Mary Lambkin & George S. Day

Evolutionary Processes in Competitive Markets: Beyond the Product Life Cycle

The traditional product life cycle framework has little to say about the competitive processes that accompany the evolution of a market. The first part of the article identifies the major shortcomings of the product life cycle. This analysis is used to establish the requirements for a more comprehensive model that incorporates both demand- and supply-side factors. The second part shows how concepts from population ecology theory can be adapted to satisfy these requirements. With this dynamic theory, specific propositions can be made about changes in competitive structure and performance as the market evolves.

FEW management concepts have been so widely accepted or thoroughly criticized as the product life cycle. As criticisms of the conceptual deficiencies and strategic shortcomings mount, the basic notion of life cycles may be so eroded that little of value will remain. However, out of the criticism has come a clearer picture of the limitations of product life cycles and directions for needed improvement.

In addressing the shortcomings of the product life cycle (PLC), we first spell out the requirements for a comprehensive framework for understanding market evolution. This framework is used to identify the areas most in need of further development. Finally, we examine the potential of population ecology models of organizations for new insights into evolutionary processes in competitive product-markets.

A Framework for Understanding Product-Market Evolution

The first requirement in building a framework for understanding market evolution is to specify the unit of analysis. Several candidates have been suggested—industries (Porter 1980), product classes (Day 1981; Harrell and Taylor 1981), product forms and brands (Enis, La Garce, and Prell 1977; Rink and Swan 1979)—but each has its problems. Industries have been ruled out because they generally embrace several classes of noncompetitive products, each with its own pattern of evolution. For example, the major home appliance industry includes stoves, refrigerators, and dishwashers. At the other end of the spectrum, product forms or other brands are not appropriate because they tend to be close substitutes for one another—such as front-loading washing machines replacing top-loading washing machines—reflecting competitive developments within life cycles rather than overall life cycle patterns.

To capture an overall life cycle pattern, the product class seems the most appropriate unit of analysis. This level reflects the aggregate effects of interbrand rivalry and of extensions brought about through the emergence of new or improved product forms. The product class also corresponds most closely to the business unit level where competition between firms occurs most directly.

The next requirement for understanding market evolution is to incorporate the factors that influence the pattern of product class sales over the life cycle.

Mary Lambkin is a Lecturer, Department of Marketing, University College, Dublin, Ireland. George S. Day is Magna International Professor of Business Strategy, University of Toronto.

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Consensus is emerging that the evolution of product-markets reflects the outcome of numerous market, technological, and competitive forces, each force acting in concert with others to facilitate or inhibit the rate of sales growth or decline (Day 1981; Porter 1980; Tellis and Crawford 1981; Weitz 1985). The particular "forces" referred to by the authors cited have not been spelled out systematically, but usually fit into three categories: the demand system, the supply system, and the supporting resource environment.

The Demand System: Market Environment and Pattern of Diffusion

The fundamental demand factor is the size of the pool of prospective buyers that is the *market potential*. This factor is dynamic to the extent it may be altered over time by exogenous factors such as demographic and economic trends and the evolution of complementary markets (Mahajan and Muller 1979).

In this system potential buyers pass through (or drop out of) an adoption process that culminates in observable trial and first-purchase adopter behavior. The determinants of the likelihood and rate of acceptance include:

- the perceived comparative advantage of the new product in relation to the best available alternative,
- the perceived risk, jointly determined by financial exposure in the event of failure and uncertainty about the outcome,
- barriers to adoption (such as commitment to present facilities or incompatibility with prevailing values) that slow acceptance even though other factors are supportive, and
- information and availability. Not only must the product be readily available (for purchase and servicing), but the prospective buyers must be aware of the product and informed of the benefits.

These determinants are dynamic, so the rate of acceptance is likely to increase as suppliers of the new product improve performance (and comparative advantage), overcome the barriers of risk and availability, and invest in communications that build awareness and change perceptions.

The Supply System: Competitive Environment and Supplier Behavior

The rate at which a new market develops is also influenced strongly by the *number* and *types* of suppliers that enter the market and by their particular *strategic choices*. The firms that enter and develop new markets typically differ in size and in the resources they have to invest. The extent and form of their investment vary according to their expectations about market potential and their aspirations for their own competitive position.

The product offering that initiates a new life cycle results from the resource commitments and strategic choices of the pioneering entrant, which may stimulate or impede the rate of sales growth in the new market. For example, the initial market appeal of the Apple microcomputer was limited significantly by the fact that it was sold in kit form requiring self-assembly. The decisions of pioneering firms about pricing strategy and level of marketing support also are significant in determining the speed with which the primary demand for the product is developed.

Once evidence of a substantial new market has been revealed by efforts of the pioneering firms, the subsequent pattern of development is likely to be influenced by the number of other firms that enter the market, the speed of their arrival, and the level of resources they invest in their entry moves. Generally, the more intense the competitive activity, the faster the sales growth will be, though this benefit may be offset by a downward pressure on profit margins for individual competitors.

An important and commonly neglected facet of the supply system is the presence and behavior of substitutes. Seldom do entrenched substitutes give up their market without a fight; their defensive efforts are directed to narrowing the perceived comparative advantage of the new product by price cutting, performance enhancements, and extensions. Substitution is also a symmetric phenomenon. The decline stage of a life cycle often is precipitated by an emerging substitute with a new basis of comparative advantage.

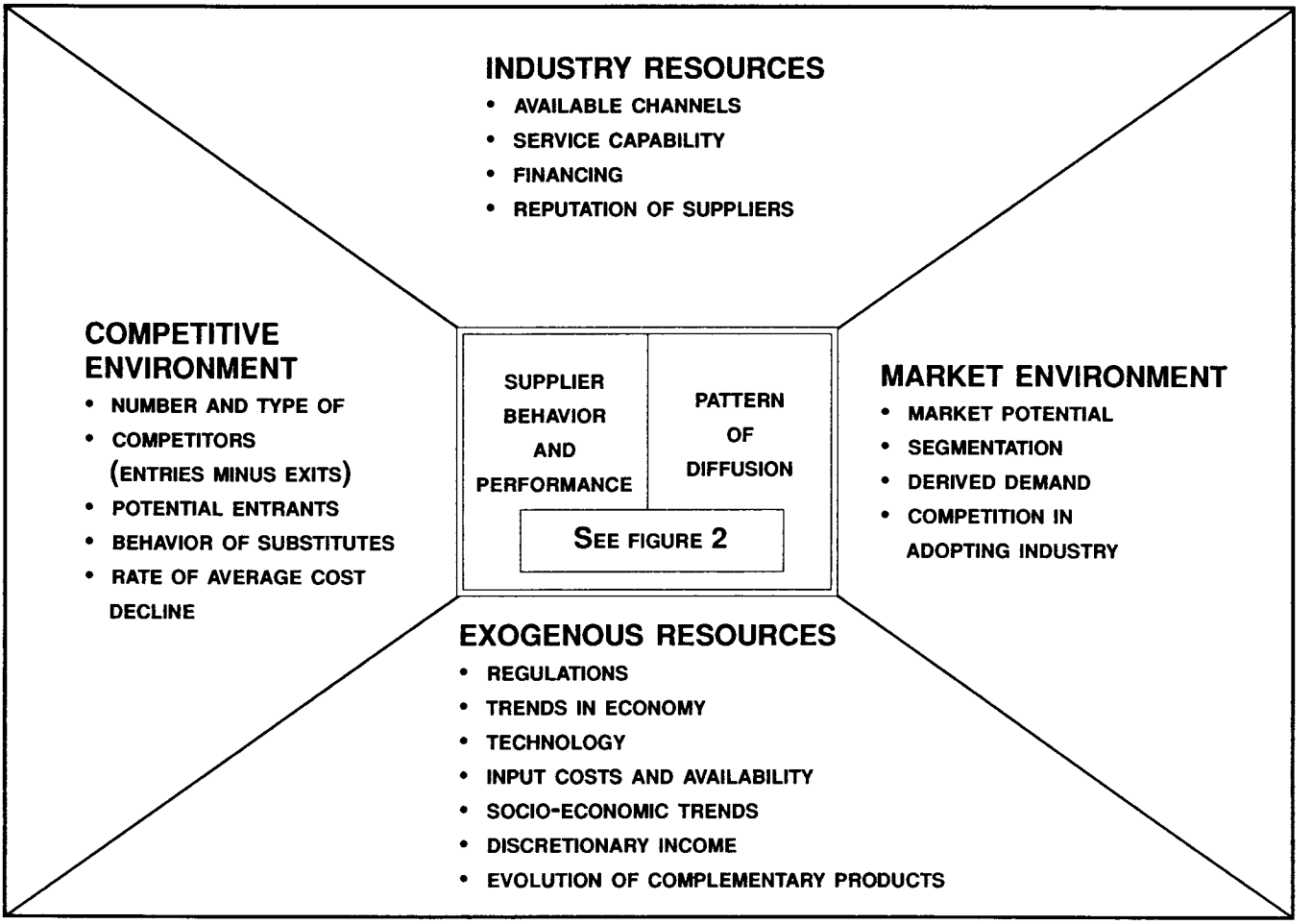
Resource Environment: Exogenous and Industry Factors

The dynamic variables in the supply and demand systems are mediated constantly by trends and events in the surrounding resource environment. The primary resources include:

- the developments in *product and process technology* that enable the product to be commercialized and to be refined and improved thereafter,
- the availability and cost of input *materials and systems*, which determine the cost and market attractiveness of the finished product,
- the presence or absence of an industry *infrastructure*, which may hasten or delay the market penetration,
- and a favorable regulatory environment to legitimize the new industry.

The evolutionary framework suggested by these variables is illustrated in Figures 1 and 2. No one theory or model could reasonably be expected to include all of these elements and their potential interactions. What is more striking, however, is how little of the complete framework has been illuminated by any of the available theories and, in particular, by the PLC.

FIGURE 1
A Framework for Understanding Market Evolution



Insights from Product Life Cycle Analysis

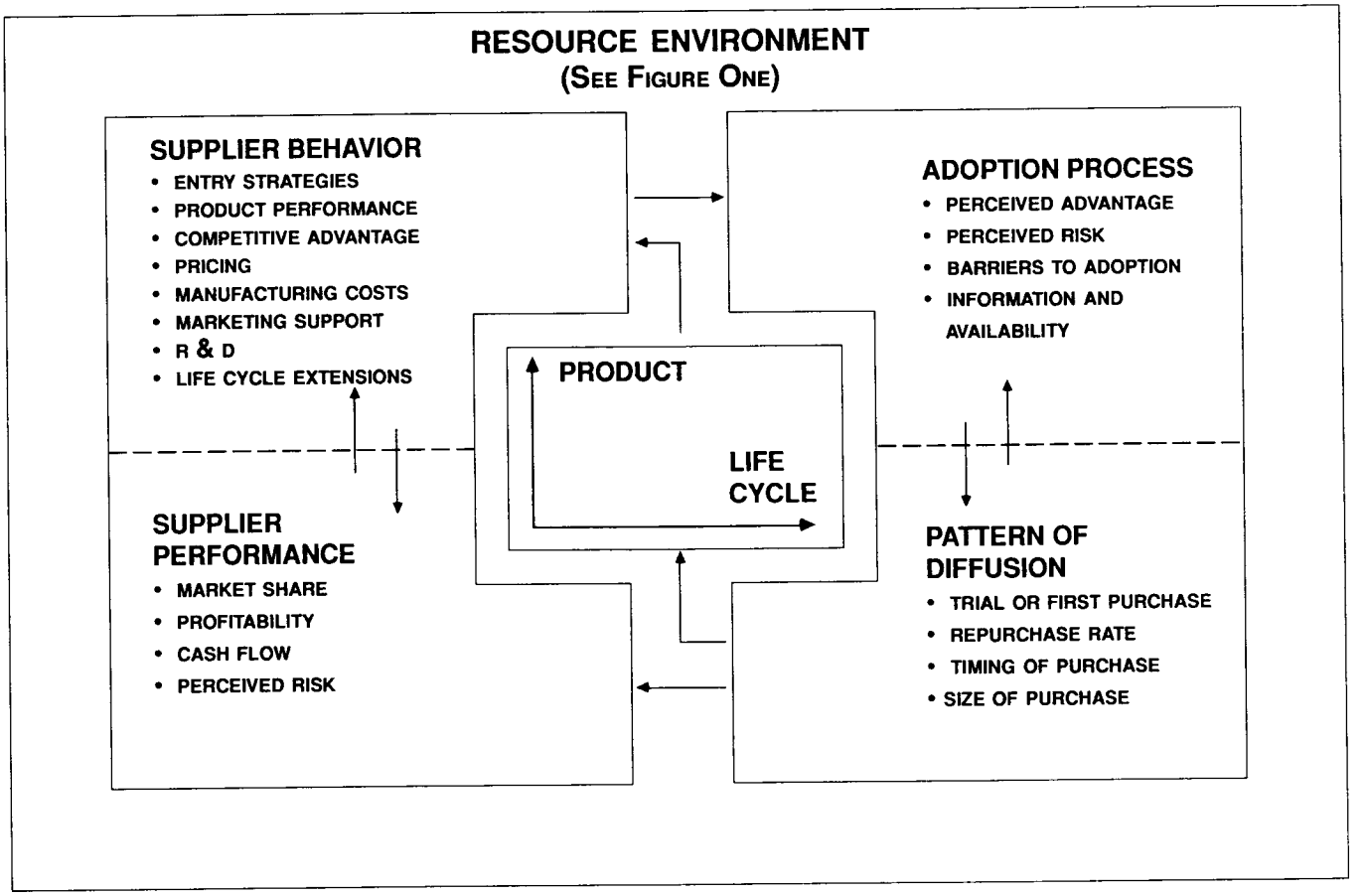
In reviewing the PLC literature, both demand-side and supply-side perspectives can be identified. The demand-side stream has adhered closely to the tenets of diffusion theory in studying the rates at which new products penetrate their markets (Mahajan and Muller 1979; Mahajan and Wind 1985). The counterpart supply-side contributions have virtually ignored the details of the diffusion process while deriving normative strategy prescriptions from the pattern of competitive behavior said to characterize each stage of the PLC. Neither of these perspectives, however, addresses very many of the strategic issues confronted in dynamic markets.

Demand-Side Perspectives: Diffusion Theory and Models

Diffusion theory attempts to explain the distribution of time of adoption across a population of prospective buyers, which in turn determines the rate and pattern of diffusion within the market. Though the theory considers several determinants of adoption time, including attributes of the product and social system, the emphasis of the research is on the characteristics of individual adopters and their responsiveness to interpersonal communication (Gatignon and Robertson 1986; Rogers 1983).

Robertson and Gatignon (1986) have proposed several dynamic additions to the basic diffusion model to reflect supply-side influences on the size of market and speed of diffusion. They include *structural* factors, such as competitive intensity, credibility of suppliers, and standardization of designs, and *resource commitments,* such as expenditures on R&D and the amount and focus of marketing support. Their interest however, is in broadening the set of determinants of the diffusion rate and only tangentially in the interplay among competitors. Nothing is said about such important variables as rates of entries and exits, the characteristics, resources, and strategies of competitors,

FIGURE 2
The Interaction of the Supply and Demand Determinants of the Product Life Cycle (see Figure 1)



or the implications of these issues for market share and financial performance.

Diffusion models. The models used to forecast rates of diffusion have been quicker than the theory to recognize supply-side variables. The basic model, which centers on the part of the life cycle contributed by the first-purchase sales volume (Bass 1969), has been extended to include supply-side variables, including price (Bass 1980; Dolan and Jeuland 1981; Robinson and Lakhani 1975), advertising (Dodson and Muller 1978; Horsky and Simon 1983), and personal selling (Lilien, Rao, and Kalish 1981). Though these variables generally have been entered one at a time rather than in combination, the extensions offer persuasive evidence of the impact of supply-side factors on adoption rate.

These models have advanced understanding of the diffusion process, but have contributed little to the broader strategic questions. Like diffusion theory, the models ignore the structure and interplay of competition. The marketing mix variables that have been added would all be considered tactical decision variables in a broader competitive context. No consideration is given to strategic variables such as competitive advantage, investment intensity, or resource allocation patterns. Even for the variables that are included there is uncertainty about the precise form of their influence on the speed or pattern of diffusion of new products—for example, how advertising affects potential adopters and whether it has a direct influence or is filtered through the perceptions of opinion leaders (Mahajan and Muller 1979).

Supply-Side Perspectives: The PLC as a Managerial Framework

The product life cycle (PLC) concept has long afforded marketers a framework to guide the adaptation of strategies to changing market conditions and requirements (Kotler 1984). Consequently, some marketers judge the life cycle concept to rival the segmentation concept in value to strategy-making (Schendel 1986). Among its virtues are that it "enables marketers to think dynamically" (Biggadike 1981)

and that it is "the most fundamental variable in determining an appropriate business strategy" (Hofer 1975).

These claims are seriously undermined by a notable absence of conceptual validity or rigorous empirical support (Gardner 1987). The life cycle pattern ostensibly is derived from the theory of diffusion of innovations. In reality, diffusion theory has only a slight relationship to the product life cycle concept. Diffusion theory is derived deductively from postulates about individual behavior, largely descriptive in both character and intent, and has been tested extensively. In contrast, the product life cycle concept is inductive, normative in its insistence on prescribing strategies, and infrequently and inadequately tested.

The *normative* bias of the product life cycle framework is evident in textbook enumerations of the appropriate strategies for each stage. These prescriptions usually are preceded by a brief description of the defining features of each stage and some underlying assumptions (e.g., that profit rises sharply in the growth stage and begins to decline in maturity because of competitive pressures even as volume continues to rise). This approach was pushed to its limit by Rink and Swan (1979), who catalogued 567 recommended strategies for each of five life cycle stages and seven functional areas of business.

These prescriptions are like most business policy frameworks or approaches that have been characterized as checklists, based on inductive, armchair generalizations from detailed case studies (Camerer 1985). Because they aspire to be exhaustive, all possibilities are mentioned indiscriminately. The impression is given that just about everything makes some contribution to performance. However, we want to know what strategic moves will make the most contribution in each situation.

Testing the life cycle framework. Few conclusive answers can yet be gleaned from the research literature on the product life cycle, though the topic has been popular for many years. This lack of progress is due partly to a difference in focus between researchers and practitioners and partly to the inherent problems of studying this dynamic phenomenon.

The early work in this area was concerned with verifying the evidence of an S-shaped life cycle curve by measuring the sales patterns of various products (Buzzell 1966; Cox 1967; Polli and Cook 1969). Only when it became clear that this effort was misdirected—there appear to be as many different curves as there are products—was this approach abandoned in favor of an emphasis on the factors shaping the various life cycle patterns (Rink and Swan 1979).

The more recent work (Buzzell and Gale 1987, Ch. 10; Thietart and Vivas 1984; Thorelli and Burnett 1981) has contributed useful insights about the changes in market structures over the life cycle (variables such as entries and exits of competitors, degree of concentration, and extent of differentiation) and in the strategies and performance of the market participants. However, all of these studies are based on cross-sectional data—normally the PIMS database—with change being inferred by comparing profiles of firm characteristics at different stages, rates of growth, or age of the market.

With this design the actual pattern of adjustments of businesses to changing conditions cannot be revealed. A further flaw of cross-section designs is that they miss firms that did not survive the previous stages. For these reasons, as well as reliance on a sample that underrepresents businesses in the very early and very late stages of the life cycle (Day 1986), the research using the PIMS database has not shed much light on the adequacy of the strategy propositions or of the framework itself.

Conceptual Gaps in the Product Life Cycle Framework

Even with adequate research methods, the typically generalized descriptions and prescriptions in the product life cycle literature would be unlikely to find empirical support because key assumptions are flawed and important dimensions of evolutionary processes are overlooked.

1. Little account is taken of the different competitive positions or resources of the competing business units that might alter the applicability of the generalized courses of action. The normative life cycle literature has largely ignored differences between large and small firms, between established firms and new firms, between firms that develop their own entry and those that enter the market by acquisition, licensing, or joint venture, or between firms that choose to follow different strategies. The generalized treatment of the relationship between market growth and market share inherent in portfolio models is the only significant attempt so far to recognize the importance of differing competitive positions over the stages of market evolution. The Arthur D. Little Matrix of Industry Maturity and Competitive position offers specific propositions about appropriate strategic moves that account for life cycle and market position (Day 1986), but apparently has never been tested empirically.
2. Apart from studies of the experiences of market pioneers (Bond and Lean 1977; Robinson and Fornell 1985; Urban et al. 1986; Whitten 1981; Robinson 1988), there is no recognition that the "strategic window" for competitive entry opens at different times for different types of prospective entrants (Abell 1978) and that the risks and rewards of entry depend on the choice of timing.
3. The framework has no capacity to reflect the conditions that trigger competitive "shakeouts," yet a recurring risk in high growth markets is that too many competitors will enter with unrealistic market share expectations (Aaker and Day 1986). Absence of a supply-side di-

mension to the product life cycle means little guidance on when and why shakeouts are triggered or which types of businesses are likely to be winners or losers in the event (Willard and Cooper 1985).

4. Feedback effects of the choice of strategy on the shape of the growth curve usually are ignored, despite evidence from diffusion models that supply-side factors can accelerate or slow the rate of growth. One possible consequence is a premature identification of maturity (Dhalla and Yuspeh 1976). The result is a self-fulfilling prophecy in which the established competitors collectively decide their best action is to reduce marketing and R&D investments to a sustaining level that will protect their market share position. The resulting slowdown in sales initially confirms the wisdom of the change in strategy, which leads to complacency that is an open invitation to competitors from adjacent markets or geographic areas. When they enter with product innovations, segmented offerings, and heavy marketing expenditures, the market begins to grow again.
5. The apparent one-way determinism of the birth → life → death analogy from biology can prompt a fatalistic and unwarranted acceptance of eventual decline (Chakravarthy 1984). This analogy often has been repudiated by evidence of successful strategies to rejuvenate and extend life cycles. In the mid-1970s the product category called "radios" was presumed by most North American producers to be living out its natural life. The Japanese made no such assumption and rejuvenated the whole category with a flood of product improvements, putting the Sony Walkman in the vanguard.
6. The environmental context is either ignored or subordinated in most frameworks, though product life cycles are influenced by what is happening in the overall industry environment. The stage of industry life cycle reflects the sum of the life cycles of the products that make up the industry. In an embryonic industry the distribution, delivery, and service infrastructure is not in place and market penetration of the first product is slow. As the industry structure develops, the introduction of new product classes becomes easier (Day 1986); customers are more knowledgeable, sales and promotion efforts are more effective, and service and distribution networks are already in place.
7. The most pervasive feature of emerging markets is uncertainty about customer acceptance and the eventual size of the market, which process and product technology will be dominant, whether cost declines will be realized, and the identity, structure, and actions of competitors. Life cycle strategy frameworks appear to assume there is no uncertainty, for no consideration is given to the tradeoffs involved in confronting uncertainty (Wernerfelt and Karnani 1987). Firms have the choice of acting early or waiting and can elect to focus their resources or spread them over several technology, marketing, and process options to lower the risk by maintaining flexibility.

The nature of the conceptual gaps suggests that greater progress can be made by attending to supply-side issues than by making incremental gains with diffusion models. Especially needed is a mechanism for modeling the dynamics of competitive behavior in evolving market structures. One such model that has attracted considerable attention in other management disciplines, and some interest in marketing, is the theory of natural selection applied within a broader ecological framework.

Population Ecology Perspectives on Market Evolution

The term "population ecology" originates in biology, where it was introduced to describe the study of how different populations of organisms (i.e., species) adapt to their environments (Hawley 1968). In essence, the bio-ecological model considers the evolution of different species inhabiting the same environment to be a dynamic process based on competition for scarce resources. The theory of natural selection (Darwin 1859) provides the mechanism for explaining the differential allocation of resources across competing species. In general, the theory predicts that the species best "fitted" to the contingencies of the environment will survive and prosper and their less fit rivals will fail and disappear because of their inability to secure adequate resources.

Marketers have long recognized the potential of the ecological paradigm for understanding competition in commercial product-markets. The basic ideas first were introduced by Alderson (1957), who borrowed ecological terminology such as "behavior systems" and "ecological niches." Other scholars have addressed this topic over the years (Gross 1968; Thorelli 1967), but only recently has significant progress been made in realizing the potential of the ecological paradigm for studying market evolution (Boxer and Wensley 1983; Tellis and Crawford 1981; Wind 1982). Tellis and Crawford in particular spell out in detail the recasting of the product life cycle in terms of the biological model of evolution.

All of the articles cited, however, are descriptive in content, focusing on finding marketing referents for each of the terms of the ecological model. No attempt is made to develop an explanatory model or to put forward testable propositions. Hence this work can be considered a first phase in the development of ecological models in marketing. The next phase is to extend the ecological ideas to explain the differential selection and adaptation of competitors as product-markets evolve.

Our purpose is to show that the ecology model can be used to provide a supply-side theory of market evolution including the following three elements:

- A *population growth process* that accounts for differences in the competitive environment over time, particularly in the intensity of competition.
- A *typology of strategies* for competing in new markets that recognizes the diversity of resources and skills among the business population, as well as differences in their order of entry.

- An *integrative model* that provides predictions about the likely success of different generic strategies as the product-market evolves through different stages.

The version of the ecology model used as the basis for this discussion is that of Hannan and Freeman (1977), which is an adaptation of the original bio-ecological model developed specifically for the study of organizations. This organization ecology model is widely accepted and obviates the need to work with complex and unfamiliar biological terms.

The Population Growth Process

A population can be defined as the aggregate of businesses serving a particular product-market. Because the emergence of a new population of businesses coincides with the commencement of a new product life cycle, the same criteria should be used for identification of both. A new PLC, and consequently a new population of businesses, commences only when a substantial change in technology, customer function, or customer group occurs that is outside the scope of all or most of the current suppliers (Day 1981). The exploitation of the opportunity created by such a change requires the setting up of new ventures by individuals or established corporations.

Given such an event, whether initiated by a new firm or by a new division of an established firm, the population ecology model specifies the process by which the population of suppliers grows to some ultimate equilibrium level. This process is depicted as a logistic or S-shaped curve that is identical to the PLC, modeled formally as (Hannan and Freeman 1977; 1988):

$$\frac{dN}{dt} = rN\left[\frac{K-N}{K}\right].$$

In this equation, the rate of change in a population of size N is a function of some natural rate of increase, r, and the upper limit or carrying capacity, K.

The r term in this process represents the difference between the rates of organizational births and deaths in the population.[1] This rate is assumed to be strongly positive in the early stages of development of a new population when the number of members is small in relation to the carrying capacity. In this situation, the effect of K is not significant and the population growth equation reduces to

$$\frac{dN}{dt} = rN,$$

indicating that growth is exponential.

As the population size approaches its upper limit, K, the rate of growth slows until eventually it reaches zero or overshoots the carrying capacity of the resource environment. Thus, the K term becomes the determining factor in the later stages of population growth, indicating an increasing scarcity of resources and therefore the likelihood of more intense competition.

A Typology of Strategies

Because of the different competitive conditions characterizing the early and late stages of population growth, ecologists have adopted the convention of describing alternative time-based strategies in terms of the parameters of the growth equation, that is, as r-strategies and K-strategies (Brittain and Freeman 1980). According to this view, r-strategists are organizations that enter a new resource space at an early stage when the population contains few other members, whereas K-strategists enter later when the competitors are more numerous. This distinction between early and late entrants highlighted by the concept of r- and K-strategies is the first building block in a typology of competitive entry strategies. Further building blocks are provided by the concepts of density dependence, environmental niches, and niche width strategies.

The concept of density dependence. According to this concept, competitive conditions in any population are a function of the number of organizations competing for the finite level of resources available to that population. In a new population containing few members, competition is likely to be indirect and diffuse because the abundance of resources means that the growth of one competitor need not suppress the growth of another (Brittain and Wholey 1988).

As the density of the population increases, it becomes increasingly difficult to avoid direct competition wherein the gains of one competitor must result from losses to another. This situation leads to an intensification of competitive activity with an emphasis on the achievement of large scale and functional efficiency. Competition is likely to be particularly aggressive in a situation of oversupply, that is, when the size of a population exceeds the carrying capacity of its environment. This situation seems equivalent to the "shakeout" phase in PLC terms, which can be re-

[1]The classic logistic model of population growth assumes that the rate of growth, n, is equal to $a_o - b_o$ which is the difference between the rates of births and deaths of organizations (Hannan and Freeman 1988). It further assumes that birth and death rates vary with the size or density of the population. In particular, the birth rate, a, is believed to fall approximately linearly with the population size and the death rate is believed to increase approximately linearly with the population size.

The net effect of these tendencies is that when the size of the population is small in relation to its carrying capacity, the rate of births far exceeds the rate of deaths, resulting in an exponential growth in the total number of organizations; the reverse applies when the size of the population equals or exceeds the carrying capacity, resulting in a zero or negative growth rate.

solved only when the overcapacity disappears through business failures or mergers.

Given that the density of a developing population is constantly changing with the increasing number of new competitors, it follows that the level of resources facing prospective entrants and the nature of the prevailing competitive conditions are also continually in flux. Hence, each competitor entering a market at a given point in time faces a unique set of resources and competitive conditions.

The concept of niches. In ecological terms, each unique combination of resources and competitive conditions that is sufficient to support any one type of organization is defined as a niche. However, because a single resource space (market) typically contains several overlapping niches, competition is likely to alter the extent to which individual organization forms can proliferate in their chosen niches. To capture this competitive process, ecologists distinguish between *fundamental* niches and *realized* niches (Hannan and Freeman 1977). The fundamental niche refers to the size of the potential niche (market segment) available to any new category of competitors and the realized niche describes the size of the segment that is actually available once competitors have secured a certain amount of that segment.

It follows from this distinction that the boundaries of fundamental niches cannot be identified readily. To overcome this difficulty, ecologists have directed their attention to realized niches identified by the characteristics of the organizations that occupy them, with each different type of organization considered to occupy a distinct niche (Freeman and Boeker 1984).

This convention is based on the premise that because organizations are fashioned from the resources available at their time of founding, those founded at the same time tend to have a similar structure or form and those founded at different times have different forms (Stinchcombe 1965). Hence, the development of a new population of competing firms can be thought of in terms of *waves of organizing,* with different types of organizations appearing in each stage.

A further corollary of this argument is that once a particular type of organization emerges, it tends to be preserved in its original form because of factors such as commitments to past technologies, the vesting of interests, and the development of common ideologies. This phenomenon, which ecologists describe as *structural inertia* (Hannan and Freeman 1977), produces a resistance to change that impedes the ability of established competitors to adapt their structure to meet changes in environmental conditions. The inertia of established organizations provides the opportunity for new organizations to emerge and, given that the later entrants are unlikely to displace established organizations completely, the mature population seems likely to contain a variety of organization forms, each adapted to suit certain niche conditions.

The concept of niche width. Many dimensions might be used to describe the unique character of organizations occupying separate niches, but one particular dimension known as "niche width" has been emphasized in the ecology literature (Freeman and Hannan 1983; Hannan and Freeman 1977). This variable usually is represented as a continuum from *generalism* to *specialism.* The distinction between these strategies refers to whether an organization chooses to spread its resources across a broad spectrum of the environment in the hope of balancing its risks or concentrates its resources in a narrow segment of the environment in the hope of earning a high return. In a measurement context, the difference between these alternatives seems to be one of scale, though it includes other aspects of strategy that typically accompany variations in scale such as breadth of product line, size of customer base, and extent of geographic coverage (Carroll 1985).[2]

Specialists are depicted as small, often new organizations without access to substantial capital resources. They rely for their success on factors independent of scale, especially their ability to exploit first-mover advantages by either pioneering entirely new markets or being first to exploit new segments in mature markets. The r-specialists, which tend to be early entrants into entirely new markets, exemplify the first of these categories. A typical example of an r-specialist is Apple Computer when it first commenced operations; late entrants such as Compaq and Amstrad fit the definition of K-specialists.

Generalists, in contrast, tend to be large, established organizations with access to extensive skills and resources. Because of their size and commitment to current technologies through prior investments, these organizations have a structural inertia and may not be able to move as quickly as the specialists in exploiting new market niches. For this reason, they are more likely to be early followers of the pioneers. They compensate for their lateness by making a heavy investment in production and distribution scale to achieve market leadership on the basis of superior competitive effi-

[2]Carroll (1985) argues that generalist organizations are usually larger than specialists but that the relationship between niche width and size is not exact. By definition, the fundamental niche for generalists is wider than that for specialists. Therefore generalist organizations that achieve maximum size within their fundamental niches would be expected to show a direct relationship between the degree of generalization and size as long as resources are distributed fairly evenly across environmental conditions.

If resources are distributed unevenly, however, certain specialists may find their preferred resources in abundance and grow very large. Conversely, such conditions provide few advantages to generalists, which therefore may be small.

ciency (lower unit costs arising from economies of scale). The much-publicized entry of IBM into the microcomputer market seems a classic example of this category.

The objective of market dominance is achievable for generalist organizations whose skills and resources in related markets enable them to overcome barriers to entry such as technical knowledge, product differentiation, and access to distribution channels. However, large organizations whose activities are widely diversified do not have the same opportunities for achieving synergies across markets, except perhaps in the management of finance and in their accumulated experience in diverse startup situations. Diversified early followers of this type are referred to in the ecological literature as polymorphists, a variant of the generalist. Examples in the microcomputer industry are companies such as Xerox, Texas Instruments, AT&T, Sony, Zenith, and Ericsson.

In summary, the typology of market entry provided by the ecology model enables us first to distinguish between early and late entries, with early entrants being described as r-strategists and late entrants as K-strategists. We then can divide these two categories into generalists and specialists, extending the typology to include market pioneers (r-specialists and r-generalists), early followers (K-generalists and polymorphists), and late entrants (K-specialists). The full typology of competitive strategies derived from the ecology model is given in Table 1.

The Process of Natural Selection

Given the descriptive typology, the next important question is which of these strategies has the best prospects of success or, in ecological terms, which is likely to achieve the best fit to its environment. Success in this sense can have several levels of meaning. At the extreme, it means literally the survival or failure of entire organizations, failure being evidenced by withdrawal or dissolution. A less drastic outcome is what is referred to as *mobility,* in which the organization fails in the sense that it is substantially transformed so that it is no longer recognizable in its original form (Hannan and Freeman 1977). A large increase in scale, for example, when a specialist becomes a generalist, exemplifies this phenomenon, as does the occurrence of mergers and acquisitions. The least extreme measure of success is described as *viability,* which refers to the relative performance of surviving competitors. Variables such as market share and profitability may be considered as measures of viability (Aldrich 1979).

Predictions from niche theory. Niche theory provides a set of general predictions to indicate which strategies are most likely to be successful under various types of environmental conditions. The sets of conditions considered in this theory result from differences in the degree of variability (radical or minor) and the frequency or rate of change. An environment undergoing radical and frequent change is highly unstable and therefore a difficult one in which to operate; the opposite conditions imply a stable and benign competitive environment. The essential difference between the states of environmental variation is in the cost of suboptimal strategies in the face of the uncertainty.

1. When changes are extreme and rapidly paced, the population experiences widely varying conditions over time that make it extremely difficult to design an organization that can perform equally well under all of the conditions. The emergent phase of a radically new market in which both production and marketing methods must be developed from scratch typifies these conditions. A specialist strategy in which the organization is designed to perform well under one set of conditions is optimal in this environment because the cost of maladaptation is far higher for an organization that makes a heavy investment in pursuing a generalist strategy.
2. Change that is frequent but minor in amplitude, as in the case of cyclical fluctuations, favors large-scale generalists with sufficient "slack" (Cyert and March 1963) to cope with the changing conditions. They have an advantage over specialists that may not have sufficient resources to absorb the frequent small shocks.
3. Change that is radical though infrequent, such as a major recession, requires a more flexible, combination strategy, known as polymorphism. This strategy in-

TABLE 1
Competition and Selection in Developing Markets: Strategies for Success[a]

Niche Configuration	Embryonic	Developing	Maturing
Population density	Low	Increasing	High
Size and rate of environmental change	High	Reducing	Low
Predominant organization form	r-specialists	K-generalists	K-generalists
Other forms	r-generalists	Polymorphists	K-specialists
Best performers	r-specialists	K-generalists	K-generalists

[a]r-specialists are small-scale pioneers and r-generalists are large-scale pioneers. K-generalists are early followers with established businesses in related markets. Polymorphists are early followers with widely diversified portfolios. K-specialists are small-scale late entrants occupying narrow market segments.

voves a federation of several specialist organizations, each well suited to at least one state of the environment.

4. When change is minor and infrequent, generalists again tend to outcompete specialists over the full range of conditions to which they are adapted because of their relatively large scale and superior competitive efficiency. When the conditions approach certainty, however, some specialists may again outcompete the generalists, which are well adapted overall but which may not be so efficient in marginal areas of the niche (individual market segments).

The practical implications of these predictions are seen in the evolution of competitive product-markets.

The Stages of Market Evolution

As a market evolves, three processes are set in motion and become the driving forces for change in competitive structure and in performance. These processes seem directly analogous to the ecological patterns just described.

- New markets attract increasing numbers of competitors, leading to an increasing level of population density until eventually the resource space is filled and a shakeout occurs (the timing depends on whether resource supplies expand or efficiency in resource use rises).
- Each wave of entrants introduces new structures and strategies in response to shifts in the availability of resources (r-strategists and K-strategists).
- The nature of the competitive conditions alters over time with a tendency toward lower risk and uncertainty and higher competitive intensity.

The operation of these processes results in an unfolding series of distinct niche configurations (Brittain and Freeman 1980) that correspond to the traditional stages of the product life cycle. As resource conditions change and new niche configurations emerge, the resulting market structure and resource profile of each life cycle stage also change in predictable directions.

The onset of a new pattern of market and competitive conditions can be identified by inflexion points in the S-shaped population growth curve. To be consistent with this convention and for clarity of exposition, we discuss the implications of the ecological predictions according to the commonly identified stages of market evolution.

Embryonic Markets: Low Population Density

The introduction stage in the development of a radically new product-market has the highest level of uncertainty in the whole life cycle. The fact that a substantial level of market demand has not yet been proven creates a high level of risk for the pioneering business (Levitt 1965). Also, substantial diversity is likely among pioneering entrants in all facets of their operations, including product and process design and marketing methods. Initial development is a matter of trial and error, with rapid changes occurring as competitors try to match or exceed one another's performance (Porter 1980).

Niche theory predicts that r-specialists are likely to be the predominant form among the organizations pioneering the development of the new population. These r-specialists are typically small new organizations set up specifically to exploit first-mover advantages in the new resource space. They are frequently "spinoffs" from established organizations by individuals who have the skills and resources to exploit a perceived new opportunity but are impatient with the slowness of response of their employer organizations (Freeman 1982). These individuals typically do not have access to large resources, so they tend to concentrate on activities that require relatively low levels of investment and simple structures.

The opportunity for such small firms to gain a foothold in the new market arises from the fact that the population density is low and competition is not very intense. However, the apparent richness of the competitive environment is no guarantee of success. The uncertainty of resource availability coupled with the firms' own inexperience exposes these early entrants to a "liability of newness" (Stinchcombe 1965), which inevitably results in some failures. Future competition by fast followers presents a further threat to viability.

The theory indicates that these factors will lead to the demise of a majority of the pioneering firms. This prediction certainly seems to have been borne out in the microcomputer industry, where several of the early entrants filed for bankruptcy (e.g., Osborne, Computer Devices, and Vector Technologies) and many others had serious trading difficulties (e.g., Vector Graphic, Fortune, Intertec Data Systems, Altos Computer Systems, and Grid Systems).

The few pioneering firms that manage to survive are those able to exploit first-mover advantages such as (Brittain and Freeman 1980):

- the establishment of their first version of the product as the industry standard against which all later variants will be compared,
- the development of cost and pricing advantages from acquired production experience, and
- the accumulation of monopoly profit during the interval before competition increases, which can be reinvested to increase capacity and thereby to dominate the market as it develops.

Developing Markets: Increasing Population Density

As sales gain momentum in the growth stage, the ultimate potential of the market becomes more clearly understood and the initial uncertainties gradually are

resolved. Customers with homogeneous needs begin to be identified, which allows marketing effort to be targeted more precisely, and experience with the product, process, and materials technologies leads to greater efficiency and increased standardization.

In ecological terms, the environment is changing from highly uncertain to moderately uncertain. Such conditions make it feasible to design a large-scale generalist organization that can achieve adequate performance in several environmental states by exploiting a wide range of environmental resources. Another significant feature is the increasing density of the population, which puts an emphasis on competitive efficiency as the criterion for survival.

These conditions favor K-strategists and, in particular, K-generalists, as the dominant form. In a few cases, K-generalists will have evolved from r-strategists that have exploited first-mover advantages successfully in the previous niche and have acquired sufficient resources to undertake the large expansion in scale that defines the K-generalist strategy. However, such transformations are very difficult to achieve because of the intrinsic inefficiencies of new organizations in comparison with their longer established peers (the liability of newness) and because once a firm is structured in a particular way, structural inertia begins to inhibit adaptation. K-generalists therefore are more likely to enter the resource space for the first time at this point; they tend to be organizations from closely related or overlapping niches. They inherit a strong brand identification from their parent and have the parent's resources to fund a large-scale entry with standardized high quality products.

If the niche is still subject to major and abrupt changes in market requirements, production processes, and technology—albeit at a reduced frequency—the variant of the K-generalist strategy known as polymorphism may be the dominant form. Because of the widely varying contingencies in this environment, committing all or most of an organization's resources to a narrow band of the environment is risky. In this case, an organization form with a loosely structured federation of activities, each specialized to different niches, is likely to be positively selected.

Overall, the model predicts that in this relatively uncertain market both K-generalists and polymorphists generally will outperform the r-strategists that initially appeared dominant because of their relative advantage in scale and experience. Some of these r-strategists may fail in the sense of withdrawing from the market, but many may continue as a result of mergers or acquisitions. A typical event is that widely diversified companies following a polymorphist strategy acquire r-specialists as a way of making a fast entry into an evidently growing market. The acquisition of Scientific Data Systems by Xerox and of a 20% stake in Sun Microsystems by AT&T exemplifies this strategy.

Maturing Markets: High Population Density

As the size of the population approaches the ultimate carrying capacity, the pattern of environmental variation approaches certainty. In markets where economies of scale are present, a tendency toward concentration is probably evident by this time, with a small number of firms coming to dominate the market. These long-term market leaders are most likely to be K-generalists—large, long-established firms selling closely related products.

Even in highly concentrated markets, the market leaders do not usually control all of the resource space. Typically, a generalist strategy appeals to some common denominator across all areas of the markets in order to maximize economies of scale. The cost advantage of such a strategy, however, may be offset by an inability to cater to segments of the market that have heterogeneous requirements. Areas of the market that are not served or are poorly served by the market leaders are therefore available to specialist firms offering tailormade products. The result is a kind of resource partitioning in which generalist and specialist firms can coexist without engaging in direct competition (Carroll 1985).

This resource partitioning is most likely to occur as the market approaches a stable maturity because it is at this point that untapped market segments and weaknesses among current competitors can be most easily identified. By this time also, knowledge about the relevant technologies and marketing methods is likely to be widely available and is no longer a significant barrier to entry even for small, specialist firms.

These conditions tend to stimulate a third wave of entrants belonging to the general category of K-strategists because of the late point at which they join the population. These late entrants are more appropriately described as K-specialists, however, because of the types of competitive strategy they follow. Some variants are (Brittain and Freeman 1980):

1. *Independent producers*—small and possibly new organizations with lower overhead costs than the large generalists. Companies such as Compaq and Amstrad are in this category, as are the producers of microcomputer clones, which have proliferated in recent years (companies such as Access, Otrona, Athena, Gavilan, and Cromenco).
2. *Captive producers*—supply or support other units of the same firm, but sell nothing on the open market. They generally have been acquired by r-strategists to support vertical integration moves. The chip manufacturing and software divisions of companies such as IBM belong in this category.
3. *Subordinate producers*—stand-alone divestments of K-generalists and polymorphists that market products with temporary or permanent declines in demand. They have

the advantages of low carrying costs of assets and lower coordination costs than the generalists. The revamped Osborne Computers represents this category, as do the personal computer divisions sold off by Xerox and Texas Instruments.

Winners and losers during the shakeout. Two classes of competitors are especially vulnerable as the population density reaches and exceeds the carrying capacity of the market. The most likely failures or below-par performers are polymorphists—the small-scale specialized subunits of large diversified companies. They are trapped between two sets of competitors better suited to a more predictable, albeit competitive, environment. On one side are larger K-generalists with a relative scale and efficiency advantage in their niche. On the other side is a new threat from K-specialists, recently attracted to the increasing segmentation possibilities. These new players have an advantage over polymorphists because of lower coordination (overhead) costs.

This prediction certainly has been borne out in the microcomputer market in the very poor performance records of such companies as AT&T, Xerox, Texas Instruments, and Ericsson. In fact, all of these companies but AT&T have by now cut their losses and exited this market.

Additional dropouts are also likely among the earlier specialists, because they lack the ability to withstand the constriction in resources when too many competitors are chasing too little volume. Their strategy of early concentration on a narrow range of the environment means they have little slack to withstand any unexpected shocks in an overcrowded environment. As a result the weaker members of the population either fail or become subordinate or captive producers. The trading difficulties experienced by companies such as Vector Graphic, Fortune, Intertec, Altos Computer Systems, and Apollo Computers might reasonably be attributed to such a cause. Only time will tell whether these problems are temporary or permanent.

Shakeouts follow the same pattern in many markets, including discount audio-video retailers (Saporito 1987). The rapid growth of these retailers was fueled by videocassette recorders introduced in 1981, but in 1987 sales growth slowed abruptly to 10% while the top 10 discounters expanded store space by 25%. The overexpansion was dictated partly by the need for each chain to have a major presence in each local market it served. This concentration provided economies of scale, especially in advertising costs that might be as high as 8% of sales. However, most markets usually have room (resources) for only two such "power" retailers. With overcapacity, margins dropped sharply and the original local entrepreneurs were compressed into a few well-run national chains. The "generalists" like Circuit City are expected to survive and prosper because they have the control, warehousing, and distribution systems needed to achieve very low costs.

Testing the Ecology Model

The predictions from the ecology model can be summarized in the following propositions.

P_1 (pioneers): Firms pioneering the development of radically new markets are likely to be predominantly r-specialists. They are typically independent new ventures that enter the market with a low level of capital investment. Because of inherent difficulties in developing a new primary market, as well as the small size and inexperience of these firms, the attrition rate among them is likely to be high though a few may succeed in becoming major long-term players.

P_2 (early followers): Early followers into rapidly growing markets are likely to be the most numerous category. The predominant form will be subsidiaries or divisions of large, integrated firms that have a high degree of synergy with the new product-market (K-generalists). These businesses are likely to enter on a relatively large scale (in terms of both production and distribution) in comparison with the pioneers and to market their product more intensively. This strategy, when backed by extensive resources, enables these businesses to become the long-term market leaders and achieve strong financial performance.

Other early followers will be subsidiaries or divisions of large, diversified firms that have extensive resources but few market-specific skills (polymorphists). This disadvantage restricts them to a relatively small market share and correspondingly weak level of financial performance. In fact, the combination of heavy capital investment and low market share is likely to result in the poorest performance of all entrant categories.

P_3 (late entrants): Late entrants into mature markets are likely to be the least numerous category. They are typically small new ventures set up to exploit a competitive advantage in meeting the needs of one particular market segment (usually centered either on quality or price). Even the most successful of these K-specialists is unlikely to achieve a large market share, but this disadvantage may be offset by a disproportionately strong financial performance.

Empirical Testing

Because the ecological model is relatively new to the marketing discipline, it has not been adequately tested. Preliminary testing has yielded promising results and evidence from other sources supports individual propositions from the model.

Industry case studies. The first attempt to test the overall model was an analysis of the semiconductor industry by Brittain and Freeman (1980). They clearly demonstrated that competitive conditions did change over time as the density of the supplier population increased and that there was a definite pattern of succession as new entrants with superior products or more appropriate competitive strategies usurped the posi-

tions of earlier entrants. However, this study was purely qualitative with no attempt to quantify such issues as the number and size of entrants, the precise timing of their entry, their attrition rate, or the relative performance of survivors.

These deficiencies were largely overcome in a recent case study of the evolution of the minicomputer industry (Romanelli 1988). The qualitative analysis was bolstered with the collection of detailed product, market, competitive, and financial data on the population of 108 entrants into the market. The basic data on entry strategies and probability of surviving at least six years are summarized in Table 2. Firms were classified as specialists or generalists on the basis of a median split on the number of market segments they served by year three.

The results confirmed expectations that early entrants tend to be specialists (75%) and that early followers during the rapid growth stage are the most numerous category. An unexpected finding was the very high proportion of early followers that were specialists. Nonetheless, the most successful early followers were generalists like Data General—subject to the qualification that their entry was aggressive. This group had a 100% survival rate. Interestingly, fast followers that were conservative generalists had only a 20% survival rate. They appear to share the debilitating characteristics of polymorphists.

Also as expected, the late entrants were the least numerous, with the lowest survival rate. Most were small specialists, though Tandem succeeded in a big way by entering in 1976 with a specialist strategy based on dominance of the severe operating environment segment. Overall, this study provides encouraging support for the propositions derived from the ecology model and demonstrates the insights to be gained from longitudinal industry studies. What is now needed is a diverse array of studies to test for consistency of the findings in different environments.

Cross-sectional analysis of new ventures. One recent study used the database of new ventures launched by firms represented in the PIMS database (Lambkin 1988) to corroborate further the propositions about the different strategic profiles of successive waves of market entrants. The results of this study showed that pioneers, early followers, and late entrants were systematically different on several dimensions of their structure and strategy, including production and distribution scale and their choice of marketing mix. Furthermore, these differences were found to translate into differences in market shares and profit performance. However, this study was limited by the fact that it focused only on survivors and, in particular, on new businesses launched by large, successful corporations (predominantly members of the *Fortune Top 500*). It provided no additional information on either the survival/failure rates of successive market entrants or the experiences of small, independent ventures in comparison with their larger corporate rivals.

TABLE 2
Early Strategies and Survival in the Microcomputer Industry (percentage of firms surviving 6 years)[a]

Entry Strategy	Pioneers (1957–1966)	Early Followers (1967–1971)	Later Entrants (1972–1981)
Generalist	66 (n = 3)	63 (n = 11)	20 (n = 5)
Specialist	77 (n = 9)	75 (n = 47)	64 (n = 33)

[a]Adapted from Romanelli (1988).

Similar problems apply to most of the studies that have a bearing on constituent elements of the ecological model. Studies of market pioneers, which are relevant in testing the first proposition, generally concentrate on firms that survived their entry attempts, thereby excluding any failures from the calculations (Bond and Lean 1977; Whitten 1981). The usual approach is to define pioneers as firms that first promoted the product on a national basis. This definition excludes small local firms that may have sold the product at an earlier time or firms that failed to achieve national distribution. For example, in the semiconductor industry, Intel would be regarded as the *de facto* pioneer though a company called Advanced Memory Systems was actually the first to sell microprocessors (Brittain and Freeman 1980).

This selectivity bias means the general finding that pioneers tend to outperform all later entrants is likely to be overstated. Furthermore, the propensity to concentrate on average values means that little information is provided on the range of performance by pioneering businesses apart from their survival or failure. The only thing that is clear from the evidence is that all pioneers, regardless of their degree of success, tend to lose share over time as additional competitors enter the market.

A more stringent test of the ecological proposition on pioneers would require that the definition of this category of entrants be broadened to include all firms attempting to market a new product and that the sample studied track failures as well as successes. It seems reasonable to speculate that such an approach would produce a result different from that of the previous studies.

Related research on diversification. For the second ecological proposition on early followers, the research stream concerned with the relationship between diversification strategies and performance seems of most relevance (Montgomery 1982; Rumelt 1974). These studies are all consistent in the finding that re-

lated diversifiers, which seem to correspond to K-generalists, significantly outperform unrelated and conglomerate diversifiers, which seem to match closely the concept of polymorphism. A recent study has found that the performance of the highly diversified firms is related to the rate of market growth, with higher growth enhancing profitability (Wernerfelt and Montgomery 1986). This finding may imply that degree of diversification interacts with timing of entry in influencing performance so that early entry improves the performance prospects of widely diversified firms more than those of closely related firms. Clearly, such possibilities provide interesting questions for future research.

In the case of the third proposition on late entrants, some evidence suggests that even small, new competitors entering mature markets—the profile of K-specialists—can earn attractive returns by concentrating on narrow market segments not served by the market leaders (Hamermesh, Anderson, and Harris 1978; Woo and Cooper 1982). Again, however, these studies examine only successful late entrants. They give no indication of the incidence of failure among late entrants or, indeed, of whether the successful businesses studied were the exception rather than the rule in their respective markets. Future research should explore whether the survival chances are any higher for late entrants than for market pioneers, given the risk of strong competitive reaction in place of the uncertainties involved in developing new markets.

In sum, though research has provided several insights on the ecological propositions, clearly some major questions have not been addressed. The first question, which might be termed demographic, concerns the pattern of entries and exits at different stages of market evolution, the numbers and types of firms that enter and leave at different points. The second question concerns the competitive behavior of the various firms in the market, specifically differences in strategies between new entrants and incumbent firms and the nature and extent of competitive reaction. Finally, work is needed to establish the full range of performance outcomes of different types of competitors at different stages of evolution, with equal emphasis given to the failures and the successes.

Questions such as these represent a novel perspective in terms of research on market evolution, and the capacity to raise interesting new questions is one of the important contributions of the ecological approach.

An Assessment of the Ecology Model

Advantages of the Model

The first and most basic advantage of the model is the focus on the supply side of market transactions and on the process of competition, which is a fundamental feature of most populations of suppliers in a free-market economy. This focus parallels the normative, managerial stream of the PLC literature and affords an opportunity to develop and refine that branch by recasting it in a stricter theoretical framework.

Second, population ecology is a dynamic model concerned explicitly with the pattern of entries and exits among the organizations competing within particular populations. It implies a longitudinal research design that provides a direct contrast to the cross-sectional designs prevalent in marketing research. The availability of data places a significant constraint on longitudinal designs, but more insight may be gained by sacrificing large sample size in favor of analysis of single industries.

Third, the ecological model treats the performance of individual competitors as a function of its complex underlying causes. It recognizes that performance is a consequence of the effects of the prevailing competitive conditions in combination with the structures and strategies of different firms. In a research context, this approach treats the product life cycle as a causal model that overcomes the risks of tautological reasoning, which has been a frequent criticism of research attempting to model the product sales curve (Tellis and Crawford 1981). Furthermore, this ecological approach is suitable for testing by causal modeling methods using multiple measures and latent variables.

In a management context, this causal model also has the benefit of avoiding self-fulfilling prophecies by focusing on factors that can be manipulated to enhance the firm's position or at least to minimize damage.

Limitations of the Model

The first and perhaps most fundamental criticism of the population ecology model—which also applies to the PLC—pertains to the appropriateness of biological analogies for the analysis of social organizations. Detractors argue that the life cycles of social organizations do not have the same uniformity and predictability as the life cycles of biological organisms and therefore that organizational theories derived from biology cannot have much predictive validity (Perrow 1979). The fact that many large organizations seem to persist indefinitely without any evidence of decline is considered a particularly cogent example of this problem (Aldrich 1979).

Supporters of the ecological paradigm accept these limitations but argue that it can still offer many novel and valuable insights into organizational life (Aldrich 1979; Kimberley et al. 1980; McKelvey 1979). Though ecological models do not have perfect predictive validity (nor do other organizational theories), they provide a useful contingency approach that allows "what

if" questions to be asked about the relationships between variations in the environment and changes in populations of organizations. Furthermore, the introduction of new models, even those with limited theoretical status, always opens the possibility for new research questions to be identified or for current questions to be recast in new ways, which may stimulate productive new research directions.

The particular issue of population decline and of the decline of constituent organizations is less easy to resolve. The conceptual literature in ecology has a major imbalance in its emphasis on the development phase with almost no consideration of the other end of the life cycle curve (Wholey and Brittain 1986). A few empirical studies within the ecological tradition have begun to focus on describing and explaining differential levels of mortality within and between populations of organizations (Carroll and Delacroix 1982; Freeman and Hannan 1983), but they have examined mature and fragmented industries (newspapers and restaurants) and therefore have not contributed significantly to our understanding of evolutionary phenomena.

A second problem with the ecological model is its reliance on "natural selection" as the mechanism that determines the success or failure of competing organizations. This approach is considered by some people to be antithetical to the management disciplines because a strict interpretation suggests performance is determined fully by the environment and is indifferent to management behavior (Perrow 1979; Van de Ven 1979). Ecological scholars have responded to this criticism by specifically acknowledging that organizational performance results from the joint effects of management actions and environmental conditions (Aldrich 1979; Hannan and Freeman 1977; Singh, Tucker, and House 1986). However, the basic model takes no account of management behavior.

A final problem with the ecological model, which may be attributable to the recency of its introduction into an organizational context, is that many of the variables lack clear, unambiguous definitions and directions for how they should be applied (Carroll 1985; Freeman 1982; Wholey and Brittain 1986). Central concepts such as resource spaces, niches, organizational form, natural selection, and performance typically are discussed at a very abstract level without much consideration of measurement issues. Researchers who want to apply this model are merely recommended to develop definitions and operational referents that are relevant to the context of their own research (Freeman 1982; Hannan and Freeman 1977), as we have done, with the attendant risks of misinterpretation and lack of standardization. However, organization theorists are now well aware of these problems. Undoubtedly the current high interest in this area will result in many of these problems being resolved.

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