PREFACE

Product sales, especially those of new products, are influenced by many factors. These factors are both internal and external to the selling organization and both controllable and uncontrollable. Due to the enormous complexity of such factors, it is not surprising that product failure rates are relatively high. Indeed, new-product failure rates have variously been reported in the range of 40 to 90 percent.

This situation, however, has not deterred marketing researchers from developing and designing techniques to predict or explain the levels of new-product sales over time. The proliferation of the Internet, the need to plan for the launch and exit times of various generations of a product, and the shortening of product life cycles are challenging firms to investigate market-penetration or innovation-diffusion models. These models not only provide information on new-product sales over time but also provide insight on the speed with which a new product is being accepted by various buying groups, such as the innovators, early adopters, early majority, late majority, and laggards.

New-Product Diffusion Models attempts to assess the state of the art of both the theoretical development and the practice of innovation-diffusion models of new-product acceptance. The state-of-the-art assessment includes contributions by individuals who have been at the forefront of developing and applying these models in industry. The twelve chapters, covering various issues related to new-product diffusion models, are written by 32 authors from 25 different universities and organizations in the US, Europe, and Hong Kong.

The primary aim of this book is to provide research that distills, integrates, syn-

thesizes, and projects the best thinking that is currently available on the theory and practice of new-product diffusion models. *New-Product Diffusion Models* will appeal to academics and students in marketing and technological forecasting. It will also appeal to academics and students in other allied disciplines who study relevant aspects of innovation diffusion, such as economics, geography, sociology, and communication. We anticipate that practitioners in high-tech and consumer durable industries will gain new insight from reading *New-Product Diffusion Models*.

This book is the outcome of a conference that was held in September 1998 at the Wharton School, University of Pennsylvania. The conference was cosponsored by the SEI Center for Advanced Studies in Management at the Wharton School, and the IC^2 Institute and the Center for Customer Insight at The University of Texas at Austin. We are grateful to the sponsors, participants, and the authors for their contributions.

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2. FIRM STRATEGY AND SPEED OF DIFFUSION

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Abstract. Consumer and organizational behavior perspectives have dominated research on the diffusion of innovations within the marketing literature. These perspectives are important but underrepresent the role of the firm's strategic actions in affecting diffusion. In this chapter, we view strategic actions as critical in accelerating or retarding the speed of adoption of an innovation. We are especially interested in the influence of the firm's technological choices and entry strategy on the speed of diffusion. We review the relevant literature and discuss the role played by technology and entry strategy in the diffusion of innovations. Issues that could be addressed to enhance the field's understanding of the interface between strategy and diffusion are also suggested.

2.1 INTRODUCTION

Diffusion theory, regardless of the domain of inquiry (agriculture, medicine, education, or industry), has focused on the forces that determine the adoption and diffusion of innovations. Individual and organizational attributes within the social system have dominated research until now. However, a recent emphasis of diffusion research and modeling has been the interface of firm strategy and the diffusion process. One interesting development is the discussion of speed of diffusion in the general context of the time-based competitive paradigm. A specific area of interest is whether and how marketing strategy has an impact on this particular dimension of the diffusion process. The objective of this chapter is to review the current state

of knowledge in this field and to propose a propositional framework for the influence of strategy on diffusion speed.

Our basic tenet is that strategic actions of the firm affect the behavior of consumers and, in particular, the speed of diffusion of new-product innovations. This view is particularly relevant for marketing because it espouses the principle that the speed with which a population within a social system adopts an innovation can be influenced significantly by the "management" of that innovation. Especially crucial are the strategic marketing actions that may accelerate or retard adoption of the innovation. In most situations management is interested in increasing the speed of diffusion, although it may be more profitable in some cases to accept a slower diffusion. These cases would include (1) to optimize profits until competitors enter the market, especially if the innovation cannibalizes the firm's existing products, (2) to send signals to possible entrants that the market is small, or (3) to maintain a quality image (as opposed to a mass-market image). Therefore, given the firm's intention to accelerate or retard diffusion, what are the strategic options that will influence the speed of diffusion objective?

In this chapter we focus on the strategic factors that affect the speed with which an innovation may diffuse, as opposed to the pattern of diffusion or the level of market potential. This choice is based on two reasons. First, speed has been embraced as a business strategy that can help a firm to create a sustainable competitive advantage (Stalk and Hout 1990; Stalk 1993). A large part of this discussion in marketing had been directed toward the management of the new-product development process, but there also has been recent interest in extending this view to the market-penetration process (Kerin, Varadarajan, and Peterson 1992). The emphasis placed on speed is, in part, due to the competitive nature of markets, especially in the context of competing technologies. The second reason for our focus on speed is the lack of both theoretical and empirical evidence concerning the role of strategic factors on rate of diffusion. Our approach can be contrasted with most of the prior literature, which has focused on explaining the adoption process from the point of view of the consumer who is faced with a new-product alternative.

According to diffusion theory, those who innovate communicate the product's benefits to others through interpersonal communication, which can be verbal (such as word-of-mouth communication) or visual (Rogers 1996). This behavioral explanation of diffusion has been validated in the context of the commercialization of innovations where interpersonal communication plays a major role in consumer decision making. Interpersonal influence reflects the influence of early adopters who relay information that can change attribute beliefs and reduce the perceived risk for other consumers. Consistent with the literature viewing the adoption process in a decision theoretic framework (Jensen 1982; Chatterjee and Eliashberg 1990), adoption takes place when the perceived relative advantage of an innovation is greater than the hurdle of adoption, represented by price and/or cognitive hurdles (Sinha and Chandrashekaran 1992). The customer's expected value of benefits from a new product potentially increases as more information becomes available and uncertainty is resolved (Jensen 1982; Kalish 1988).

Most of the components of this adoption decision process, which was just briefly

sketched, can be influenced managerially. For example, the perceived uncertainty associated with adoption can be influenced by the strategic actions of the firm marketing the innovation. Thus, diffusion should not be viewed as an "inevitable" process, but instead, the firm can affect the diffusion process. Understanding the speed of diffusion and the role that marketing strategy plays in this process is of significant managerial relevance, especially for market development. We explain diffusion as a decentralized process—at the firm level for newly introduced products—as opposed to a process where innovations are assumed to come from a centralized source and diffuse from there. In a decentralized diffusion system, the diffusion process is triggered by the multiple sources from which innovations evolve (Schön 1967; Rogers 1996).

In this context—where competing firms constitute multiple sources influencing the diffusion of innovation—in line with previous research (e.g., Robertson and Gatignon 1986; Gatignon and Robertson 1989) we build on the thesis that strategic choices have an impact on the diffusion process. Because of this decentralized view, most of our discussion refers to the product marketed by a firm as the unit of analysis. Consequently, we are essentially concerned with the issue of how a firm can influence the speed of the diffusion of its innovative products. Diffusion models, for example, have taken into account marketing mix variables to demonstrate their effect on the process of adoption (e.g., Robinson and Lakhani 1975; Lilien, Rao, and Kalish 1981; Horsky and Simon 1983; Horsky 1990; Jain and Rao 1990), suggesting that different marketing strategies may generate different diffusion patterns. However, this stream of research has remained limited to the role of marketing mix variables, in spite of the recognition that the life cycle of an innovation is, in part, influenced by choices of a more strategic nature. This is, for example, the case when a manufacturer decides not to introduce an innovation to prevent cannibalization with an existing product. We are interested in the impact of such key strategic choices, particularly when a technological dimension characterizes the innovation.

Our propositional framework is embedded in the conceptual model shown in Figure 2.1, which proposes that a firm's innovation strategy affects the speed of diffusion of a new product. We discuss (1) the technological choices made by the suppliers of the innovation and (2) the firm's entry strategy in the marketplace. In studying the technological choices of firms, we are mainly concerned with the issues of the compatibility of the technology with other products and whether to choose competence-destroying or competence-enhancing technologies. The major questions regarding the entry strategy concern (1) market segmentation and target selection decisions, (2) the decision of whether to be the first to market (the order-of-entry issue), (3) the preannouncement strategy, (4) the commitment level made by the firm and the signal it gives to the market, and (5) the marketing-mix decisions to be taken, especially the role of distribution. These key strategic factors are summarized in Figure 2.1, as are their effects on the dependent variable of interest (the speed of diffusion of the innovation). Our objective is to review the literature concerned with these issues in the hope of encouraging future research in these directions. Further inquiry should have a significant impact not only on our
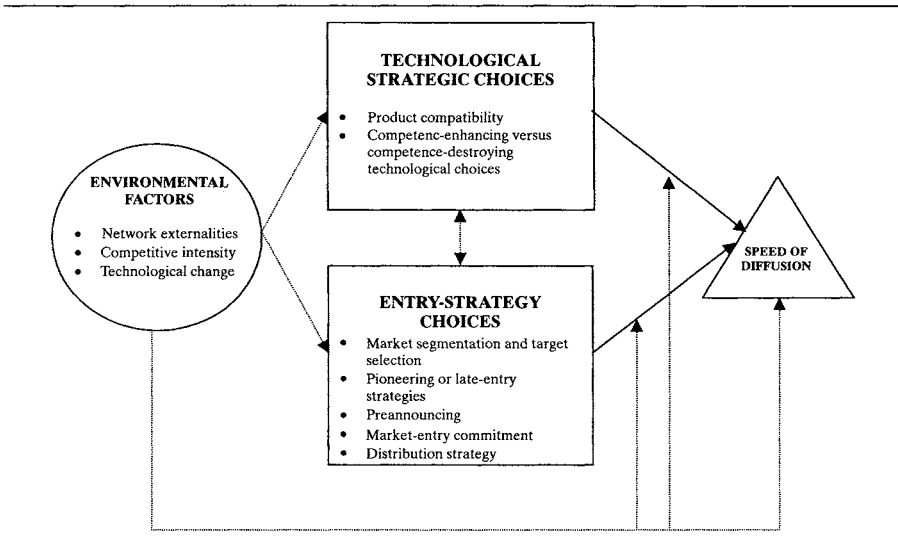
Figure 2.1. Conceptual Model of the Influence of Firm Strategy on Diffusion Speed

understanding of the diffusion of innovations but also on the marketing manage-
ment of new products.

Environmental factors are also represented in Figure 2.1 because strategic
choices—notably entry and technology strategies—are not independent of the envi-
ronment characterizing the firm introducing the innovation (Gatignon, Weitz, and
Bansal 1990). We do not intend to review this large literature base, which is mainly
rooted in the field of strategy. However, to the extent that the environment influ-
ences strategic choices, which, in turn, affect the diffusion of an innovation, these
characteristics should not be ignored. In addition, the impact of some strategic
choices can vary depending on these environmental factors. For example, it is crit-
ical to consider the moderating effects of competitive variables (a critical review of
competitive diffusion models is offered by Chatterjee, Eliashberg, and Rao in
Chapter 8 in this volume). Similarly, we discuss the impact of changes in the tech-
nological environment and the increasing role of network externalities. Figure 2.1
shows these three moderating variables: network externalities, competitive intensity,
and technological change.

The diffusion process has been characterized in terms of the pattern of diffusion,
the potential penetration level, and the rate of diffusion (Gatignon and Robertson
1985). The rate of diffusion is what is generally referred to as *diffusion speed*. Speed
can be captured by the rate of growth in sales (e.g., Qualls, Olshavsky, and Michaels
1981, an approach that is consistent with the PLC concept), or it can be defined
in terms of growth rates in penetration levels. The latter approach is more preva-
lent in diffusion research (e.g., Olshavsky 1980). Diffusion speed refers to the time
it takes to go from a given penetration level to another, higher level of penetration.

Fisher and Pry (1971) and Grübler (1991), for example, measure the time between the 10 percent and 90 percent penetration levels. Bayus (1992) gauges the time to peak sales, T^*, the maximum adoption level, among other measures. Generally, there are multiple approaches to measure diffusion speed. A measure can be computed for the entire diffusion process, captured, for example, by the coefficient of internal influence q (e.g., Olshavsky 1980; Takada and Jain 1991) and p (the coefficient of external influence), or t^* given the Bass model. In addition to t^*, Bayus (1992), for example, uses the total contagion level and the growth parameter θ in a logistic function to analyze diffusion rates over time. Another approach is to measure diffusion speed at every point in time for which data are present. Van den Bulte (1998) refers to this as an *instantaneous measurement approach*. In his reassessment of the diffusion-acceleration thesis (see below), he uses the empirical diffusion hazard $f(t)$ /$[1 - F(t)]$. This operationalization has the merit that no specific functional specifications about the diffusion process have to be assumed.

Although speed is espoused as a business philosophy, two research questions have been raised: Has there been a recent acceleration of the speed of diffusion of innovations, and what levers can be utilized to speed the diffusion of innovations? Whereas the first question has been addressed to some extent in the literature, there is some recent interest (Van den Bulte and Lilien 1997; Van den Bulte 1998) in reconciling different findings with regard to the diffusion-acceleration thesis (Olshavsky 1980; Takada and Jain 1991; Bayus 1992, 1998). This thesis refers to the popular belief that products are diffusing at an increasing pace. Consistent evidence, however, is lacking, and previously found support for this contention (e.g., Grübler 1991; Olshavsky 1980; Takada and Jain 1991) may be due to a method artifact (see Van den Bulte and Lilien 1997). Van den Bulte (1998) found a small systematic increase in diffusion speed over time and provides explanations as to what may cause this effect (such as changes in disposable income and level of unemployment).

In this chapter, however, we are particularly interested in the second issue concerning how strategic actions of the firm may affect the speed of diffusion of an innovation marketed by that firm. We intend to provide insight into diffusion-inducing strategy options that are relevant in complex market environments, such as technology-based industries. The role of technological choices appears particularly critical in today's markets, especially for durable goods (both consumer and industrial), which are often the focus of diffusion research in marketing. These issues of technological choices are first discussed, and then entry strategy options and their impact on speed of diffusion are presented. Next, we discuss the set of technology strategies and the firm's entry strategy and argue how a firm's choices with regard to these strategies affect the speed of diffusion of innovations. In our concluding section, we summarize our propositional framework and suggest research areas and discuss managerial implications.

2.2 TECHNOLOGICAL STRATEGIC CHOICES

Certain technological strategies may influence the speed of diffusion. We recognize that the firm does not necessarily have complete technological control but that man-

agers do have influence over technology variables. In particular, we discuss the role of product compatibility decisions and of competence-enhancing or competence-destroying technological choices. These strategic choices are influenced by factors such as technological change and network externalities and may directly or indirectly affect the choice of a particular entry strategy.

2.2.1 Product Compatibility

On the supply side network externalities influence the configuration that technologies will take: they lead to the choice of a particular technology to be offered by the firm (Matutes and Regibeau 1988). These standards are sometimes mandated by government or industry committees, but a large amount of standardization is actually left to the marketplace and is mostly supported by dominant firms (Tirole 1995). When technology choices are conditioned by market forces, dominant firms may achieve compatibility either individually (by choosing a particular technology) or collectively (by encouraging other industry players to adopt the same technology) (Farrell and Saloner 1985). They may also choose to keep their products incompatible. Until the uncertainties about industrywide compatibility are resolved, consumers will be likely to delay adoption.

Some markets are characterized by complementarity in consumption of their products with other products. In such cases, the consumer's utility derived from a product depends on the penetration of these other products as well. The issue of compatibility is especially relevant in markets for technological innovations where standardization enables uses of products together, minimization of learning requirements, and reduction in uncertainty about the future of the technology.

For example, the ability to combine camcorders with televisions using the same standard, such as NTSC or PAL, increases the utility of camcorders. More recently introduced digital systems may be able to achieve an even greater level of compatibility with audio, video, and computer technologies, which facilitate and improve home video production. This constitutes a benefit to consumers who may be more likely, therefore, to adopt digital camcorder technology quickly. Noncomplementarity can be particularly problematic due to the resulting learning requirements on the part of the consumer. When a firm chooses product compatibility, it can enable consumers to achieve economies of scope for learning how to use these products. Consequently, some of the barriers to adoption due to learning requirements are removed or significantly reduced (Gatignon and Robertson 1985). An example of noncomplementarity resulting in insufficient adoption is that of high-definition television (HDTV). While this technology was invented by a Japanese company in the 1970s, the market is still in its infancy due to the inability of manufacturers and governing institutions to solve the standards issue and thereby reduce consumers' uncertainty about this technology.

The economics' literature has focused on the motivation for firms to choose compatible technologies, especially in markets where network externalities exist (Farrell and Saloner 1985; Katz and Shapiro 1985, 1986; Gilbert 1992). *Positive* network externalities occur when a product is more valuable to a user when more users

adopt the same product or complementary ones. Although many examples can be found in electronics, standards do not apply only to high technology and may affect mundane articles as well, such as flashlight batteries, ski bindings, or typewriter keyboards (see, for example, David 1985 for an account of the adoption of the QWERTY keyboard). Externalities can be either direct or indirect (Tirole 1995). The former arises from the benefits of an increasingly large number of users in the same network (for example, telephone users connecting to the same network). Indirect externalities accrue from the benefits of a growing network in the form of increased availability of compatible products.

The presence of network externalities has important consequences for both the demand and supply side. On the demand side network externalities lead to a coordination problem. This coordination problem is due to the interdependency between a consumer's optimal individual choice and other consumers' actual technological choices. The problem of conflicting preferences regarding the choice of a particular technology can lead to two potential inefficiencies: the consumer either postpones adoption (excess inertia) or quickly adopts a technology for fear of getting stranded (Katz and Shapiro 1986). From a managerial point of view, case 1 is the undesirable scenario, and Farrell and Saloner (1985) show that when network externalities are present, customers indeed tend to be discouraged from early adoption until the uncertainty concerning the network is resolved. Consequently, strategies that reduce this uncertainty—such as compatibility strategies—will gain managerial importance. The firm's incentives to achieve compatibility revolve around the opportunity to eliminate intertechnology competition. Interfirm competitive effects on the diffusion process have been demonstrated in terms of the propensity to slow diffusion until standards emerge or to limit brand potential due to the penetration of competing brands (Parker and Gatignon 1994). Therefore, we argue that, *ceteris paribus*, a strategy of compatibility increases the speed of diffusion, especially when network externalities are present.

In some cases, however, deliberate incompatibility could be used as a strategy to protect returns from R&D and to convey a credible signal of the firm's ability to control the market in the future (Padmanabhan, Rajiv, and Srinivasan 1996). Nevertheless, the choice of launching a product with a technology that is incompatible with an existing installed base or with emerging rival technologies is less likely to occur when consumers may postpone their purchases due to uncertain expectations about the network, which would retard market acceptance.

Compatibility may sometimes lead to consequences that may not necessarily produce a faster speed of diffusion. For example, the pursuit of compatibility may allow the firm to charge higher prices, since consumers are willing to pay a premium for compatibility. This is because compatibility allows them to access a larger network or to assemble a product system that is closer to their ideal configuration (Matutes and Regibeau 1988; Economides 1989; Economides and White 1994). Higher prices may reduce the positive effect of compatibility on speed of diffusion. It may also be that the achievement of compatibility is costly (Katz and Shapiro 1986). Costs to achieve compatibility include the incremental expense of design and development and the expense of negotiating to reach a standard (Besen and Farrell 1994).

These costs tend to lead to higher consumer prices and therefore to a slower speed of diffusion. These higher costs may, however, be compensated by the economies of scale achieved through faster diffusion. Consequently, the overall effect of compatibility strategy on speed of diffusion will depend on the implications of compatibility on costs or prices. To our knowledge, no research to date has examined empirically the impact of developing compatible products on costs or prices, especially taking into consideration the alleged faster diffusion of compatible products. Below we discuss pricing as part of entry commitment, and we revisit this argument. Therefore, an area for future research concerns the consequences of compatibility and network externalities on cost and pricing strategies.

2.2.2 Competence-Enhancing Versus Competence-Destroying Technological Choices

The management literature has repeatedly amplified the notion of core competencies or capabilities (e.g., Teece 1986; Prahalad and Hamel 1990). Core capabilities are the knowledge that a firm has built over time (Leonard-Barton 1992) and that constitute a unique set of resources that are difficult for other competitors to duplicate (Prahalad and Hamel 1990). These distinctive competencies can be deployed systematically in order to carve out a sustainable competitive advantage.

The notion of core capabilities is not new and is the essence of the resource-based view of the firm (Rumelt 1974; Hayes 1985; Hitt and Ireland 1985), which dominates current research in strategy. Prahalad and Hamel (1990) discuss capabilities that are institutionalized within the firm and that give it an opportunity for strategic differentiation. Such a capability can be the ability to coordinate diverse production skills and to integrate multiple streams of technologies. According to Prahalad and Hamel, a core competence should provide potential access to a wide variety of markets and therefore constitutes an experience factor that potentially facilitates the commercialization of new products. Ansoff (1965) previously emphasized the impact of experience in technology and marketing on market success. Maidique and Zirger (1985) also has pointed out that successful new products are often a result of these competencies.

The same core competencies, however, can also constitute core rigidities that hinder successful commercialization of innovations, since institutionalized capabilities may render a firm inflexible when environmental conditions change—a phenomenon that is referred to as "incumbent inertia" (Lieberman and Montgomery 1988). This may be especially the case when a change in the technological paradigm occurs—for example, when technological discontinuities arise (Tushman and Anderson 1986) or when architectural innovations emerge (Henderson and Clark 1990). Strong core capabilities may limit the strategic vision or scope of the firm, which may then lead it not to take advantage of other options. Changes in the technological competitive environment also may render particular core capabilities obsolete. This latter case is an example of the idea that a strategic choice (a core capability) has a varying effect, depending on the competitive environmental con-

ditions. As a superior technology becomes available in the market, the core capability advantage may become a handicap.

A particular strategic choice that a firm may face concerns the development and adoption of technologies that build and enhance existing competencies or technologies that are radical and may destroy existing competencies. Multiple dimensions have been proposed to characterize innovations. The technology management, strategy, and organizational behavior literatures have recently developed new concepts that, given the importance of the interface between these functions of the organization, may have a significant impact on the innovations that are being brought to market and consequently that may affect the adoption and diffusion of these innovations.

One important dimension is expressed in the concept of the *radicalness* of an innovation. This issue has previously been discussed in marketing from a behavioral point of view (e.g., Robertson 1967, 1971). The technological viewpoint (Dewar and Dutton 1986) has recently been at the forefront of innovation research: "discontinuities are breakthrough innovations that advance by an order of magnitude the technological state-of-the-art which characterizes an industry" (Anderson and Tushman 1991, pp. 26–27). The radicalness of an innovation can be viewed as one expression of the firm's strategy. Indeed, Gatignon and Xuereb (1997) show that the ability to develop a radical innovation is associated with the strategic orientation of the firm. Although the potential market for these radical innovations may be greater than the potential of continuous innovations, the penetration in the market may be slower.

The related concept of *competence-destroying* versus *competence-enhancing innovations* (Tushman and Anderson 1986) offers significant potential for understanding better differences in diffusion rates across innovations. "A competence-enhancing discontinuity builds on know-how embodied in the technology that it replaces," whereas "a competence-destroying discontinuity renders obsolete the expertise required to master the technology that it replaces" (Anderson and Tushman 1990, p. 609). Two research questions need to be addressed. The first one concerns the general strategic issue of understanding which types of firms tend to develop competence-enhancing versus competence-destroying innovations. This stream of research could push the results of Gatignon and Xuereb (1997) further by investigating whether firms with a particular strategic orientation (such as customer orientation) are more likely to pursue innovations that tend to be competence destroying.

The second question addresses more directly the problem of understanding the impact of this characteristic of the innovation (whether it is competence-enhancing or competence-destroying) on the speed of diffusion of that innovation. It would seem that, on the one hand, competence-destroying innovations may require organizational changes within the firm that will retard the ability to reach the market quickly. On the other hand, it could be that organizations that develop such innovations are more open and flexible so that they can adapt faster to market that innovation efficiently. Any such impact on the speed of diffusion is not due to

demand factors but is driven by the ability of the firm to respond to the market and to market the innovation rapidly and efficiently.

This concept of a competence-enhancing versus a competence-destroying innovation could also be applied to the individual consumer. A new product can build on a consumer's know-how or render obsolete the expertise acquired previously. For example, recording with a mini disc seems to build on the knowledge that consumers developed in recording with tapes. However, for some people, a digital camera may not build on the existing photographic experience base but requires a new computer-based skill set. This competence-enhancing versus competence-destroying notion, put in the consumer context, appears as a refinement of Robertson's (1971) concept of fit with established patterns of consumption. The proposition is that the speed of diffusion of an innovation that builds on the competencies of the consumer will be faster than one that destroys existing competencies. It should be noted that an innovation can be competence destroying for a segment of consumers but competence enhancing for another one. For example, it may be that digital cameras build on the skills of computer users while they render the expertise of traditional photographers with few computer skills obsolete. This has direct consequences on the segments that the firm marketing the innovation should target, as discussed below.

2.3 ENTRY-STRATEGY CHOICES

We consider a number of key choices describing the entry strategy adopted by the firm introducing the innovation to the market. In particular, we discuss the following strategy dimensions: market segmentation and target selection, order of entry, preannouncing, market-entry commitment, and distribution.

2.3.1 Market Segmentation and Target Selection

The diffusion theory literature has focused considerable attention on market heterogeneity issues—that is, on the characteristics of adopter segments. It is well established in the diffusion literature that not all potential adopters of an innovation adopt simultaneously: some adopt early in the process, whereas others adopt later due to the diffusion effect taking place (Rogers 1996).

Different adopter categories have been defined based on this knowledge (Bass 1969; Rogers 1996), and categorization schemes have subsequently been used by marketers in making decisions regarding the targeting of consumers for a new product. Traditionally, researchers and practitioners were relatively unified in agreeing that the "venturesome" innovators were the first to target when selling a new product because they would then influence later adopters. This assumption has recently been revisited by (Moore 1991) and Mahajan and Muller (1998), who investigated optimal allocation of marketing effort and resources to two different market segments: the innovators and the majority. They show that under certain conditions it might be optimal to target the majority rather than the innovators when launching a new product.

Another issue when deciding whom to target concerns the role of the early adopters in the dissemination of the innovation. These early adopters can have an active role in spreading positive or negative information about the innovation (Midgley 1976). Some individuals have a greater likelihood of communicating with other members of the social system. These consumers are centrally located in their social network and consequently may have a greater potential of influencing the population in the social system (Krachardt 1996; Burt 1973). Focusing on these consumers creates a snowball effect, which speeds the diffusion of the innovation. This may, however depend on the innovation. If the innovation is normative in the sense that it is "consistent with the prevailing norms in the system" (Burt 1980, p. 329), the logic described above holds because the person has a maximum exposure with the others in the system. However, the role of "marginals" can be significant in influencing other members of a group because they are more likely to be exposed to innovations that are inconsistent with the norms of the social system (Becker 1970). Patterns of communication within and across countries can be critical for the diffusion of innovations in a multinational context (Putsis et al. 1997; Helsen, Jedidi, and DeSarbo 1993). Yet diffusion research on a global basis remains scarce.

Insights into the problem of appropriate segmentation and therefore targeting and positioning are fruitful areas of research as these are dimensions that affect the speed of diffusion.

2.3.2 Pioneering- or Late-Entry Strategies

The issue of entry timing has received considerable attention in theoretical and empirical research. The focal question is whether pioneers enjoy a distinct competitive advantage over later entrants. A significant number of empirical studies in the marketing, economics, and strategy literatures demonstrate a consistent pattern for a first-mover or market-pioneer advantage (Biggadike 1979; Whitten 1979; Robinson and Fornell 1985; Urban et al. 1986; Lambkin 1988; Robinson 1988; Moore, Boulding, and Goodstein 1991; Kalyanaram and Urban 1992; Bowman and Gatignon 1996), although with some recent controversy (Kerin, Varadarajan, and Peterson 1992; Golder and Tellis 1993; Tellis and Golder 1996; Shankar, Carpenter, and Krishnamurthi 1998) (for a metaanalysis, see VanderWerf and Mahon 1997).

First-mover or market-pioneer advantages may stem from multiple dimensions, such as shaping consumer preferences early in the diffusion process, gaining technological leadership, establishing switching costs, aligning distribution channels, achieving lower costs through economies of scale, realizing learning curve effects, and generating a reputation as a market leader. Three types of effects have been demonstrated: a main effect for order of entry (Urban et al. 1986), a recursive effect whereby pioneering leads to, for example, better products, and broader product lines (Robinson and Fornell 1985), and asymmetric marketing-mix effectiveness (Bowman and Gatignon 1996; Parker and Gatignon 1996). These effects have led to the conclusion that pioneering results in higher long-run market shares, compared to later entrants in an industry. Pioneers, however, are also exposed to a higher

risk of failure (Lieberman and Montgomery 1988) and are vulnerable to later entrants that free-ride on technological breakthroughs or that take advantage of changes in consumer preferences (Szymanski, Troy, and Bharadwaj 1995).

Despite the rich theoretical and empirical base of order-of-entry impact on long-run market share, little is known with regard to the effect of a particular market-entry strategy on the diffusion process. After controlling for differences in marketing expenditures, Kalyanaram and Urban (1992) find that later entrants still suffer a long-run market-share disadvantage. The order-of-entry penalty is evident both in trial- and repeat-purchase behavior. Their results on the dynamics of order-of-entry effects suggest, however, that later entrants approach their lower levels of share at a higher speed. This result is consistent with the notion that the customer's expected value of benefits from a new product potentially increases as more information becomes available and uncertainty is resolved (Jensen 1982; Kalish 1988). In a similar vein, Parker and Gatignon (1996) study order-of-entry effects on trial diffusion and con-clude that me-too products face less initial trial resistance than the pioneering brand. They also observe faster takeoff, although this effect is mitigated by the diffusion of competitive brands—that is, the later the entry, the stronger the negative competi-tive influence. In their recent study, Shankar, Carpenter, and Krishnamurthi (1998) show that, although pioneers have higher rates of repeat purchase and more effec-tive marketing spending compared with *noninnovative* late entrants, they may be dis-advantaged compared with *innovative* late entrants. The latter may grow faster than pioneers, have higher market potentials, have higher repeat rates, and may even slow the pioneer's growth. This suggests that order of entry does not determine the success of a particular entry strategy but that the later entrant's capability to out-compete the pioneer is also a factor.

From this discussion we infer that there are numerous pioneering- or early-entry advantages, except faster diffusion. As the studies cited here suggest, later entrants may diffuse faster. This is consistent with standard diffusion theory (Rogers 1996) when late entry means facing customers that are less uncertain. The suggestion may especially hold true in the case where product categories exhibit some kind of novelty. In these situations, Sujan (1985) showed that consumers may have little initial knowledge. This could explain their resistance and, therefore, the slower dif-fusion rates for pioneers.

In a similar vein, Kerin, Varadarajan, and Peterson (1992) make the important sug-gestion that pioneer advantages are moderated by product and market characteris-tics, and they conclude that they are most pronounced in markets that remain stable for an extended period of time. Consequently, emerging industries and industries that go through technological change will exhibit different pioneering- or order-of-entry effects than less turbulent market environments. This argument is akin to the novelty point raised above and we conclude that in these environments, diffu-sion will be even slower for the pioneer. Anderson and Tushman (1990), for example, found that in emerging technology markets, the pioneering technology was never dominant. This suggests problems in diffusing a pioneering technology, of which speed may represent one important dimension. We conclude that emerging

industries should exhibit a small pioneering advantage and a slower diffusion than in stable environments.

2.3.3 Preannouncing

Preannouncing conveys information about a forthcoming product (e.g., Eliashberg and Robertson 1988). In doing so it can facilitate the creation of an installed base by potentially reducing customers' costs of changing from an existing product or technology to an emerging one and by ameliorating information asymmetries between the firm and its customers. The reduction in switching costs is due to the consumer's ability to plan the migration to the new technology over a more extended time parameter in advance of product availability. The net effect is a potential increase in the speed of diffusion.

According to Eliashberg and Robertson (1988), consumers respond faster to new product offerings that are preannounced because they can better anticipate a switching path to the new product, especially if switching costs are high. Also, they are aware of the new product earlier, hear about the benefits of the new product faster, and they can start a long purchase decision process earlier. Research about the impact of preannouncements on these factors, which would seem extremely relevant, especially for business customers, has been scarce.

2.3.4 Market–Entry Commitment

A firm's resource commitment plays an important role in determining the speed of technology diffusion (Robertson and Gatignon 1986). In the preintroduction and introduction phases of a product launch, we often observe that firms adopt penetration strategies that entail aggressive pricing and high resource commitments to advertising, salesforce, and promotional activities. The selection of such penetration strategies is driven by several objectives: to gain rapid market acceptance, to stimulate demand through a diffusion effect (Kalish 1988), to benefit from cost reductions through learning effects (Dean 1969; Robinson and Lakhani 1975), and to discourage competitors from taking an equally strong stance in the market. Other indicators of a firm's commitment to a market, especially when entering a new market, are plant size, plant production capacity, and investments in nonreversible assets.

Marketing-mix decisions, especially pricing and advertising, are important indicators of the entry commitment made by the firm. Strategies of entry commitment are designed to accelerate the rate of diffusion. We posit that the higher the level of entry commitment for a given product, the faster the speed of diffusion.

Pricing plays an important role in the strategy of entry commitment, as a lower price reduces the adoption hurdle for the potential adopter and therefore stimulates demand. For instance, in their pioneering work on optimal-pricing dynamics in a monopoly, Robinson and Lakhani (1975) posit that price affects the remaining market potential and conclude that when word-of-mouth effects are assumed to be

a strong driver for new product diffusion, a penetration pricing strategy is optimal. This result was also derived by Dolan and Jeuland (1980). In a similar vein, Horsky (1990) addresses the question of why durables are purchased and how the timing of the purchase is determined. Considering word-of-mouth effects and the cost of capital, he develops a decision rule on when price penetration is optimal for the monopolist launching a new durable. For example, if word-of-mouth effects are weak—that is, $q < (2p + k)/4F(t)$; k = cost of capital—then price skimming is optimal. If they are strong—that is, $q > (2p + k)/4F(t))$—the optimal solution is to price penetrate. In general, the social-contagion effect that is assumed to occur is an important factor in determining the optimal pricing strategy over time.

Penetration pricing is often coupled with high initial levels of spending on advertising. A firm can accelerate information diffusion through advertising, and therefore this marketing-mix instrument plays an important demand-inducing role. Normative diffusion models that incorporate advertising generally suggest that firms use high initial levels of advertising and then gradually decrease advertising spending over the life cycle (e.g., Horsky and Simon 1983). Similar to penetration pricing, the optimization of advertising spending over the life cycle ultimately depends on the strength of the imitation effect that is assumed to occur.

The optimal entry commitment strategy will depend not only on the responsiveness of the targeted consumer base to the marketing-mix elements employed (such as price and advertising) but also on competitive factors in the respective industry. The industrial organization paradigm, for example, deals with how market structure determines the conduct of competing firms. Scherer and Ross (1990) identify various features of market structure—specifically, the number and size of firms, homogeneity of the market, cost structure, barriers to entry, and vertical integration. Market structure affects the manner in which firms choose to compete in a given industry, which, in turn, influences the diffusion process (Robertson and Gatignon 1986).

It is, for example, intuitively appealing that, under conditions of high competitive intensity, firms will allocate greater resources to the market and pursue more competitive price decisions. This may encourage rapid market acceptance and a faster diffusion of new products (Robertson and Gatignon 1986). Eliashberg and Jeuland (1986) show that prices tend to decrease when a competitive new entry occurs and consequently demand increases.

The diffusion modeling literature, in a desire to make managerial recommendations concerning optimal pricing strategies under different levels of industry concentration and competitive intensities, has made assumptions concerning how prices affect the diffusion of innovation. Eliashberg and Jeuland (1986) find that, if an incumbent expects the entry of a rival, penetration strategies become even more aggressive. However, the role of competitive marketing-mix variables on the diffusion process is not always clear. Recently, interest has focused on the impact of competitive effects in oligopolistic settings on the diffusion process. Parker and Gatignon (1994), for example, modeled competitive effects in brand-level diffusion models and found that competitive marketing-mix variables were critical in explaining the dif-

fusion of brands. However, these effects were not identical across brands and were not symmetric. Further research focusing on the explanation of these asymmetries would provide a significant contribution to the strategy and innovation literatures. It appears to be the case that competitive marketing-mix actions negatively affect the diffusion rate of a new brand, although they may have a positive effect on the rate of product category diffusion. This suggests that competitive marketing actions have a negative effect on the diffusion speed of a new brand in an established category but may have a positive effect in a relatively new product category.

Penetration pricing was a key strategic issue in the 1970s as the concept of experience curve effects was promulgated. It regained strategic importance (especially in technology markets) when the existence of network externalities was assumed to discourage customers from early adoption until the uncertainty concerning the future network was resolved (Farrell and Saloner 1985). In general, we can assume that entry commitment strategy is managerially important in markets where network externalities prevail. In these environments firms may be inclined to employ these strategies to "get the market going." Examples from Internet industries seem to highlight this point. America Online and Netscape, for example, distributed free samples of their software to build an installed base and to gain momentum. Network externalities are therefore an important moderator of entry commitment.

Similarly, in the previous discussion on compatibility as a technological choice to speed of diffusion, we argued that the pursuit of compatibility may allow firms to charge higher prices. The assumption is that consumers are willing to pay a premium for the ability to, for example, access a larger network. Also, compatibility may be costly for the firm. The decision of the firm regarding how to design the entry commitment strategy will therefore depend to a certain extent on the price implications due to compatibility.

Finally, another aspect of entry commitment that has not received much attention in the literature is the breadth versus the depth of the commitment (Gatignon, Robertson, and Fein; Kuester, Homburg, and Robertson 1999). In the context of competitive reactions, Gatignon, Robertson, and Fein (1997) show the importance of distinguishing between the intensity of the reaction using a single marketing-mix instrument versus using multiple marketing-mix variables. This would appear to be an interesting avenue of research, as low price by itself may not be perceived to be as substantial a commitment by consumers as an effort on a broader scope of marketing activities.

2.3.5 Distribution

The effect of marketing-mix variables on diffusion speed has been reviewed by Gatignon and Robertson (1991). They propose to analyze the role of marketing-mix variables along three constructs of the adoption process: innovation awareness, willingness to pay the market price, and availability of the innovation. Price and communication activities influence mainly the first two components of the adoption process. These factors have received a significant amount of attention in the diffusion modeling literature in the past. Recent contributions have been to assess

empirically the changes in the importance of price and advertising as the innovation diffuses and achieves high levels of penetration in the population (Parsons 1975; Parker 1992; Parker and Gatignon 1996; Parker and Neelamegham 1997). There is, however, a relative paucity of diffusion research that addresses availability and distribution issues. The previous assumption in most of the diffusion literature (possibly due to the epidemiological analogy) was that the innovation is available if the consumer is ready to buy. This is not necessarily a valid assumption.

Some researchers have begun to break ground by addressing the role of distribution in the diffusion of new products (e.g., Jones and Mason 1990; Jones and Ritz 1991; Gatignon and Anderson 1998). Jones and Ritz (1991), for example, recognize that the adoption of an innovation by consumers is conditional on the innovation being distributed by the channels of distribution. The study of the penetration of the innovation in the channel of distribution is therefore critical to an understanding of the diffusion rate in a given population of users. Although distribution may be instantaneous in some cases, this cannot be assumed generally. Little empirical evidence can be found to understand the evolution of the number and type of stores carrying an innovation.

This diffusion among distributors follows a process, which has been described conceptually. Distributors carry the innovation if there is indication of potential (Farley and Leavitt 1968; Jones and Mason 1990). This depends on the marketing activities promised by the manufacturer of the innovation but also on the consumer response, as can be observed from early distribution (Bronnenberg, Mahajan, and Vanhonacker 1998). Diffusion also depends on interchannel dynamics, which may be either competing or complementary (for example, specialized versus mass-market channels). Therefore, two issues need to be investigated: (1) the simultaneity of adoption between the distribution system and consumers (that is, consumers can adopt only if the innovation is carried by the distributors, but the distributors will carry the innovation only if the consumer response is sufficient) and (2) the diffusion speed within the distribution system, and especially the interchannel dynamics, as these affect the diffusion of the product among consumers.

The distribution issue has gained importance as the power of channels of distribution is increasing in many industries and as retail concentration becomes more prevalent. This increasing power may continue with multinational mail-order channels and the recent enthusiasm for marketing on the Worldwide Web. Since the adoption of a new product by a large distributor is complex (Montgomery 1975), it is critical to understand the diffusion of innovation by those who make it available to consumers. Yet there is little empirical data on how distribution spreads within and across chains. It is likely that diffusion is different within the various potential channels for an innovation.

The role of each channel is different in that it may reach distinct segments of consumers, which exhibit different patterns of adoption. For example, innovators may be more likely to purchase in specialist channels. On the other hand, because of the mass-market targeting of some channels, diffusion may reach its maximum if such mass channels adopt. However, these patterns of diffusion in the various channels may lead to strong competitive effects. For example, when mass merchandisers

cut prices to generate growth for the product category, it may spoil the market for other channels that may then deaccentuate the category or even stop carrying the product. Further research needs to investigate these interchannel dynamics and their impact on the speed of diffusion of new products.

In this section, we have developed a number of issues that have been discussed to different degrees in the literature. In general, there has been little empirical validation of these explanations, and a number of important questions need to be addressed to provide generalizable conclusions. This could be useful for explaining the diffusion of innovations and could have a significant influence on the behavior of manufacturers and distributors.

2.4 CONCLUSION AND MANAGERIAL IMPLICATIONS

Our intent in this analysis of the interface between innovation strategy and speed of diffusion has not been to be exhaustive but rather to suggest some promising areas of research that we consider to be important for gaining understanding of the diffusion of new products. Such understanding will also help marketers to develop their new-product-introduction strategies. Although significant progress has been made over the last decade in studying the impact of managerial actions on the diffusion process, this review and the questions we raise should encourage marketing scientists to develop new streams of research. These would expand the extant theories concerning the role of firms as change agents in the dissemination of new products, ideas, practices or services.

Our overall conclusion is that the actions of business firms can have a major effect on the speed of diffusion of a new product marketed by a firm. Unlike the assumption of classical diffusion theory (Rogers 1996), an innovation does not emanate from a single centralized source, and maximum diffusion acceleration is not always the dominant objective. Instead, individual firms may market multiple versions of an innovation for the same or different market segments and may have varying diffusion objectives depending on their resources and the potential for cannibalization of their existing technologies. What we propose is a refined theoretical perspective combining classical diffusion theory with extant strategy theory. We identify new avenues for research in this area, which should open new perspectives in the diffusion-modeling literature. This calls for incorporating strategic decisions into diffusion models. It also requires broadening the scope of single-innovation diffusion models to models that explain differences in diffusion speed across new products. The end result should be a theory of greater realism and applied value to business enterprises because it would incorporate major strategic choices that managers must make when marketing new products beyond the usual marketing-mix decisions.

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