of new technologies by British firms reported by Oakey and his colleagues (Oakey, 1991; Oakey et al., 1990).

In North America, Wilson and Woodside (1992) and Woodside (1994) report on third party activities in creating, sponsoring, and sustaining new inter-firm organizational associations to stimulate marketing-purchasing of a new technology. Wilson and Woodside (1992) report on the strategy implementation of an electric utility company in designing and financially sponsoring an association of industrial distributors for marketing new heating/cooling technology equipment (heat pumps) for commercial and residential customers. Both the manufacturers of the new technology and most industrial distributors tended to be inactive in marketing the new technology. The third-party organization and its electric utility sponsor provided both training and financial support to both distributors and their customers to gain replacement of the installed base technology and adoption of the new technology.

Woodside (1994) reports on the strategy implementation work of a “network champion” to gain adoption of superior new technologies in manufacturing. Network champions are those firms and individuals bringing about new relationships among firms at multiple channel levels to support and sustain the marketing and purchasing of new, superior technologies (see Woodside, 1994; Woodside and Wilson, 1994).

**Proposition 6**

*P6:* Within the customer firm, the appearance of an innovation buying champion (IBC) is necessary for overcoming resistance, gaining acceptance and purchasing a superior new technology that replaces an installed base technology.

Ridicule and skepticism may be the initial (and long-term) reactions to superior new technologies by some members of the buying center in the customer firm. One or more persons in the buying center may need to champion the idea of seriously evaluating the innovation in terms of its performance capabilities, and its impact on revenues, costs, and profits. Most likely, someone with substantial organizational power has to be won over to advocate the new technology; the IBC has to be able to handle the personal criticism s/he is likely to receive about causing waves (e.g. “extra work for us in testing something that we don’t need and does not meet our specs”).

The IBC concept for buying a superior new technology is analogous to the product champion concept in developing and marketing a new technology.
(Burgelman, 1983; Maidique, 1980; Schön, 1967). Peters and Waterman (1982) propose that product champions are found for almost all successful innovations. This proposal likely holds true across several organizations developing, marketing, and buying a superior new technology: manufacturing firms including suppliers to the new technology firm; third parties; and lead users. If the IBC concept is viable, research is needed on identifying such persons and the streams of interactions, decisions and events included in their support of the adoption of the superior new technology and overcoming resistance to change.

Initial theory of customer rejection of superior, new manufacturing technologies and new product-service innovations

Figure 1 is a summary of some of the propositions described in the previous section. The model shown in the Figure is intended as a rudimentary expert system (see Harmon and Sawyer, 1990) of acceptance/rejection of new superior technologies. The model represents a general framework of the set of heuristics and events operating through time that lead an enterprise to embrace or reject a new superior technology. Thus, the attempt here is to respond to Sheth’s (1996) call for theory development beyond case study description to reach abstract theories, laws, and principles.

**Figure 1. Buyer model of industrial supplier rejection, relationship continuation and search for new supplier relationships**
The new technology evaluation and adoption/rejection model in Figure 1 represents a simplified binary decision-process model intended to reflect buyer information processing and decision processes implemented often in evaluating new, superior manufacturing technologies. Certainly not all persons responsible for buying the installed base technology or evaluating new, superior technologies follow the decision routes shown in the Figure. However, the model is a simplified summary of the reality faced often by marketers-buyers of new superior technologies.

The model is based on intensive interviews of channel members, including customers and third-parties, involved in marketing and adopting/rejecting a new industrial technology. Details of this empirical study are reported in the next section.

This new technology evaluation model was developed using a think aloud (van Someren et al., 1994) methodology as well as a summary “gatekeeping” (Montgomery, 1975) analysis of key questions raised and answered by buyers considering information about new technologies. Montgomery (1975) developed a similar gatekeeper model from interviews with three supermarket channel buyers evaluating 124 new product proposals. Gatekeeper modeling includes hierarchy threshold analysis: the researcher searches for a variable and for a value of that variable that enables us to reach a classification decision for all or a part of our sample while making very few errors; following this initial classification, the researcher searches uses additional variables for further classification until a classification is reached that indicates acceptance or rejection of the alternative the research is focused on (e.g. adoption/rejection of a new technology).

Among the advantages of Montgomery’s modeling approach is that it appears to be a less labor-intensive way of developing a process model than more traditional methods. On the other hand, there is no assurance that the resulting model has any descriptive validity. Rather, the approach provides a heuristic for developing an “optimal” node sequence, “optimal” in the sense it appears to minimize the amount of information processing necessary to arrive at a decision. Such an approach offers a means to attain parsimony, and a criterion by which to evaluate and perhaps to attempt to modify descriptively valid information processing models (Hulbert, 1981, pp. 35, 39).

Wind (1967a, 1967b, pp. 106-9) used a similar, think aloud, research method to collect data for buyers’ evaluation for a hypothetical new part needed by an R&D engineer. While several similarities exist in both the methodologies and findings, Wind’s model does not consider the issue of a new technology replacing an installed base technology.

While the model summarized in Figure 1 appears to be a micro-analysis of information search and decision making, the description included offers only a broad outline of how buyers address related issues in evaluating superior new technologies versus installed base technologies. Marketers and scholars interested in how a new technology overcomes the installed base effect would want to learn the detailed, individual and group, mental steps involved in going from box 10 to box 13 in Figure 1. In response to this issue: research Findings reported here and elsewhere
(Woodside and Sherrell, 1980; Woodside and Wilson, 1994) indicate that buyers prefer to include a period of local, in-plant testing of the new technology whenever possible, before adopting the new, and eliminating the installed, technology.

The starting point of the model: prior experience with the vendor

Note in Figure 1 that in response to the initiation of a buying problem or being asked to consider a new technology (box 1), a buyer asks himself/herself if this is one of my preferred suppliers (box 2). Typical self-asked questions include the following: “Do I know this guy? Am I buying from him/her now? Do I trust him/her? Do I know for sure that the manufacturer s/he represents produces high quality workpieces that meet my firm’s engineering standards at a price I can live with?”

Because the innovation process often occurs by manufacturers and lead users outside of the existing channel manufacturing, marketing and purchasing the installed base technology, the superior new technology faces a tough hurdle from the start. For the new technology, the buyer is often unfamiliar with the:

- industrial manufacturing representative;
- manufacturer;
- new technology itself.

Consequently, for new superior technologies the route most often taken from box 2 is to box 3 and from boxes 3 to 6. The need to create new relationships among new channel members is a central requirement in gaining adoptions of new superior technologies and the lack of buyer knowledge and working relationships in such new channels is a primary, cause for early rejection of new technologies.

The customer considers the new superior technology: getting in/out of boxes 7 and 10

To achieve consideration and further evaluation, the information about the performance characteristics of the new superior technology needs to be:

- overwhelming;
- supported by third-party sources judged to by the customer to be reliable;
- able to withstand the immediate attack by sources loyal to the installed base technology.

Most superior new technologies fail to meet all three of these requirements among current buyers/users of the installed base technology. Consequently, for most current customers of the installed base technology, the answer to box 7 in the Figure is negative. Thus, node 16 is reached: both the new vendor and the new technology are rejected.

Offering overwhelming relative advantages. To overcome the installed base effect, the relative advantages (Rogers and Shoemaker, 1971; Soete, 1985) for adopting the new superior technology have to be overwhelming compared to the installed base technology in regard to three dimensions of quality:

1. a combination of more accurate, and/or better and greater numbers of, performance features in the workpiece;
(2) more reliable conformance quality (e.g. greater than sixth sigma defect-free performance); and
(3) higher fitness-in-use, customer satisfaction.

Also, this combination of relative advantages should be offered at a lower, total operating-life cost to the customer for the new versus installed technology. In the 1990s, the replacements of natural fuel-based technologies with electronic technologies in manufacturing are examples of such combinations of higher quality (i.e. performance, conformance and fitness-in-use quality) with lower total operating-life cost (see Gross et al., 1995; Woodside, 1994).

Support by third-party sources. Second, third-party sources must provide testimonial support concerning the relative advantages and lower cost of the new versus installed base technology. Such endorsements help to counter the argument offered by members of the customer’s firm that, “our local situation [industry, company, operating site] is unique and it would not work here.” Herbig et al. (1995, p. 391) also stress this negative view toward the new technology, “While potential adopters know about the innovation, many do not know enough about its actual performance within their own specific economic environment. This uncertainty (risk) often leads to the inertia inherent in the installed base effect.”

A localized on-site test of the new technology may be required by the customer firm to overcome the it-can’t-work-here objection. Examples of such field tests of new technologies have been reported for MRO items (Woodside and Sherrell, 1980) and potable water treatment plants (Woodside and Wilson, 1994).

Withstanding attacks from persons loyal to the installed base technology. Several types of arguments against serious evaluation of a new superior technology are likely to arise:

- we have no time or budget to evaluate the new technology;
- why fix something that is not broken;
- the new technology has a serious operating flaw that prevents our adoption;
- our situation is unique;
- its physical and performance features do not meet our engineering standards;
- the risks of operating with the new technology are too great-the financial risks and the possible harmful impact on relationships with our customers;
- we have no funds available to test the new technology locally, even if we wanted to do so;
- the suppliers of the installed base technology are also our customers and we will harm these relationships if we replace the installed technology with the new one.

Consequently, negative responses to box 10 occurs often for most users of installed base technologies.

Providing convincing additional evidence in favor of a new superior technology to counter these counter-attacks usually involves a multi-party,
network marketing strategy of the manufacturer of the new technology working closely with channel members and third-party enterprises. Gaining the support of customers’ customers (CCs) for the new technology by demonstrating its relative advantages and having CCs champion the new versus installed technology has been found to help overcome the inertia inherent to the installed base effect (in Woodside, 1994, Figure 9).

In addition, at some point in the adoption process an inside customer-site, new technology champion needs to emerge to fight for its adoption. An example of such a new-tech champion is found in case study research reports in industrial marketing and purchasing (e.g. Woodside, 1981a). This level of detail in the adoption process is not included in the Figure.

Covering all risks of trial and adoption (Box 13)
Given the multiple reasons for not adopting the new, superior technology and the lack of marketing-customer knowledge and financial resources of many new technology manufacturers (see Oakey, 1991), involvement by third-parties often becomes a necessity in providing the technical and financial resources required by customer firms to install, test, and adopt the new technologies. For several, new electronic technologies used in manufacturing, starting in the 1980s in the US, some electric utility companies served this third-party role in providing technical and financial support for their commercial customers. Examples of such marketing programs include the new technology marketing programs offered by Duke Power in North and South Carolina; Entergy Corporation in Louisiana, Arkansas, and Mississippi; such programs include paying for all testing costs; and in some cases, for the new technology manufacturing equipment and guaranteeing that the new technology would surpass the workpiece performance of the installed base technology (see Woodside, 1994). Biemans (1989) reports details of third-party support for both marketers and customers in adoptions of new medical equipment in hospitals in The Netherlands. More complex networks of firms supporting the adoption of new technologies in extensive case studies are reported by Hakansson and Snehota (1995).

Meeting the new technology challenge by suppliers of the installed base technology (Box 11)
After effectively holding back, slowing-up, the adoption of a new superior technology, almost all manufacturers-marketers of the installed base technology fail to change in time. Cooper (1986) reports that in 56 of 58 cases of major innovations studied, the established or dominant firm failed to make the necessary transition to the next generation of superior technology. Imparato and Harair (1994) offer useful heuristics for practicing the necessary creative destruction to “jump the technology curve.”

Note that Box 11 in the Figure emphasizes the status-quo benefits of the supplier of the installed base technology. Most customers would prefer to be able to buy the new technology from trusted suppliers; industrial customers are supportive of long-term relationships with their suppliers (see Kalwani and Narayandas, 1995). However, if supporters of the new technology are able to reach box 11 in the Figure, then they are less likely to be thwarted from gaining a share of a customer’s requirements by actions of suppliers of the installed base technology. Similar to manufacturers of new technologies not planning on counter-attacks by suppliers of the installed base technology,
most suppliers of the installed base never believe Box 11 can be reached by suppliers of new technologies until it is too late.

Empirically testing the model
The model on rejection of superior new industrial technologies was developed both from a review of relevant literature and one set of data on channel and customer evaluations of a new technology. Adequate testing of such a model requires the use of an additional set of data not used in developing the original model (see Gladwin 1989; Howard and Morgenroth, 1968; Morgenroth, 1964). Thus, two sets of data need to be collected and used; both sets need to include interviews with channel members and buyers involved in marketing-purchasing the installed base or new technology.

Central conclusions and suggestions for research
The focus here has been on the seemingly unexpected: market failure on proven, superior, new industrial technologies. The central conclusions of the reported field study include the following points:

• overcoming resistance in the marketing channel and among heavy users of the installed base technology is a task more formidable than likely realized by manufacturers of superior new technologies;

• finding/serving customers responsive to the benefits of adopting the superior new technologies likely requires developing hybrid marketing channel relationships.

Theories on customer rejection and acceptance of new superior technologies would benefit from thick descriptions of the streams of behavior, decisions, and networks of relationships that occur through several months of marketing and evaluating such technologies. To do such work involves: a triangulation of data collection methods (Denzin, 1978; Jick, 1979); getting face-to-face with some respondents; and buckets-of-time. Mail surveys do not permit learning about the unknown relationships and third-party participation that we can expect to identify by getting-out into the field.

References and further reading
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